

A Markdown Interpreter for T_EX

Vít Starý Novotný, Andrej Genčur
witiko@mail.muni.cz

Version 3.15.1-0-g51841b67
2026-06-11

Contents

1	Introduction	1	3	Implementation	182
1.1	Requirements	2	3.1	Lua Implementation . . .	182
1.2	Feedback	6	3.2	Plain T _E X Implementation	429
1.3	Acknowledgements	7	3.3	L ^A T _E X Implementation . .	475
2	Interfaces	7	3.4	ConT _E Xt Implementation	522
2.1	Lua Interface	7			
2.2	Plain T _E X Interface	57			
2.3	L ^A T _E X Interface	168			
2.4	ConT _E Xt Interface	177			
				References	534
				Index	535

List of Figures

1	A block diagram of the Markdown package	8
2	A sequence diagram of typesetting a document using the T _E X interface . .	53
3	A sequence diagram of typesetting a document using the Lua CLI	54
4	An example directed graph	83
5	An example mindmap	84
6	An example UML sequence diagram	85
7	The banner of the Markdown package	86
8	A pushdown automaton that recognizes T _E X comments	303

1 Introduction

The Markdown package¹ converts CommonMark² markup to T_EX commands. The functionality is provided both as a Lua module and as plain T_EX, L^AT_EX, and ConT_EXt macro packages that can be used to directly typeset T_EX documents containing markdown markup. Unlike other converters, the Markdown package does not require any external programs, and makes it easy to redefine how each and every markdown element is rendered. Creative abuse of the markdown syntax is encouraged. 😊

This document is a technical documentation for the Markdown package. It consists of three sections. This section introduces the package and outlines its prerequisites.

¹See <https://ctan.org/pkg/markdown>.

²See <https://commonmark.org/>.

Section 2 describes the interfaces exposed by the package. Section 3 describes the implementation of the package. The technical documentation contains only a limited number of tutorials and code examples. You can find more of these in the user manual.³

```

1 local metadata = {
2   version   = "(((VERSION)))",
3   comment   = "A module for the conversion from markdown "
4             .. "to plain TeX",
5   author    = "John MacFarlane, Hans Hagen, Vít Starý Novotný, "
6             .. "Andrej Genčur",
7   copyright = {"2009-2016 John MacFarlane, Hans Hagen",
8             "2016-2026 Vít Starý Novotný, Andrej Genčur"},
9   license    = "LPPL 1.3c"
10 }
11
12 if not modules then modules = { } end
13 modules['markdown'] = metadata

```

1.1 Requirements

This section gives an overview of all resources required by the package.

1.1.1 Lua Requirements

The Lua part of the package requires that the following Lua modules are available from within the LuaTeX engine (though not necessarily in the LuaMetaTeX engine).

LPeg ≥ 0.10 A pattern-matching library for the writing of recursive descent parsers via the Parsing Expression Grammars (PEGs). It is used by the Lunamark library to parse the markdown input. LPeg ≥ 0.10 is included in LuaTeX $\geq 0.72.0$ (TeX Live ≥ 2013).

```
14 local lpeg = require("lpeg")
```

MD5 A library that provides MD5 crypto functions. It is used by the Lunamark library to compute the digest of the input for caching purposes. MD5 is included in all releases of LuaTeX (TeX Live ≥ 2008).

```
15 local md5 = require("md5")
```

Kpathsea A package that implements the loading of third-party Lua libraries and looking up files in the TeX directory structure.

³See <http://mirrors.ctan.org/macros/generic/markdown/markdown.html>.

Only load the package outside the ConT_EXt format, where we can use the resolvers API [1, Section 11.5].

```
16 if resolvers == nil then
17   (function()
```

If Kpathsea has not been loaded before or if LuaT_EX has not yet been initialized, configure Kpathsea on top of loading it. Since ConT_EXt MkIV provides a `kpse` global that acts as a stub for Kpathsea and the lua-uni-case library expects that `kpse` is a reference to the full Kpathsea library, we load Kpathsea to the `kpse` global.

```
18     local should_initialize = package.loaded.kpse == nil
19                               or tex.initialize ~= nil
20     kpse = require("kpse")
21     if should_initialize then
22       kpse.set_program_name("luatex")
23     end
24   end)()
25 end
```

All the abovelisted modules are statically linked into the current version of the LuaT_EX engine [2, Section 4.3]. Beside these, we also include the following third-party Lua libraries:

api7/lua-tinyyaml A library that provides a regex-based recursive descent YAML (subset) parser that is used to read YAML metadata when the `jekyllData` option is enabled.

```
26 hard lua-tinyyaml
```

1.1.2 Plain T_EX Requirements

The plain T_EX part of the package requires that the plain T_EX format (or its superset) is loaded, all the Lua prerequisites (see Section 1.1.1), and the following packages:

expl3 A package that enables the expl3 language [3] from the L^AT_EX3 kernel in T_EX Live \leq 2019. It is used to implement reflection capabilities that allow us to enumerate and inspect high-level concepts such as options, renderers, and renderer prototypes.

```
27 hard l3kernel
28 \unprotect
29 \expandafter\ifx\csname ExplSyntaxOn\endcsname\relax
30   \input expl3-generic
31 \fi
```

lt3luabridge A package that allows us to execute Lua code with LuaTeX as well as with other TeX engines that provide the *shell escape* capability, which allows them to execute code with the system’s shell.

Note that this support for TeX engines other than LuaTeX comes with some limitations with respect to file and directory names. Specifically, the filenames of your .tex files may not contain spaces⁴. If `-output-directory` is provided, it may not contain spaces either.

32 `hard lt3luabridge`

The plain TeX part of the package also requires the following Lua module:

Lua File System A library that provides access to the filesystem via OS-specific syscalls. It is used by the plain TeX code to create the cache directory specified by the `cacheDir` option before interfacing with the Lunamark library. Lua File System is included in all releases of LuaTeX (TeXLive \geq 2008).

The plain TeX code makes use of the `isdir` method that was added to the Lua File System library by the LuaTeX engine developers [2, Section 4.2.4].

The Lua File System module is statically linked into the LuaTeX engine [2, Section 4.3].

Unless you convert markdown documents to TeX manually using the Lua command-line interface (see Section 2.1.7), the plain TeX part of the package will require that either the LuaTeX `\directlua` primitive or the shell access file stream 18 is available in your TeX engine. If only the shell access file stream is available in your TeX engine (as is the case with pdfTeX and XeTeX), then unless your TeX engine is globally configured to enable shell access, you will need to provide the `-shell-escape` parameter to your engine when typesetting a document.

1.1.3 L^ATeX Requirements

The L^ATeX part of the package requires that the L^ATeX 2_ε format is loaded, a TeX engine that extends ε-TeX, and all the plain TeX prerequisites (see Section 1.1.2).

```
33 \NeedsTeXFormat{LaTeX2e}
34 \RequirePackage{expl3}
```

The following packages are soft prerequisites. They are only used to provide default token renderer prototypes (see sections 2.2.6 and 3.3.5) or L^ATeX themes (see Section 2.3.4) and will not be loaded if the option `plain` has been enabled (see Section 2.2.2.3):

url A package that provides the `\url` macro for the typesetting of links.

⁴See <https://github.com/Witiko/markdown/issues/573>.

35 `soft url`

graphicx A package that provides the `\includegraphics` macro for the typesetting of images. Furthermore, it also provides a key–value interface that is used in the default renderer prototypes for image attribute contexts.

36 `soft graphics`

enumitem and paralist Packages that provide macros for the default renderer prototypes for tight and fancy lists.

The package `paralist` will be used unless the option `experimental` has been enabled, in which case, the package `enumitem` will be used. Furthermore, enabling any test phase [4] will also cause `enumitem` to be used. In a future major version, `enumitem` will replace `paralist` altogether.

37 `soft enumitem`

38 `soft paralist`

fancyvrb A package that provides the `\VerbatimInput` macros for the verbatim inclusion of files containing code.

39 `soft fancyvrb`

csvsimple A package that provides the `\csvautotabular` macro for typesetting CSV files in the default renderer prototypes for iA Writer content blocks.

40 `soft csvsimple`

41 `soft pgf` # required by ``csvsimple``, which loads ``pgfkeys.sty``

42 `soft tools` # required by ``csvsimple``, which loads ``shellesc.sty``

43 `soft etoolbox` # required by ``csvsimple``, which loads ``etoolbox.sty``

amsmath and amssymb Packages that provide symbols used for drawing ticked and unticked boxes.

44 `soft amsmath`

45 `soft amssymb`

graphicx A package that provides extended support for graphics. It is used in the `witiko/diagrams`, and `witiko/graphicx/http` plain T_EX themes, see Section 2.2.3.

46 `soft graphics`

47 `soft epstopdf` # required by ``graphics`` and ``graphicx``, which load ``epsopdf-base.sty``

48 `soft epstopdf-pkg` # required by ``graphics`` and ``graphicx``, which load ``epsopdf-base.sty``

soul and xcolor Packages that are used in the default renderer prototypes for strike-throughs and marked text in pdfTeX.

```
49 soft soul
50 soft xcolor
```

lua-ul and luacolor Packages that are used in the default renderer prototypes for strike-throughs and marked text in LuaTeX.

```
51 soft lua-ul
52 soft luacolor
```

ltxcmds A package that is used to detect whether the minted and listings packages are loaded in the default renderer prototype for fenced code blocks.

```
53 soft ltxcmds
```

luaxml A package that is used to convert HTML to L^AT_EX in the default renderer prototypes for content blocks, raw blocks, and inline raw spans.

```
54 soft luaxml
```

verse A package that is used in the default renderer prototypes for line blocks.

```
55 soft verse
```

1.1.4 ConT_EXt Prerequisites

The ConT_EXt part of the package requires that either the Mark II or the Mark IV format is loaded, all the plain T_EX prerequisites (see Section 1.1.2), and the following ConT_EXt modules:

m-database A module that provides the default token renderer prototype for iA Writer content blocks with the CSV filename extension (see Section 2.2.6).

1.2 Feedback

Please use the Markdown project page on GitHub⁵ to report bugs and submit feature requests. If you do not want to report a bug or request a feature but are simply in need of assistance, you might want to consider posting your question to the T_EX-L^AT_EX Stack Exchange.⁶ community question answering web site under the `markdown` tag.

⁵See <https://github.com/witiko/markdown/issues>.

⁶See <https://tex.stackexchange.com>.

1.3 Acknowledgements

The Lunamark Lua module provides speedy markdown parsing for the package. I would like to thank John Macfarlane, the creator of Lunamark, for releasing Lunamark under a permissive license, which enabled its use in the Markdown package.

Extensive user documentation for the Markdown package was kindly written by Lian Tze Lim and published by Overleaf.

Funding by the Faculty of Informatics at the Masaryk University in Brno [5] is gratefully acknowledged.

Support for content slicing (Lua options `shiftHeadings` and `slice`) and pipe tables (Lua options `pipeTables` and `tableCaptions`) was graciously sponsored by David Vins and Omedym.

The T_EX implementation of the package draws inspiration from several sources including the source code of L^AT_EX 2_ε, the minted package by Geoffrey M. Poore, which likewise tackles the issue of interfacing with an external interpreter from T_EX, the filecontents package by Scott Pakin and others.

2 Interfaces

This part of the documentation describes the interfaces exposed by the package along with usage notes and examples. It is aimed at the user of the package.

Since neither T_EX nor Lua provide interfaces as a language construct, the separation to interfaces and implementations is a *gentlemen's agreement*. It serves as a means of structuring this documentation and as a promise to the user that if they only access the package through the interface, the future minor versions of the package should remain backwards compatible.

Figure 1 shows the high-level structure of the Markdown package: The translation from markdown to T_EX *token renderers* is exposed by the Lua layer. The plain T_EX layer exposes the conversion capabilities of Lua as T_EX macros. The L^AT_EX and ConT_EXt layers provide syntactic sugar on top of plain T_EX macros. The user can interface with any and all layers.

2.1 Lua Interface

The Lua interface provides the conversion from UTF8 encoded markdown to plain T_EX. This interface is used by the plain T_EX implementation (see Section 3.2) and will be of interest to the developers of other packages and Lua modules.

The Lua interface is implemented by the `markdown` Lua module.

```
56 local M = {metadata = metadata}
```

2.1.1 Conversion from Markdown to Plain T_EX

The Lua interface exposes the `new(options)` function. This function returns a conversion function from markdown to plain T_EX according to the table `options`

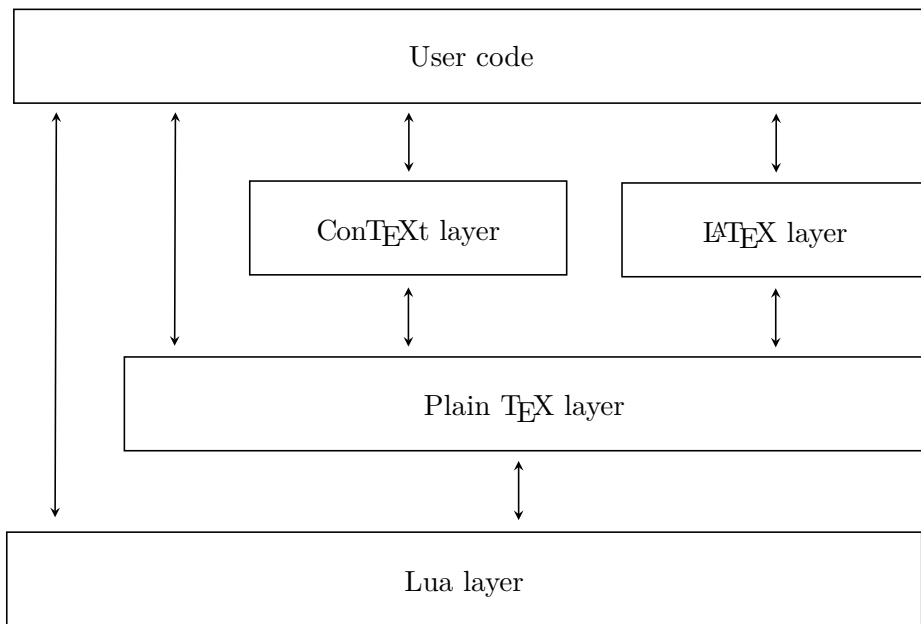


Figure 1: A block diagram of the Markdown package

that contains options recognized by the Lua interface (see Section 2.1.3). The `options` parameter is optional; when unspecified, the behaviour will be the same as if `options` were an empty table.

The following example Lua code converts the markdown string `Hello *world*!` to a T_EX output using the default options and prints the T_EX output:

```
local md = require("markdown")
local convert = md.new()
print(convert("Hello *world*!"))
```

2.1.2 User-Defined Syntax Extensions

For the purpose of user-defined syntax extensions, the Lua interface also exposes the `reader` object, which performs the lexical and syntactic analysis of markdown text and which exposes the `reader->insert_pattern` and `reader->add_special_character` methods for extending the PEG grammar of markdown.

The read-only `walkable_syntax` hash table stores those rules of the PEG grammar of markdown that can be represented as an ordered choice of terminal symbols. These rules can be modified by user-defined syntax extensions.

```
57 local walkable_syntax = {
```



```

58  Block = {
59      "Blockquote",
60      "Verbatim",
61      "ThematicBreak",
62      "BulletList",
63      "OrderedList",
64      "DisplayHtml",
65      "Heading",
66  },
67  BlockOrParagraph = {
68      "Block",
69      "Paragraph",
70      "Plain",
71  },
72  Inline = {
73      "Str",
74      "Space",
75      "Endline",
76      "EndlineBreak",
77      "LinkAndEmph",
78      "Code",
79      "AutoLinkUrl",
80      "AutoLinkEmail",
81      "AutoLinkRelativeReference",
82      "InlineHtml",
83      "HtmlEntity",
84      "EscapedChar",
85      "Smart",
86      "Symbol",
87  },
88 }

```

The `reader->insert_pattern` method inserts a PEG pattern into the grammar of markdown. The method receives two mandatory arguments: a selector string in the form "*<left-hand side terminal symbol> <before, after, or instead of> <right-hand side terminal symbol>*" and a PEG pattern to insert, and an optional third argument with a name of the PEG pattern for debugging purposes (see the `debugExtensions` option). The name does not need to be unique and shall not be interpreted by the Markdown package; you can treat it as a comment.

For example. if we'd like to insert `pattern` into the grammar between the `Inline -> LinkAndEmph` and `Inline -> Code` rules, we would call `reader->insert_pattern` with "`Inline after LinkAndEmph`" (or "`Inline before Code`") and `pattern` as the arguments.

The `reader->add_special_character` method adds a new character with special meaning to the grammar of markdown. The method receives the character as its only argument.

2.1.3 Options

The Lua interface recognizes the following options. When unspecified, the value of a key is taken from the `defaultOptions` and `experimentalOptions` tables.

```
89 local defaultOptions = {}
90 local experimentalOptions = {}
91 setmetatable(experimentalOptions, { __index = function (_, key)
92   return defaultOptions[key] end })
```

To enable the enumeration of Lua options, we will maintain the `\g_@@_lua_options_seq` sequence.

```
93 \ExplSyntaxOn
94 \seq_new:N \g_@@_lua_options_seq
```

To enable the reflection of default/experimental Lua options and their types, we will maintain the `\g_@@_default_lua_options_prop`, `\g_@@_experimental_lua_options_seq` and `\g_@@_lua_option_types_prop` property lists and sequences, respectively.

```
95 \prop_new:N \g_@@_lua_option_types_prop
96 \prop_new:N \g_@@_default_lua_options_prop
97 \seq_new:N \g_@@_experimental_lua_options_seq
98 \seq_new:N \g_@@_option_layers_seq
99 \tl_const:Nn \c_@@_option_layer_lua_tl { lua }
100 \seq_gput_right:NV
101   \g_@@_option_layers_seq
102   \c_@@_option_layer_lua_tl
103 \cs_new_protected:Nn
104   \@@_add_lua_option:nnn
105   {
106     \@@_add_option:Vnnn
107     \c_@@_option_layer_lua_tl
108     { #1 }
109     { #2 }
110     { #3 }
111   }
112 \cs_new_protected:Nn
113   \@@_add_option:nnnn
114   {
115     \seq_gput_right:cn
116       { g_@@_ #1 _options_seq }
117       { #2 }
118     \prop_gput:cnn
119       { g_@@_ #1 _option_types_prop }
120       { #2 }
121       { #3 }
122     \prop_gput:cnn
123       { g_@@_default_ #1 _options_prop }
124       { #2 }
```

```

125     { #4 }
126     \@@_typecheck_option:n
127     { #2 }
128 }
129 \cs_generate_variant:Nn
130 \@@_add_option:nnnn
131 { Vnnn }
132 \cs_new_protected:Nn
133 \@@_add_experimental_lua_option:n
134 {
135     \@@_add_experimental_option:Vn
136     \c_@@_option_layer_lua_tl
137     { #1 }
138 }
139 \cs_new_protected:Nn
140 \@@_add_experimental_option:nn
141 {
142     \seq_gput_right:cn
143     { g_@@_ #1 _options_seq }
144     { #2 }
145     \seq_gput_right:cn
146     { g_@@_experimental_ #1 _options_seq }
147     { #2 }
148     \prop_gput:cnn
149     { g_@@_ #1 _option_types_prop }
150     { #2 }
151     { boolean }
152 }
153 \cs_generate_variant:Nn
154 \@@_add_experimental_option:nn
155 { Vn }
156 \tl_const:Nn \c_@@_option_value_true_tl { true }
157 \tl_const:Nn \c_@@_option_value_false_tl { false }
158 \cs_new_protected:Nn \@@_typecheck_option:n
159 {
160     \@@_get_option_type:nN
161     { #1 }
162     \l_tmpa_tl
163     \str_case_e:Vn
164     \l_tmpa_tl
165     {
166         { \c_@@_option_type_boolean_tl }
167         {
168             \@@_get_option_value:nN
169             { #1 }
170             \l_tmpa_tl
171             \bool_if:nF

```

```

172         {
173             \str_if_eq_p:eV
174             { \l_tmpa_tl }
175             \c_@@_option_value_true_tl ||
176             \str_if_eq_p:eV
177             { \l_tmpa_tl }
178             \c_@@_option_value_false_tl
179         }
180     {
181         \msg_error:nnne
182         { markdown }
183         { failed-typecheck-for-boolean-option }
184         { #1 }
185         { \l_tmpa_tl }
186     }
187 }
188 }
189 }
190 \msg_new:nnn
191 { markdown }
192 { failed-typecheck-for-boolean-option }
193 {
194     Option~#1~has~value~#2,~
195     but~a~boolean~(true~or~false)~was~expected.
196 }
197 \cs_generate_variant:Nn
198 \str_case_e:nn
199 { Vn }
200 \cs_generate_variant:Nn
201 \msg_error:nnnn
202 { nnne }
203 \prg_generate_conditional_variant:Nnn
204 \str_if_eq:nn
205 { eV }
206 { p }
207 \seq_new:N
208 \g_@@_option_types_seq
209 \tl_const:Nn
210 \c_@@_option_type_clist_tl
211 { clist }
212 \seq_gput_right:NV
213 \g_@@_option_types_seq
214 \c_@@_option_type_clist_tl
215 \tl_const:Nn
216 \c_@@_option_type_counter_tl
217 { counter }
218 \seq_gput_right:NV

```

```

219 \g_@@_option_types_seq
220 \c_@@_option_type_counter_tl
221 \tl_const:Nn
222 \c_@@_option_type_boolean_tl
223 { boolean }
224 \seq_gput_right:NV
225 \g_@@_option_types_seq
226 \c_@@_option_type_boolean_tl
227 \tl_const:Nn
228 \c_@@_option_type_number_tl
229 { number }
230 \seq_gput_right:NV
231 \g_@@_option_types_seq
232 \c_@@_option_type_number_tl
233 \tl_const:Nn
234 \c_@@_option_type_path_tl
235 { path }
236 \seq_gput_right:NV
237 \g_@@_option_types_seq
238 \c_@@_option_type_path_tl
239 \tl_const:Nn
240 \c_@@_option_type_slice_tl
241 { slice }
242 \seq_gput_right:NV
243 \g_@@_option_types_seq
244 \c_@@_option_type_slice_tl
245 \tl_const:Nn
246 \c_@@_option_type_string_tl
247 { string }
248 \seq_gput_right:NV
249 \g_@@_option_types_seq
250 \c_@@_option_type_string_tl
251 \cs_new_protected:Nn
252 \@@_get_option_type:nN
253 {
254   \bool_set_false:N
255   \l_tmpa_bool
256   \seq_map_inline:Nn
257   \g_@@_option_layers_seq
258   {
259     \prop_get:cnNT
260     { g_@@_ ##1 _option_types_prop }
261     { #1 }
262     \l_tmpa_tl
263     {
264       \bool_set_true:N
265       \l_tmpa_bool

```

```

266         \seq_map_break:
267     }
268 }
269 \bool_if:NF
270   \l_tmpa_bool
271   {
272     \msg_error:nnn
273       { markdown }
274       { undefined-option }
275       { #1 }
276   }
277 \seq_if_in:NVF
278   \g_@@_option_types_seq
279   \l_tmpa_tl
280   {
281     \msg_error:nnnV
282       { markdown }
283       { unknown-option-type }
284       { #1 }
285     \l_tmpa_tl
286   }
287 \tl_set_eq:NN
288   #2
289   \l_tmpa_tl
290 }
291 \msg_new:nnn
292   { markdown }
293   { unknown-option-type }
294   {
295     Option~#1~has~unknown~type~#2.
296   }
297 \msg_new:nnn
298   { markdown }
299   { undefined-option }
300   {
301     Option~#1~is~undefined.
302   }
303 \cs_generate_variant:Nn
304   \msg_error:nnnn
305   { nnnV }
306 \cs_new_protected:Nn
307   \@@_get_default_option_value:nN
308   {
309     \bool_set_false:N
310       \l_tmpa_bool
311     \seq_map_inline:Nn
312       \g_@@_option_layers_seq

```

```

313     {
314         \seq_if_in:cnT
315         { g__markdown_experimental_ ##1 _options_seq }
316         { #1 }
317         {
318             \@@_get_option_value:nN
319             { experimental }
320             #2
321             \bool_set_true:N
322             \l_tmpa_bool
323             \seq_map_break:
324         }
325         \prop_get:cnNT
326         { g_@@_default_ ##1 _options_prop }
327         { #1 }
328         #2
329         {
330             \bool_set_true:N
331             \l_tmpa_bool
332             \seq_map_break:
333         }
334     }
335     \bool_if:NF
336     \l_tmpa_bool
337     {
338         \msg_error:nnn
339         { markdown }
340         { undefined-option }
341         { #1 }
342     }
343 }
344 \cs_new_protected:Nn
345 \@@_get_option_value:nN
346 {
347     \@@_option_tl_to_csname:nN
348     { #1 }
349     \l_tmpa_tl
350     \cs_if_free:cTF
351     { \l_tmpa_tl }
352     {
353         \@@_get_default_option_value:nN
354         { #1 }
355         #2
356     }
357     {
358         \@@_get_option_type:nN
359         { #1 }

```

```

360         \l_tmpa_tl
361     \str_if_eq:NNTF
362         \c_@@_option_type_counter_tl
363         \l_tmpa_tl
364     {
365         \@@_option_tl_to_csname:nN
366         { #1 }
367         \l_tmpa_tl
368         \tl_set:Nx
369             #2
370         { \the \cs:w \l_tmpa_tl \cs_end: }
371     }
372     {
373         \@@_option_tl_to_csname:nN
374         { #1 }
375         \l_tmpa_tl
376         \tl_set:Nv
377             #2
378         { \l_tmpa_tl }
379     }
380 }
381 }
382 \cs_new_protected:Nn \@@_option_tl_to_csname:nN
383 {
384     \tl_set:Nn
385         \l_tmpa_tl
386         { \str_uppercase:n { #1 } }
387     \tl_set:Nx
388         #2
389         {
390             markdownOption
391             \tl_head:f { \l_tmpa_tl }
392             \tl_tail:n { #1 }
393         }
394     }
395 \regex_const:Nn
396     \c_@@_option_regex
397     { ^markdownOption }
398 \prg_new_protected_conditional:Nnn
399     \@@_csname_to_option_str:nN
400     { T }
401     {
402         \tl_if_regex_match:nNTF
403             { #1 }
404             \c_@@_option_regex
405             {
406                 \tl_set:Nn

```



```

407         \l_tmpa_tl
408         { #1 }
409     \tl_regex_replace_once:NNn
410     \l_tmpa_tl
411     \c_@@_option_regex
412     { }
413     \tl_set:Nn
414     \l_tmpb_tl
415     {
416         \str_lowercase:f
417         { \l_tmpa_tl }
418     }
419     \str_set:Nx
420     #2
421     {
422         \tl_head:f { \l_tmpb_tl }
423         \tl_tail:V \l_tmpa_tl
424     }
425     \prg_return_true:
426 }
427 { \prg_return_false: }
428 }

```

To make it easier to support different coding styles in the interface, engines, we define the `\@@_with_various_cases:nn` function that allows us to generate different variants of a string using different cases.

```

429 \cs_new_protected:Nn \@@_with_various_cases:nn
430 {
431     \seq_clear:N
432     \l_tmpa_seq
433     \seq_map_inline:Nn
434     \g_@@_cases_seq
435     {
436         \tl_set:Nn
437         \l_tmpa_tl
438         { #1 }
439         \use:c { ##1 }
440         \l_tmpa_tl
441         \seq_put_right:NV
442         \l_tmpa_seq
443         \l_tmpa_tl
444     }
445     \seq_map_inline:Nn
446     \l_tmpa_seq
447     { #2 }
448 }

```

By default, camelCase and snake_case are supported. Additional cases can be added by adding functions to the `\g_@@_cases_seq` sequence.

```

449 \seq_new:N \g_@@_cases_seq
450 \cs_new_protected:Nn \@@_camel_case:N
451 {
452   \regex_replace_all:nnN
453     { _ ([a-z]) }
454     { \c { str_uppercase:n } \cB\{ \1 \cE\} }
455     #1
456   \tl_set:Nx
457     #1
458     { #1 }
459 }
460 \seq_gput_right:Nn \g_@@_cases_seq { @@_camel_case:N }
461 \cs_new_protected:Nn \@@_snake_case:N
462 {
463   \regex_replace_all:nnN
464     { ([a-z])([A-Z]) }
465     { \1 _ \c { str_lowercase:n } \cB\{ \2 \cE\} }
466     #1
467   \tl_set:Nx
468     #1
469     { #1 }
470 }
471 \seq_gput_right:Nn \g_@@_cases_seq { @@_snake_case:N }

```

2.1.4 General Behavior

`eagerCache=true, false`

default: `true`

true Converted markdown documents will be cached in `cacheDir`. This can be useful for post-processing the converted documents and for recovering historical versions of the documents from the cache. Furthermore, it can also significantly improve the processing speed for documents that require multiple compilation runs, since each markdown document is only converted once. However, it also produces a large number of auxiliary files on the disk.

This behavior will always be used if the `finalizeCache` option is enabled.

false Converted markdown documents will not be cached. This decreases the number of auxiliary files that we produce and makes it easier to use the Lua command-line interface for plumbing. However, it makes it impossible to post-process the converted documents and recover historical versions of the documents from the cache. Furthermore, it

can significantly reduce the processing speed for documents that require multiple compilation runs, since each markdown document is converted multiple times needlessly.

This behavior will only be used when the `finalizeCache` option is disabled.

```
472 \@@_add_lua_option:nnn
473   { eagerCache }
474   { boolean }
475   { true }

476 defaultOptions.eagerCache = true
```

`experimental=true, false` default: false

true Experimental features that are planned to be the new default in the next major release of the Markdown package will be enabled.

At the moment, this has the following effects:

1. The version `experimental` of the theme `witiko/markdown/defaults` will be loaded.
2. Warnings for hard-deprecated features will become errors.
3. The experimental option `htmlOverLinks` will be enabled.

In the future, the effects may extend to other areas as well.

false Experimental features will be disabled.

```
477 \@@_add_lua_option:nnn
478   { experimental }
479   { boolean }
480   { false }

481 defaultOptions.experimental = false
```

`singletonCache=true, false` default: true

true Conversion functions produced by the function `new(options)` will be cached in an LRU cache of size 1 keyed by `options`. This is more time- and space-efficient than always producing a new conversion function but may expose bugs related to the idempotence of conversion functions.

This has been the default behavior since version 3.0.0 of the Markdown package.

false Every call to the function `new(options)` will produce a new conversion function that will not be cached. This is slower than caching conversion functions and may expose bugs related to memory leaks in the creation of conversion functions, see also #226 (comment)⁷.

This was the default behavior until version 3.0.0 of the Markdown package.

```
482 \@@_add_lua_option:nnn
483 { singletonCache }
484 { boolean }
485 { true }

486 defaultOptions.singletonCache = true

487 local singletonCache = {
488     convert = nil,
489     options = nil,
490 }
```

`unicodeNormalization=true, false`

default: **true**

true Markdown documents will be normalized using one of the four Unicode normalization forms⁸ before conversion. The Unicode normalization norm used is determined by option `unicodeNormalizationForm`.

false Markdown documents will not be Unicode-normalized before conversion.

```
491 \@@_add_lua_option:nnn
492 { unicodeNormalization }
493 { boolean }
494 { true }

495 defaultOptions.unicodeNormalization = true
```

`unicodeNormalizationForm=nfc, nfd, nfkc, nfkd`

default: **nfc**

nfc When option `unicodeNormalization` has been enabled, markdown documents will be normalized using Unicode Normalization Form C (NFC) before conversion.

nfd When option `unicodeNormalization` has been enabled, markdown documents will be normalized using Unicode Normalization Form D (NFD) before conversion.

⁷See <https://github.com/witiko/markdown/pull/226#issuecomment-1599641634>.

⁸See <https://unicode.org/faq/normalization.html>.

nfkc When option `unicodeNormalization` has been enabled, markdown documents will be normalized using Unicode Normalization Form KC (NFKC) before conversion.

nfkd When option `unicodeNormalization` has been enabled, markdown documents will be normalized using Unicode Normalization Form KD (NFKD) before conversion.

```

496 \@@_add_lua_option:nnn
497   { unicodeNormalizationForm }
498   { string }
499   { nfc }

500 defaultOptions.unicodeNormalizationForm = "nfc"

```

2.1.5 File and Directory Names

`cacheDir`= $\langle path \rangle$ default: .

A path to the directory containing auxiliary cache files. If the last segment of the path does not exist, it will be created by the Lua command-line and plain T_EX implementations. The Lua implementation expects that the entire path already exists.

When iteratively writing and typesetting a markdown document, the cache files are going to accumulate over time. You are advised to clean the cache directory every now and then, or to set it to a temporary filesystem (such as `/tmp` on UN*X systems), which gets periodically emptied.

```

501 \str_new:N
502   \g_@@_unquoted_jobname_str
503 \str_gset:NV
504   \g_@@_unquoted_jobname_str
505   \c_sys_jobname_str
506 \bool_new:N
507   \g_@@_jobname_quoted_bool
508 \regex_replace_all:nnNTF
509   { \A ("|') ( .* ) ("|') \Z }
510   { \2 }
511   \g_@@_unquoted_jobname_str
512   {
513     \bool_gset_true:N
514     \g_@@_jobname_quoted_bool
515   }
516   {
517     \bool_gset_false:N
518     \g_@@_jobname_quoted_bool

```

```

519     }
520   \@@_add_lua_option:nnn
521   { cacheDir }
522   { path }
523   {
524     \markdownOptionOutputDir
525     / _markdown_
526     \str_use:N
527     \g_@@_unquoted_jobname_str
528   }
529   defaultOptions.cacheDir = "."

```

contentBlocksLanguageMap=*<filename>*
 default: markdown-languages.json

The filename of the JSON file that maps filename extensions to programming language names in the iA Writer content blocks when the **contentBlocks** option is enabled. See Section 2.2.5.14 for more information.

```

530   \@@_add_lua_option:nnn
531   { contentBlocksLanguageMap }
532   { path }
533   { markdown-languages.json }
534   defaultOptions.contentBlocksLanguageMap = "markdown-languages.json"

```

debugExtensionsFileName=*<filename>* default: debug-extensions.json

The filename of the JSON file that will be produced when the **debugExtensions** option is enabled. This file will contain the extensible subset of the PEG grammar of markdown (see the **walkable_syntax** hash table) after built-in syntax extensions (see Section 3.1.7) and user-defined syntax extensions (see Section 2.1.2) have been applied.

```

535   \@@_add_lua_option:nnn
536   { debugExtensionsFileName }
537   { path }
538   {
539     \markdownOptionOutputDir
540     /
541     \str_use:N
542     \g_@@_unquoted_jobname_str
543     .debug-extensions.json
544   }
545   defaultOptions.debugExtensionsFileName = "debug-extensions.json"

```

`frozenCacheFileName`= $\langle path \rangle$ default: `frozenCache.tex`

A path to an output file (frozen cache) that will be created when the `finalizeCache` option is enabled and will contain a mapping between an enumeration of markdown documents and their auxiliary cache files.

The frozen cache makes it possible to later typeset a plain \TeX document that contains markdown documents without invoking Lua using the `frozenCache` plain \TeX option. As a result, the plain \TeX document becomes more portable, but further changes in the order and the content of markdown documents will not be reflected.

```
546 \@@_add_lua_option:nnn
547   { frozenCacheFileName }
548   { path }
549   { \markdownOptionCacheDir / frozenCache.tex }
550 defaultOptions.frozenCacheFileName = "frozenCache.tex"
```

2.1.6 Parser Options

`acronyms`= $\langle acronyms \rangle$

Acronyms, initialisms, and other all-caps sequences that will be recognized in markdown text and formatted accordingly.

```
551 \cs_generate_variant:Nn
552   \@@_add_lua_option:nnn
553   { nnV }
554 \@@_add_lua_option:nnV
555   { acronyms }
556   { clist }
557   \c_empty_clist
558 defaultOptions.acronyms = {}
```

`autoIdentifiers`=`true, false` default: `false`

true Enable the Pandoc auto identifiers syntax extension⁹:

The following heading received the identifier
``sesame-street``:

123 Sesame Street

false Disable the Pandoc auto identifiers syntax extension.

⁹See https://pandoc.org/MANUAL.html#extension-auto_identifiers.

See also the option [gfmAutoIdentifiers](#).

```
559 \@@_add_lua_option:nnn
560   { autoIdentifiers }
561   { boolean }
562   { false }

563 defaultOptions.autoIdentifiers = false
```

[blankBeforeBlockquote](#)=true, false default: false

true Require a blank line between a paragraph and the following blockquote.
false Do not require a blank line between a paragraph and the following
 blockquote.

```
564 \@@_add_lua_option:nnn
565   { blankBeforeBlockquote }
566   { boolean }
567   { false }

568 defaultOptions.blankBeforeBlockquote = false
```

[blankBeforeCodeFence](#)=true, false default: false

true Require a blank line between a paragraph and the following fenced
 code block.
false Do not require a blank line between a paragraph and the following
 fenced code block.

```
569 \@@_add_lua_option:nnn
570   { blankBeforeCodeFence }
571   { boolean }
572   { false }

573 defaultOptions.blankBeforeCodeFence = false
```

[blankBeforeDivFence](#)=true, false default: false

true Require a blank line before the closing fence of a fenced div.
false Do not require a blank line before the closing fence of a fenced div.

```
574 \@@_add_lua_option:nnn
575   { blankBeforeDivFence }
576   { boolean }
577   { false }

578 defaultOptions.blankBeforeDivFence = false
```


`blankBeforeHeading=true, false` default: false

`true` Require a blank line between a paragraph and the following header.

`false` Do not require a blank line between a paragraph and the following header.

```
579 \@@_add_lua_option:nnn
580 { blankBeforeHeading }
581 { boolean }
582 { false }

583 defaultOptions.blankBeforeHeading = false
```

`blankBeforeHtmlBlock=true, false` default: false

`true` Require a blank line between a paragraph and the following CommonMark HTML block¹⁰.

`false` Do not require a blank line between a paragraph and the following CommonMark HTML block.

```
584 \@@_add_lua_option:nnn
585 { blankBeforeHtmlBlock }
586 { boolean }
587 { false }

588 defaultOptions.blankBeforeHtmlBlock = false
```

`blankBeforeList=true, false` default: false

`true` Require a blank line between a paragraph and the following list.

`false` Do not require a blank line between a paragraph and the following list.

```
589 \@@_add_lua_option:nnn
590 { blankBeforeList }
591 { boolean }
592 { false }

593 defaultOptions.blankBeforeList = false
```

¹⁰See <https://spec.commonmark.org/0.31.2/#html-blocks>.

`bracketedSpans=true, false` default: false

true Enable the Pandoc bracketed span syntax extension¹¹:

`[This is *some text*]{.class key=val}`

false Disable the Pandoc bracketed span syntax extension.

```
594 \@@_add_lua_option:nnn
595   { bracketedSpans }
596   { boolean }
597   { false }

598 defaultOptions.bracketedSpans = false
```

`breakableBlockquotes=true, false` default: true

true A blank line separates block quotes.

false Blank lines in the middle of a block quote are ignored.

```
599 \@@_add_lua_option:nnn
600   { breakableBlockquotes }
601   { boolean }
602   { true }

603 defaultOptions.breakableBlockquotes = true
```

`citationNbsps=true, false` default: false

true Replace regular spaces with non-breaking spaces inside the prenotes and postnotes of citations produced via the pandoc citation syntax extension.

false Do not replace regular spaces with non-breaking spaces inside the prenotes and postnotes of citations produced via the pandoc citation syntax extension.

```
604 \@@_add_lua_option:nnn
605   { citationNbsps }
606   { boolean }
607   { true }

608 defaultOptions.citationNbsps = true
```

¹¹See https://pandoc.org/MANUAL.html#extension-bracketed_spans.

`citations=true, false`

default: false

`true` Enable the Pandoc citation syntax extension¹²:

Here is a simple parenthetical citation [doe99] and here is a string of several [see doe99, pp. 33-35; also smith04, chap. 1].

A parenthetical citation can have a [prenote doe99] and a [smith04 postnote]. The name of the author can be suppressed by inserting a dash before the name of an author as follows [-smith04].

Here is a simple text citation doe99 and here is a string of several doe99 [pp. 33-35; also smith04, chap. 1]. Here is one with the name of the author suppressed -doe99.

`false` Disable the Pandoc citation syntax extension.

```
609 \@@_add_lua_option:nnn
610   { citations }
611   { boolean }
612   { false }
613 defaultOptions.citations = false
```

`codeSpans=true, false`

default: true

`true` Enable the code span syntax:

Use the `printf()` function.
``There is a literal backtick (``) here.``

`false` Disable the code span syntax. This allows you to easily use the quotation mark ligatures in texts that do not contain code spans:

``This is a quote.``

```
614 \@@_add_lua_option:nnn
615   { codeSpans }
616   { boolean }
617   { true }
618 defaultOptions.codeSpans = true
```

¹²See <https://pandoc.org/MANUAL.html#extension-citations>.

`contentBlocks=true, false`

default: false

true Enable the iA Writer content blocks syntax extension [6]:

```
http://example.com/minard.jpg (Napoleon's disastrous
  Russian campaign of 1812)
/Flowchart.png "Engineering Flowchart"
/Savings Account.csv 'Recent Transactions'
/Example.swift
/Lorem Ipsum.txt
```

false Disable the iA Writer content blocks syntax extension.

```
619 \@@_add_lua_option:nnn
620 { contentBlocks }
621 { boolean }
622 { false }

623 defaultOptions.contentBlocks = false
```

`contentLevel=block, inline`

default: block

block Treat content as a sequence of blocks.

```
- this is a list
- it contains two items
```

inline Treat all content as inline content.

```
- this is a text
- not a list
```

```
624 \@@_add_lua_option:nnn
625 { contentLevel }
626 { string }
627 { block }

628 defaultOptions.contentLevel = "block"
```

`debugExtensions=true, false`

default: false

true Produce a JSON file that will contain the extensible subset of the PEG grammar of markdown (see the `walkable_syntax` hash table) after built-in syntax extensions (see Section 3.1.7) and user-defined syntax extensions (see Section 2.1.2) have been applied. This helps you to see how the different extensions interact. The name of the produced JSON file is controlled by the `debugExtensionsFileName` option.

false Do not produce a JSON file with the PEG grammar of markdown.

```
629 \@@_add_lua_option:nnn
630 { debugExtensions }
631 { boolean }
632 { false }

633 defaultOptions.debugExtensions = false
```

`definitionLists=true, false`

default: false

true Enable the pandoc definition list syntax extension:

Term 1

: Definition 1

Term 2 with **inline markup**

: Definition 2

{ some code, part of Definition 2 }

Third paragraph of definition 2.

false Disable the pandoc definition list syntax extension.

```
634 \@@_add_lua_option:nnn
635 { definitionLists }
636 { boolean }
637 { false }

638 defaultOptions.definitionLists = false
```

`ensureJekyllData=true, false`

default: false

- true** When the `jekyllData` and `expectJekyllData` options are enabled, then a markdown document must begin directly with YAML metadata and must contain nothing but YAML metadata. Otherwise, an error is produced.
- false** When the `jekyllData` and `expectJekyllData` options are enabled, then a markdown document may begin directly with YAML metadata and may contain nothing but YAML metadata. Otherwise, the markdown document is processed as markdown text.

See also the plain \TeX macros `\yamlBegin`, `\yamlEnd`, and `\yamlInput` in Section 2.2.1, the \LaTeX environment `yaml` in Section 2.3.1, and the \ConTeXt macros `\startyaml`, `\stopyaml`, and `\inputyaml` in Section 2.4.1 to see how the options `jekyllData`, `expectJekyllData`, and `ensureJekyllData` can be used together to implement high-level interfaces for processing YAML documents.

```
639 \@@_add_lua_option:nnn
640   { ensureJekyllData }
641   { boolean }
642   { false }

643 defaultOptions.ensureJekyllData = false
```

`expectJekyllData=true, false`

default: false

- true** When the `jekyllData` option is enabled, then a markdown document may begin directly with YAML metadata and may contain nothing but YAML metadata.

```
\documentclass{article}
\usepackage[jekyllData, expectJekyllData]{markdown}
\begin{document}
\begin{markdown}
- this
- is
- YAML
...
- followed
- by
- Markdown
\end{markdown}
\begin{markdown}
- this
```

```

- is
- YAML
\end{markdown}
\end{document}

```

`false`

When the `jeekyllData` option is enabled, then a markdown document may begin with YAML metadata if and only if the metadata begin with the end-of-directives marker (`---`) and they end with either the end-of-directives or the end-of-document marker (`...`):

```

\documentclass{article}
\usepackage[jeekyllData]{markdown}
\begin{document}
\begin{markdown}
---
- this
- is
- YAML
...
- followed
- by
- Markdown
\end{markdown}
\begin{markdown}
- this
- is
- Markdown
\end{markdown}
\end{document}

```

See also the plain T_EX macros `\yamlBegin`, `\yamlEnd`, and `\yamlInput` in Section 2.2.1, the L^AT_EX environment `yaml` in Section 2.3.1, and the ConT_EXt macros `\startyaml`, `\stopyaml`, and `\inputyaml` in Section 2.4.1 to see how the options `jeekyllData`, `expectJekyllData`, and `ensureJekyllData` can be used together to implement high-level interfaces for processing YAML documents.

```

644 \@@_add_lua_option:nnn
645   { expectJekyllData }
646   { boolean }
647   { false }

648 defaultOptions.expectJekyllData = false

```

`extensions`= $\langle filenames \rangle$

The filenames of user-defined syntax extensions that will be applied to the markdown reader. If the `kpathsea` library is available, files will be searched for not only in the current working directory but also in the \TeX directory structure.

A user-defined syntax extension is a Lua file in the following format:

```
local strike_through = {
  api_version = 2,
  grammar_version = 4,
  finalize_grammar = function(reader)
    local nonspacechar = lpeg.P(1) - lpeg.S("\t ")
    local doubleslashes = lpeg.P("//")
    local function between(p, starter, ender)
      ender = lpeg.B(nonspacechar) * ender
      return (starter * #nonspacechar
        * lpeg.Ct(p * (p - ender)^0) * ender)
    end

    local read_strike_through = between(
      lpeg.V("Inline"), doubleslashes, doubleslashes
    ) / function(s) return {"\\st{" , s, "}"} end

    reader.insert_pattern("Inline after LinkAndEmph",
      read_strike_through,
      "StrikeThrough")
    reader.add_special_character("/")
  end
}

return strike_through
```

The `api_version` and `grammar_version` fields specify the version of the user-defined syntax extension API and the markdown grammar for which the extension was written. See the current API and grammar versions below:

```
649 metadata.user_extension_api_version = 2
650 metadata.grammar_version = 4
```

Any changes to the syntax extension API or grammar will cause the corresponding current version to be incremented. After Markdown 3.0.0, any changes to the API and the grammar will be either backwards-compatible or constitute a breaking change that will cause the major version of the Markdown package to increment (to 4.0.0).

The `finalize_grammar` field is a function that finalizes the grammar of markdown using the interface of a Lua `reader` object, such as the `reader->insert_pattern` and `reader->add_special_character` methods, see Section 2.1.2.

```
651 \@@_add_lua_option:nnV
652   { extensions }
653   { clist }
654   \c_empty_clist
655 defaultOptions.extensions = {}
```

`fancyLists=true, false`

default: false

`true` Enable the Pandoc fancy list syntax extension¹³:

```
a) first item
b) second item
c) third item
```

`false` Disable the Pandoc fancy list syntax extension.

```
656 \@@_add_lua_option:nnn
657   { fancyLists }
658   { boolean }
659   { false }
660 defaultOptions.fancyLists = false
```

`fencedCode=true, false`

default: true

`true` Enable the commonmark fenced code block extension:

```
~~~ js
if (a > 3) {
    moveShip(5 * gravity, DOWN);
}
~~~~~

``` html
<pre>
 <code>
 // Some comments
 line 1 of code
 line 2 of code
 line 3 of code
```

<sup>13</sup>See <https://pandoc.org/MANUAL.html#org-fancy-lists>.

```
</code>
</pre>
...
```

**false**      Disable the commonmark fenced code block extension.

```
661 \@@_add_lua_option:nnn
662 { fencedCode }
663 { boolean }
664 { true }

665 defaultOptions.fencedCode = true
```

**fencedCodeAttributes**=true, false default: false

**true**      Enable the Pandoc fenced code attribute syntax extension<sup>14</sup>:

```
~~~~ {#mycode .haskell .numberLines startFrom=100}
qsort []      = []
qsort (x:xs) = qsort (filter (< x) xs) ++ [x] ++
               qsort (filter (>= x) xs)
~~~~~
```

**false**      Disable the Pandoc fenced code attribute syntax extension.

```
666 \@@_add_lua_option:nnn
667 { fencedCodeAttributes }
668 { boolean }
669 { false }

670 defaultOptions.fencedCodeAttributes = false
```

**fencedDivs**=true, false default: false

**true**      Enable the Pandoc fenced div syntax extension<sup>15</sup>:

```
::::: {#special .sidebar}
Here is a paragraph.

And another.
:::::
```

**false**      Disable the Pandoc fenced div syntax extension.

<sup>14</sup>See [https://pandoc.org/MANUAL.html#extension-fenced\\_code\\_attributes](https://pandoc.org/MANUAL.html#extension-fenced_code_attributes).

<sup>15</sup>See [https://pandoc.org/MANUAL.html#extension-fenced\\_divs](https://pandoc.org/MANUAL.html#extension-fenced_divs).

```

671 \@@_add_lua_option:nnn
672 { fencedDivs }
673 { boolean }
674 { false }
675 defaultOptions.fencedDivs = false

```

**frozenCache**=true, false

default: false

Whether an output file specified with the **frozenCacheFileName** option (frozen cache) that contains a mapping between an enumeration of markdown documents and their auxiliary cache files will be created.

The frozen cache makes it possible to later typeset a plain T<sub>E</sub>X document that contains markdown documents without invoking Lua using the **frozenCache** plain T<sub>E</sub>X option. As a result, the plain T<sub>E</sub>X document becomes more portable, but further changes in the order and the content of markdown documents will not be reflected.

```

676 \@@_add_lua_option:nnn
677 { finalizeCache }
678 { boolean }
679 { false }
680 defaultOptions.finalizeCache = false

```

**frozenCacheCounter**=*<number>*

default: 0

The number of the current markdown document that will be stored in an output file (frozen cache) when the **finalizeCache** is enabled. When the document number is 0, then a new frozen cache will be created. Otherwise, the frozen cache will be appended.

Each frozen cache entry will define a T<sub>E</sub>X macro **\markdownFrozenCache***<number>* that will typeset markdown document number *<number>*.

```

681 \@@_add_lua_option:nnn
682 { frozenCacheCounter }
683 { counter }
684 { 0 }
685 defaultOptions.frozenCacheCounter = 0

```

`gfmAutoIdentifiers=true, false` default: false

**true** Enable the Pandoc GitHub-flavored auto identifiers syntax extension<sup>16</sup>:

The following heading received the identifier  
``123-sesame-street``:

`# 123 Sesame Street`

**false** Disable the Pandoc GitHub-flavored auto identifiers syntax extension.

See also the option `autoIdentifiers`.

```
686 \@@_add_lua_option:nnn
687 { gfmAutoIdentifiers }
688 { boolean }
689 { false }
690 defaultOptions.gfmAutoIdentifiers = false
```

`hashEnumerators=true, false` default: false

**true** Enable the use of hash symbols (#) as ordered item list markers:

`#. Bird`  
`#. McHale`  
`#. Parish`

**false** Disable the use of hash symbols (#) as ordered item list markers.

```
691 \@@_add_lua_option:nnn
692 { hashEnumerators }
693 { boolean }
694 { false }
695 defaultOptions.hashEnumerators = false
```

`headerAttributes=true, false` default: false

**true** Enable the assignment of HTML attributes to headings:

`# My first heading {#foo}`

`## My second heading ## {#bar .baz}`

`Yet another heading {key=value}`  
`=====`

<sup>16</sup>See [https://pandoc.org/MANUAL.html#extension-gfm\\_auto\\_identifiers](https://pandoc.org/MANUAL.html#extension-gfm_auto_identifiers).

`false`      Disable the assignment of HTML attributes to headings.

```
696 \@@_add_lua_option:nnn
697 { headerAttributes }
698 { boolean }
699 { false }

700 defaultOptions.headerAttributes = false
```

`html=true, false`      default: `true`

`true`      Enable the recognition of HTML entities, inline HTML tags, and block HTML elements, comments, declarations, processing instructions, and CDATA sections in the input.

HTML entities will be replaced with the corresponding Unicode code-points and other HTML content will be ignored by default.

`false`      Disable the recognition of HTML markup. Any recognized HTML content in the input will be rendered as plain text.

```
701 \@@_add_lua_option:nnn
702 { html }
703 { boolean }
704 { true }

705 defaultOptions.html = true
```

`htmlOutput=basic, commonmark`      default: `basic`

`basic`

: When the `html` option is enabled, produce basic coarse-grained renderers for all HTML, see Section 2.2.5.3.

`commonmark`

: When the `html` option is enabled, produce fine-grained renderers for each top-level non-terminal element of CommonMark's grammar for HTML blocks<sup>17</sup> and raw HTML<sup>18</sup>, see sections 2.2.5.12 and 2.2.5.13, respectively.

```
706 \@@_add_lua_option:nnn
707 { htmlOutput }
708 { string }
709 { basic }

710 defaultOptions.htmlOutput = "basic"
```

---

<sup>17</sup>See <https://spec.commonmark.org/0.31.2/#html-blocks>.

<sup>18</sup>See <https://spec.commonmark.org/0.31.2/#raw-html>.

`htmlOverLinks=true, false`

default: `false`

- true** When the option `html` is enabled and a text can be understood either as a hyperlink or HTML, interpret it as HTML.
- This is especially relevant when the option `relativeReferences` is enabled, since it makes e.g. `</foo>` a valid hyperlink.
- false** When the option `html` is enabled and a text can be understood either as a hyperlink or HTML, interpret it as a hyperlink.

This is an experimental option. Whenever the option `experimental` is enabled and this option is unspecified, it will be enabled. Like other experimental options, this option will be enabled by default and soft-deprecated in the next major release of the Markdown package.

```
711 \@@_add_experimental_lua_option:n
712 { htmlOverLinks }

713 defaultOptions.htmlOverLinks = false
714 experimentalOptions.htmlOverLinks = true
```

`hybrid=true, false`

default: `false`

- true** Disable the escaping of special plain TeX characters, which makes it possible to intersperse your markdown markup with TeX code. The intended usage is in documents prepared manually by a human author. In such documents, it can often be desirable to mix TeX and markdown markup freely.
- false** Enable the escaping of special plain TeX characters outside verbatim environments, so that they are not interpreted by TeX. This is encouraged when typesetting automatically generated content or markdown documents that were not prepared with this package in mind.

The `hybrid` option makes it difficult to untangle TeX input from markdown text, which makes documents written with the `hybrid` option less interoperable and more difficult to read for authors. Therefore, the option has been soft-deprecated in version 3.7.1 of the Markdown package: It will never be removed but using it prints a warning and is discouraged.

Consider one of the following better alternatives for mixing TeX and markdown:

- With the `contentBlocks` option, authors can move large blocks of TeX code to separate files and include them in their markdown documents as external resources:

Here is a mathematical formula:

```
/math-formula.tex
```

- With the `rawAttribute` option, authors can denote raw text spans and code blocks that will be interpreted as  $\text{\TeX}$  code:

```
`$H_2 O$`{=tex} is a liquid.
```

Here is a mathematical formula:

```
``` {=tex}  
\[distance[i] =  
    \begin{dcases}  
        a & b \\  
        c & d  
    \end{dcases}  
\]  
```
```

- With options `texMathDollars`, `texMathSingleBackslash`, and `texMathDoubleBackslash`, authors can freely type  $\text{\TeX}$  commands between dollar signs or backslash-escaped brackets:

```
$H_2 O$ is a liquid.
```

Here is a mathematical formula:

```
\[distance[i] =
 \begin{dcases}
 a & b \\
 c & d
 \end{dcases}
\]
```

```
715 \@@_add_lua_option:nnn
716 { hybrid }
717 { boolean }
718 { false }
719 defaultOptions.hybrid = false
```

`inlineCodeAttributes=true, false` default: false

**true** Enable the Pandoc inline code span attribute extension<sup>19</sup>:

```
`<$>`{.haskell}
```

**false** Enable the Pandoc inline code span attribute extension.

```
720 \@@_add_lua_option:nnn
721 { inlineCodeAttributes }
722 { boolean }
723 { false }
724 defaultOptions.inlineCodeAttributes = false
```

`inlineNotes=true, false` default: false

**true** Enable the Pandoc inline note syntax extension<sup>20</sup>:

```
Here is an inline note.^[Inline notes are easier to
write, since you don't have to pick an identifier and
move down to type the note.]
```

**false** Disable the Pandoc inline note syntax extension.

```
725 \@@_add_lua_option:nnn
726 { inlineNotes }
727 { boolean }
728 { false }
729 defaultOptions.inlineNotes = false
```

`jeekyllData=true, false` default: false

**true** Enable the Pandoc YAML metadata block syntax extension<sup>21</sup> for entering metadata in YAML:

```

title: 'This is the title: it contains a colon'
author:
- Author One
- Author Two
keywords: [nothing, nothingness]
```

<sup>19</sup>See [https://pandoc.org/MANUAL.html#extension-inline\\_code\\_attributes](https://pandoc.org/MANUAL.html#extension-inline_code_attributes).

<sup>20</sup>See [https://pandoc.org/MANUAL.html#extension-inline\\_notes](https://pandoc.org/MANUAL.html#extension-inline_notes).

<sup>21</sup>See [https://pandoc.org/MANUAL.html#extension-yaml\\_metadata\\_block](https://pandoc.org/MANUAL.html#extension-yaml_metadata_block).



```
abstract: |
 This is the abstract.

 It consists of two paragraphs.

```

**false**      Disable the Pandoc YAML metadata block syntax extension for entering metadata in YAML.

See also the plain T<sub>E</sub>X macros `\yamlBegin`, `\yamlEnd`, and `\yamlInput` in Section 2.2.1, the L<sup>A</sup>T<sub>E</sub>X environment `yaml` in Section 2.3.1, and the ConT<sub>E</sub>Xt macros `\startyaml`, `\stopyaml`, and `\inputyaml` in Section 2.4.1 to see how the options `jeekyllData`, `expectJeekyllData`, and `ensureJeekyllData` can be used together to implement high-level interfaces for processing YAML documents.

```
730 \@@_add_lua_option:nnn
731 { jeekyllData }
732 { boolean }
733 { false }

734 defaultOptions.jekyllData = false
```

`linkAttributes=true, false`

default: false

**true**      Enable the Pandoc link and image attribute syntax extension<sup>22</sup>:

```
An inline ![image](foo.jpg){#id .class height=20px}
and a reference ![image][ref] with attributes.

[ref]: foo.jpg "optional title" {#id .class key=val}
```

**false**      Enable the Pandoc link and image attribute syntax extension.

```
735 \@@_add_lua_option:nnn
736 { linkAttributes }
737 { boolean }
738 { false }

739 defaultOptions.linkAttributes = false
```

<sup>22</sup>See [https://pandoc.org/MANUAL.html#extension-link\\_attributes](https://pandoc.org/MANUAL.html#extension-link_attributes).

`lineBlocks=true, false`

default: false

`true` Enable the Pandoc line block syntax extension<sup>23</sup>:

```
| this is a line block that
| spans multiple
| even
| discontinuous
| lines
```

`false` Disable the Pandoc line block syntax extension.

```
740 \@@_add_lua_option:nnn
741 { lineBlocks }
742 { boolean }
743 { false }

744 defaultOptions.lineBlocks = false
```

`mark=true, false`

default: false

`true` Enable the Pandoc mark syntax extension<sup>24</sup>:

```
This ==is highlighted text.==
```

`false` Disable the Pandoc mark syntax extension.

```
745 \@@_add_lua_option:nnn
746 { mark }
747 { boolean }
748 { false }

749 defaultOptions.mark = false
```

`notes=true, false`

default: false

`true` Enable the Pandoc note syntax extension<sup>25</sup>:

```
Here is a note reference, [^1] and another. [^longnote]

[^1]: Here is the note.

[^longnote]: Here's one with multiple blocks.
```

<sup>23</sup>See [https://pandoc.org/MANUAL.html#extension-line\\_blocks](https://pandoc.org/MANUAL.html#extension-line_blocks).

<sup>24</sup>See <https://pandoc.org/MANUAL.html#extension-mark>.

<sup>25</sup>See <https://pandoc.org/MANUAL.html#extension-footnotes>.

Subsequent paragraphs are indented to show that they belong to the previous note.

```
{ some.code }
```

The whole paragraph can be indented, or just the first line. In this way, multi-paragraph notes work like multi-paragraph list items.

This paragraph won't be part of the note, because it isn't indented.

**false**      Disable the Pandoc note syntax extension.

```
750 \@@_add_lua_option:nnn
751 { notes }
752 { boolean }
753 { false }
754 defaultOptions.notes = false
```

**pipeTables=true, false**      default: false

**true**      Enable the PHP Markdown pipe table syntax extension:

| Right | Left | Default | Center |
|-------|------|---------|--------|
| 12    | 12   | 12      | 12     |
| 123   | 123  | 123     | 123    |
| 1     | 1    | 1       | 1      |

**false**      Disable the PHP Markdown pipe table syntax extension.

```
755 \@@_add_lua_option:nnn
756 { pipeTables }
757 { boolean }
758 { false }
759 defaultOptions.pipeTables = false
```

`preserveTabs=true, false`

default: `true`

`true` Preserve tabs in code block and fenced code blocks.

`false` Convert any tabs in the input to spaces.

```
760 \@@_add_lua_option:nnn
761 { preserveTabs }
762 { boolean }
763 { true }

764 defaultOptions.preserveTabs = true
```

`rawAttribute=true, false`

default: `false`

`true` Enable the Pandoc raw attribute syntax extension<sup>26</sup>:

```
`$H_2 O$`{=tex} is a liquid.
```

To enable raw blocks, the `fencedCode` option must also be enabled:

```
Here is a mathematical formula:
``` {=tex}
\[distance[i] =
    \begin{dcases}
      a & b \\
      c & d
    \end{dcases}
\]
```
```

The `rawAttribute` option is a good alternative to the `hybrid` option. Unlike the `hybrid` option, which affects the entire document, the `rawAttribute` option allows you to isolate the parts of your documents that use T<sub>E</sub>X.

`false` Disable the Pandoc raw attribute syntax extension.

```
765 \@@_add_lua_option:nnn
766 { rawAttribute }
767 { boolean }
768 { false }

769 defaultOptions.rawAttribute = false
```

---

<sup>26</sup>See [https://pandoc.org/MANUAL.html#extension-raw\\_attribute](https://pandoc.org/MANUAL.html#extension-raw_attribute).

`relativeReferences=true, false`

default: false

`true` Enable relative references<sup>27</sup> in autolinks:

```
I conclude in Section <#conclusion>.

Conclusion {#conclusion}
=====

In this paper, we have discovered that most
grandmas would rather eat dinner with their
grandchildren than get eaten. Begone, wolf!
```

`false` Disable relative references in autolinks.

```
770 \@@_add_lua_option:nnn
771 { relativeReferences }
772 { boolean }
773 { false }

774 defaultOptions.relativeReferences = false
```

`shiftHeadings=<shift amount>`

default: 0

All headings will be shifted by *<shift amount>*, which can be both positive and negative. Headings will not be shifted beyond level 6 or below level 1.

```
775 \@@_add_lua_option:nnn
776 { shiftHeadings }
777 { number }
778 { 0 }

779 defaultOptions.shiftHeadings = 0
```

`slice=<the beginning and the end of a slice>`

default: ^ \$

Two space-separated selectors that specify the slice of a document that will be processed, whereas the remainder of the document will be ignored. The following selectors are recognized:

- The circumflex (^) selects the beginning of a document.
- The dollar sign (\$) selects the end of a document.
- ^<identifier> selects the beginning of a section (see the `headerAttributes` option) or a fenced div (see the `fencedDivs` option) with the HTML attribute #<identifier>.

---

<sup>27</sup>See <https://datatracker.ietf.org/doc/html/rfc3986#section-4.2>.

- $\$ \langle identifier \rangle$  selects the end of a section with the HTML attribute  $\# \langle identifier \rangle$ .
- $\langle identifier \rangle$  corresponds to  $\wedge \langle identifier \rangle$  for the first selector and to  $\$ \langle identifier \rangle$  for the second selector.

Specifying only a single selector,  $\langle identifier \rangle$ , is equivalent to specifying the two selectors  $\langle identifier \rangle \langle identifier \rangle$ , which is equivalent to  $\wedge \langle identifier \rangle \$ \langle identifier \rangle$ , i.e. the entire section with the HTML attribute  $\# \langle identifier \rangle$  will be selected.

```

780 \@@_add_lua_option:nnn
781 { slice }
782 { slice }
783 { ^~$ }
784 defaultOptions.slice = "^ $"

```

`smartEllipses=true, false` default: false

- true** Convert any ellipses in the input to the `\markdownRenderEllipsis`  $\TeX$  macro.
- false** Preserve all ellipses in the input.

```

785 \@@_add_lua_option:nnn
786 { smartEllipses }
787 { boolean }
788 { false }
789 defaultOptions.smartEllipses = false

```

`startNumber=true, false` default: true

- true** Make the number in the first item of an ordered lists significant. The item numbers will be passed to the `\markdownRendererOliItemWithNumber`  $\TeX$  macro.
- false** Ignore the numbers in the ordered list items. Each item will only produce a `\markdownRenderOliItem`  $\TeX$  macro.

```

790 \@@_add_lua_option:nnn
791 { startNumber }
792 { boolean }
793 { true }
794 defaultOptions.startNumber = true

```

`strikeThrough=true, false`

default: false

**true** Enable the Pandoc strike-through syntax extension<sup>28</sup>:

```
This ~~is deleted text.~~
```

**false** Disable the Pandoc strike-through syntax extension.

```
795 \@@_add_lua_option:nnn
796 { strikeThrough }
797 { boolean }
798 { false }
799 defaultOptions.strikeThrough = false
```

`stripIndent=true, false`

default: false

**true** Strip the minimal indentation of non-blank lines from all lines in a markdown document. Requires that the `preserveTabs` Lua option is disabled:

```
\documentclass{article}
\usepackage[stripIndent]{markdown}
\begin{document}
 \begin{markdown}
 Hello *world*!
 \end{markdown}
\end{document}
```

**false** Do not strip any indentation from the lines in a markdown document.

```
800 \@@_add_lua_option:nnn
801 { stripIndent }
802 { boolean }
803 { false }
804 defaultOptions.stripIndent = false
```

---

<sup>28</sup>See <https://pandoc.org/MANUAL.html#extension-strikeout>.

`subscripts=true, false` default: false

`true` Enable the Pandoc subscript syntax extension<sup>29</sup>:

H~2~0 is a liquid.

`false` Disable the Pandoc subscript syntax extension.

```
805 \@@_add_lua_option:nnn
806 { subscripts }
807 { boolean }
808 { false }
809 defaultOptions.subscripts = false
```

`superscripts=true, false` default: false

`true` Enable the Pandoc superscript syntax extension<sup>30</sup>:

2<sup>10</sup> is 1024.

`false` Disable the Pandoc superscript syntax extension.

```
810 \@@_add_lua_option:nnn
811 { superscripts }
812 { boolean }
813 { false }
814 defaultOptions.superscripts = false
```

`tableAttributes=true, false` default: false

`true` Enable the assignment of HTML attributes to table captions (see the `tableCaptions` option):

| Right | Left | Default | Center |
|-------|------|---------|--------|
| 12    | 12   | 12      | 12     |
| 123   | 123  | 123     | 123    |
| 1     | 1    | 1       | 1      |

: Demonstration of pipe table syntax. {#example-table}

<sup>29</sup>See <https://pandoc.org/MANUAL.html#extension-superscript-subscript>.

<sup>30</sup>See <https://pandoc.org/MANUAL.html#extension-superscript-subscript>.



**false**      Disable the assignment of HTML attributes to table captions.

```
815 \@@_add_lua_option:nnn
816 { tableAttributes }
817 { boolean }
818 { false }

819 defaultOptions.tableAttributes = false
```

**tableCaptions=true, false**

default: false

**true**      Enable the Pandoc table caption syntax extension<sup>31</sup> for pipe tables (see the **pipeTables** option):

| Right | Left | Default | Center |
|-------|------|---------|--------|
| 12    | 12   | 12      | 12     |
| 123   | 123  | 123     | 123    |
| 1     | 1    | 1       | 1      |

: Demonstration of pipe table syntax.

**false**      Disable the Pandoc table caption syntax extension.

```
820 \@@_add_lua_option:nnn
821 { tableCaptions }
822 { boolean }
823 { false }

824 defaultOptions.tableCaptions = false
```

**taskLists=true, false**

default: false

**true**      Enable the Pandoc task list syntax extension<sup>32</sup>:

- [ ] an unticked task list item
- [X] a ticked task list item

Our implementation also supports half-ticked task list items:

- [/] a half-checked task list item
- [.] another half-checked task list item

**false**      Disable the Pandoc task list syntax extension.

<sup>31</sup>See [https://pandoc.org/MANUAL.html#extension-table\\_captions](https://pandoc.org/MANUAL.html#extension-table_captions).

<sup>32</sup>See [https://pandoc.org/MANUAL.html#extension-task\\_lists](https://pandoc.org/MANUAL.html#extension-task_lists).

```

825 \@@_add_lua_option:nnn
826 { taskLists }
827 { boolean }
828 { false }

829 defaultOptions.taskLists = false

```

`texComments=true, false`

default: false

**true** Strip T<sub>E</sub>X-style comments.

```

\documentclass{article}
\usepackage[texComments]{markdown}
\begin{document}
\begin{markdown}
Hello *world*!
\end{markdown}
\end{document}

```

Always enabled when `hybrid` is enabled.

**false** Do not strip T<sub>E</sub>X-style comments.

```

830 \@@_add_lua_option:nnn
831 { texComments }
832 { boolean }
833 { false }

834 defaultOptions.texComments = false

```

`texMathDollars=true, false`

default: false

**true** Enable the Pandoc dollar math syntax extension<sup>33</sup>:

```

inline math: $E=mc^2$

display math: $$E=mc^2$$

```

**false** Disable the Pandoc dollar math syntax extension.

```

835 \@@_add_lua_option:nnn
836 { texMathDollars }
837 { boolean }
838 { false }

839 defaultOptions.texMathDollars = false

```

<sup>33</sup>See [https://pandoc.org/MANUAL.html#extension-tex\\_math\\_dollars](https://pandoc.org/MANUAL.html#extension-tex_math_dollars).

`texMathDoubleBackslash=true, false` default: false

**true** Enable the Pandoc double backslash math syntax extension<sup>34</sup>:

|                                                                  |
|------------------------------------------------------------------|
| <pre>inline math: \\\(E=mc^2\\) display math: \\[E=mc^2\\]</pre> |
|------------------------------------------------------------------|

**false** Disable the Pandoc double backslash math syntax extension.

```
840 \@@_add_lua_option:nnn
841 { texMathDoubleBackslash }
842 { boolean }
843 { false }
844 defaultOptions.texMathDoubleBackslash = false
```

`texMathSingleBackslash=true, false` default: false

**true** Enable the Pandoc single backslash math syntax extension<sup>35</sup>:

|                                                                  |
|------------------------------------------------------------------|
| <pre>inline math: \\\(E=mc^2\\) display math: \\[E=mc^2\\]</pre> |
|------------------------------------------------------------------|

**false** Disable the Pandoc single backslash math syntax extension.

```
845 \@@_add_lua_option:nnn
846 { texMathSingleBackslash }
847 { boolean }
848 { false }
849 defaultOptions.texMathSingleBackslash = false
```

`tightLists=true, false` default: true

**true** Unordered and ordered lists whose items do not consist of multiple paragraphs will be considered *tight*. Tight lists will produce tight renderers that may produce different output than lists that are not tight:

---

<sup>34</sup>See [https://pandoc.org/MANUAL.html#extension-tex\\_math\\_double\\_backslash](https://pandoc.org/MANUAL.html#extension-tex_math_double_backslash).

<sup>35</sup>See [https://pandoc.org/MANUAL.html#extension-tex\\_math\\_single\\_backslash](https://pandoc.org/MANUAL.html#extension-tex_math_single_backslash).

```

- This is
- a tight
- unordered list.

- This is

 not a tight

- unordered list.

```

**false** Unordered and ordered lists whose items consist of multiple paragraphs will be treated the same way as lists that consist of multiple paragraphs.

```

850 \@@_add_lua_option:nnn
851 { tightLists }
852 { boolean }
853 { true }

854 defaultOptions.tightLists = true

```

**underscores=true, false**

default: true

**true** Both underscores and asterisks can be used to denote emphasis and strong emphasis:

```

single asterisks
single underscores
double asterisks
__double underscores__

```

**false** Only asterisks can be used to denote emphasis and strong emphasis. This makes it easy to write math with the **hybrid** option without the need to constantly escape subscripts.

```

855 \@@_add_lua_option:nnn
856 { underscores }
857 { boolean }
858 { true }
859 \ExplSyntaxOff

860 defaultOptions.underscores = true

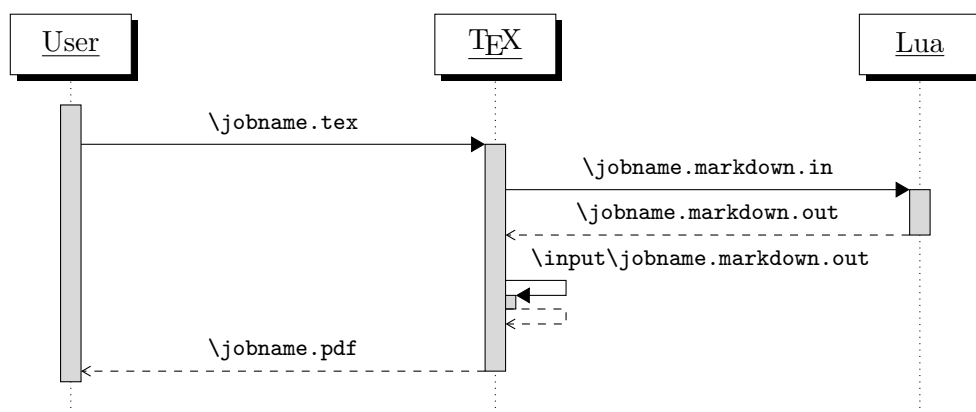
```

### 2.1.7 Command-Line Interface

The high-level operation of the Markdown package involves the communication between several programming layers: the plain T<sub>E</sub>X layer hands markdown documents to the Lua layer. Lua converts the documents to T<sub>E</sub>X, and hands the converted documents back to plain T<sub>E</sub>X layer for typesetting, see Figure 2.

This procedure has the advantage of being fully automated. However, it also has several important disadvantages: The converted T<sub>E</sub>X documents are cached on the file system, taking up increasing amount of space. Unless the T<sub>E</sub>X engine includes a Lua interpreter, the package also requires shell access, which opens the door for a malicious actor to access the system. Last, but not least, the complexity of the procedure impedes debugging.

A solution to the above problems is to decouple the conversion from the typesetting. For this reason, a command-line Lua interface for converting a markdown document to T<sub>E</sub>X is also provided, see Figure 3.

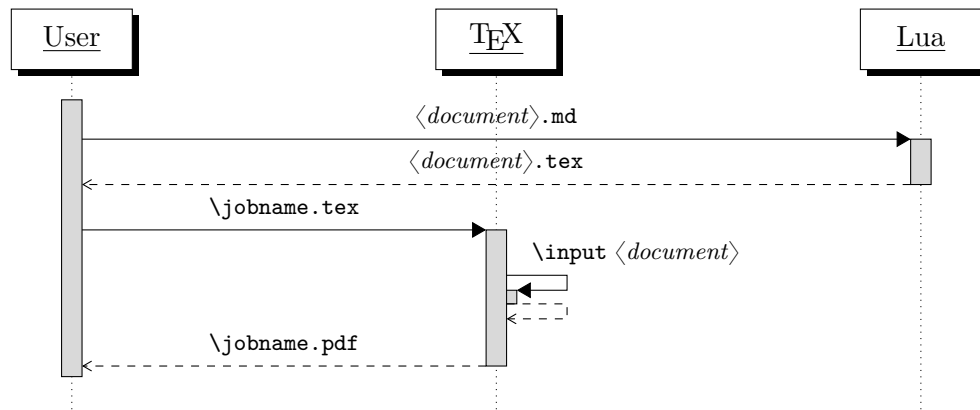


**Figure 2: A sequence diagram of the Markdown package typesetting a markdown document using the T<sub>E</sub>X interface**

```

861 .TH MARKDOWN2TEX 1 "(((LASTMODIFIED)))"
862 .SH NAME
863 markdown2tex \- convert .md files to .tex
864 .SH SYNOPSIS
865 local HELP_STRING = "Usage: " .. [[
866 markdown2tex [OPTIONS] -- [INPUT_FILE] [OUTPUT_FILE]
867
868 .SH DESCRIPTION
869 OPTIONS are documented in Section 2.2.1 of the Markdown Package User
870 Manual (https://ctan.org/pkg/markdown).
871

```



**Figure 3: A sequence diagram of the Markdown package typesetting a markdown document using the Lua command-line interface**

872 When OUTPUT\_FILE is unspecified, the result of the conversion will be  
 873 written to the standard output. When INPUT\_FILE is also unspecified, the  
 874 result of the conversion will be read from the standard input.

```

875
876 Report bugs to: witiko@mail.muni.cz
877 Markdown package home page: <https://github.com/witiko/markdown>]]
878
879 local VERSION_STRING = [[
880 markdown2tex (Markdown)]] .. metadata.version .. [[
881
882 Copyright (C)]] .. table.concat(metadata.copyright,
883 "\nCopyright (C) ") .. [[
884
885 License:]] .. metadata.license
886
887 local function warn(s)
888 io.stderr:write("Warning: " .. s .. "\n")
889 end
890
891 local function error(s)
892 io.stderr:write("Error: " .. s .. "\n")
893 os.exit(1)
894 end

```

To make it easier to copy-and-paste options from Pandoc [7] such as `fancy_lists`, `header_attributes`, and `pipe_tables`, we accept `snake_case` in addition to camel-Case variants of options. As a bonus, studies [8] also show that `snake_case` is faster to read than camelCase.

```

895 local function camel_case(option_name)

```

```

896 local cased_option_name = option_name:gsub("_(%l)", function(match)
897 return match:sub(2, 2):upper()
898 end)
899 return cased_option_name
900 end
901
902 local function snake_case(option_name)
903 local cased_option_name = option_name:gsub("%l%u", function(match)
904 return match:sub(1, 1) .. "_" .. match:sub(2, 2):lower()
905 end)
906 return cased_option_name
907 end
908
909 local cases = {camel_case, snake_case}
910 local various_case_options = {}
911 for option_name, _ in pairs(defaultOptions) do
912 for _, case in ipairs(cases) do
913 various_case_options[case(option_name)] = option_name
914 end
915 end
916
917 local process_options = true
918 local options = {}
919 local input_filename
920 local output_filename
921 for i = 1, #arg do
922 if process_options then

```

After the optional `--` argument has been specified, the remaining arguments are assumed to be input and output filenames. This argument is optional, but encouraged, because it helps resolve ambiguities when deciding whether an option or a filename has been specified.

```

923 if arg[i] == "--" then
924 process_options = false
925 goto continue

```

Unless the `--` argument has been specified before, an argument containing the equals sign (`=`) is assumed to be an option specification in a `<key>=<value>` format. The available options are listed in Section 2.1.3.

```

926 elseif arg[i]:match("=") then
927 local key, value = arg[i]:match("(.-)=(.*)")
928 if defaultOptions[key] == nil and
929 various_case_options[key] ~= nil then
930 key = various_case_options[key]
931 end

```

The `defaultOptions` table is consulted to identify whether `<value>` should be parsed as a string, number, table, or boolean.

```

932 local default_type = type(defaultOptions[key])
933 if default_type == "boolean" then
934 options[key] = (value == "true")
935 elseif default_type == "number" then
936 options[key] = tonumber(value)
937 elseif default_type == "table" then
938 options[key] = {}
939 for item in value:gmatch("[^,]+") do
940 table.insert(options[key], item)
941 end
942 else
943 if default_type ~= "string" then
944 if default_type == "nil" then
945 warn('Option "' .. key .. '" not recognized.')
946 else
947 warn('Option "' .. key .. '" type not recognized, ' ..
948 'please file a report to the package maintainer.')
949 end
950 warn('Parsing the ' .. 'value "' .. value .. '" of option "' ..
951 key .. '" as a string.')
952 end
953 options[key] = value
954 end
955 goto continue

```

Unless the `--` argument has been specified before, an argument `--help`, or `-h` causes a brief documentation for how to invoke the program to be printed to the standard output.

```

956 elseif arg[i] == "--help" or arg[i] == "-h" then
957 print(HELP_STRING)
958 os.exit()

```

Unless the `--` argument has been specified before, an argument `--version`, or `-v` causes the program to print information about its name, version, origin and legal status, all on standard output.

```

959 elseif arg[i] == "--version" or arg[i] == "-v" then
960 print(VERSION_STRING)
961 os.exit()
962 end
963 end

```

The first argument that matches none of the above patterns is assumed to be the input filename. The input filename should correspond to the Markdown document that is going to be converted to a  $\text{\TeX}$  document.

```

964 if input_filename == nil then
965 input_filename = arg[i]

```



The first argument that matches none of the above patterns is assumed to be the output filename. The output filename should correspond to the T<sub>E</sub>X document that will result from the conversion.

```
966 elseif output_filename == nil then
967 output_filename = arg[i]
968 else
969 error('Unexpected argument: "' .. arg[i] .. '".')
970 end
971 ::continue::
972 end
```

The command-line Lua interface is implemented by the files `markdown-cli.lua` and `markdown2tex.lua`, which can be invoked from the command line as follows:

```
markdown2tex cacheDir=. -- hello.md hello.tex
```

to convert the Markdown document `hello.md` to a T<sub>E</sub>X document `hello.tex`. After the Markdown package for our T<sub>E</sub>X format has been loaded, the converted document can be typeset as follows:

```
\input hello
```

## 2.2 Plain T<sub>E</sub>X Interface

The plain T<sub>E</sub>X interface provides macros for the typesetting of markdown input from within plain T<sub>E</sub>X, for setting the Lua interface options (see Section 2.1.3) used during the conversion from markdown to plain T<sub>E</sub>X and for changing the way markdown the tokens are rendered.

```
973 \def\markdownLastModified{((LASTMODIFIED))}%
974 \def\markdownVersion{((VERSION))}%
```

The plain T<sub>E</sub>X interface is implemented by the `markdown.tex` file that can be loaded as follows:

```
\input markdown
```

It is expected that the special plain T<sub>E</sub>X characters have the expected category codes, when `\input`ting the file.

### 2.2.1 Typesetting Markdown and YAML

The interface exposes the `\markdownBegin`, `\markdownEnd`, `\yamlBegin`, `\yamlEnd`, `\markinline`, `\markdownInput`, `\yamlInput`, and `\markdownEscape` macros.

### 2.2.1.1 Typesetting Markdown and yaml directly

The `\markdownBegin` macro marks the beginning of a markdown document fragment and the `\markdownEnd` macro marks its end.

```
975 \let\markdownBegin\relax
976 \let\markdownEnd\relax
```

You may prepend your own code to the `\markdownBegin` macro and redefine the `\markdownEnd` macro to produce special effects before and after the markdown block.

There are several limitations to the macros you need to be aware of:

The first limitation concerns the `\markdownEnd` macro, which must be visible directly from the input line buffer (it may not be produced as a result of input expansion). Otherwise, it will not be recognized as the end of the markdown string. As a corollary, the `\markdownEnd` string may not appear anywhere inside the markdown input.

Another limitation concerns spaces at the right end of an input line. In markdown, these are used to produce a forced line break. However, any such spaces are removed before the lines enter the input buffer of T<sub>E</sub>X [9, p. 46]. As a corollary, the `\markdownBegin` macro also ignores them.

The `\markdownBegin` and `\markdownEnd` macros will also consume the rest of the lines at which they appear. In the following example plain T<sub>E</sub>X code, the characters `c`, `e`, and `f` will not appear in the output.

```
\input markdown
a
b \markdownBegin c
d
e \markdownEnd f
g
\bye
```

Note that you may also not nest the `\markdownBegin` and `\markdownEnd` macros.

The following example plain T<sub>E</sub>X code showcases the usage of the `\markdownBegin` and `\markdownEnd` macros:

```
\input markdown
\markdownBegin
Hello **world** ...
\markdownEnd
\bye
```

The `\yamlBegin` macro marks the beginning of an YAML document fragment and the `\yamlEnd` macro marks its end.

```

977 \let\yamlBegin\relax
978 \def\yamlEnd{\markdownEnd\endgroup}

```

The `\yamlBegin` and `\yamlEnd` macros are subject to the same limitations as the `\markdownBegin` and `\markdownEnd` macros.

The following example plain T<sub>E</sub>X code showcases the usage of the `\markdownBegin` and `\markdownEnd` macros:

```

\input markdown
\yamlBegin
title: _Hello_ **world** ...
author: John Doe
\yamlEnd
\bye

```

The above code has the same effect as the below code:

```

\input markdown
\yamlSetup{jekyllData, expectJekyllData, ensureJekyllData}
\markdownBegin
title: _Hello_ **world** ...
author: John Doe
\markdownEnd
\bye

```

You can use the `\markinline` macro to input inline markdown content.

```

979 \let\markinline\relax

```

The following example plain T<sub>E</sub>X code showcases the usage of the `\markinline` macro:

```

\input markdown
\markinline{_Hello_ **world**}
\bye

```

The above code has the same effect as the below code:

```

\input markdown
\markdownSetup{contentLevel=inline}
\markdownBegin
Hello **world** ...
\markdownEnd
\bye

```

The `\markinline` macro is subject to the same limitations as the `\markdownBegin` and `\markdownEnd` macros.

### 2.2.1.2 Typesetting Markdown and yaml from external documents

You can use the `\markdownInput` macro to include markdown documents, similarly to how you might use the `\input` TeX primitive to include TeX documents. The `\markdownInput` macro accepts a single parameter with the filename of a markdown document and expands to the result of the conversion of the input markdown document to plain TeX.

```
980 \let\markdownInput\relax
```

The macro `\markdownInput` is not subject to the limitations of the `\markdownBegin` and `\markdownEnd` macros.

The following example plain TeX code showcases the usage of the `\markdownInput` macro:

```
\input markdown
\markdownInput{hello.md}
\bye
```

You can use the `\yamlInput` macro to include YAML documents, similarly to how you might use the `\input` TeX primitive to include TeX documents. The `\yamlInput` macro accepts a single parameter with the filename of a YAML document and expands to the result of the conversion of the input YAML document to plain TeX.

```
981 \def\yamlInput#1{%
982 \begingroup
983 \yamlSetup{jekyllData, expectJekyllData, ensureJekyllData}%
984 \markdownInput{#1}%
985 \endgroup
986 }%
```

The macro `\yamlInput` is also not subject to the limitations of the `\markdownBegin` and `\markdownEnd` macros.

The following example plain TeX code showcases the usage of the `\markdownInput` macro:

```
\input markdown
\yamlInput{hello.yml}
\bye
```

The above code has the same effect as the below code:

```
\input markdown
\yamlSetup{jekyllData, expectJekyllData, ensureJekyllData}
\markdownInput{hello.yml}
\bye
```

### 2.2.1.3 Typesetting TeX from inside Markdown and yaml documents

The `\markdownEscape` macro accepts a single parameter with the filename of a TeX document and executes the TeX document in the middle of a markdown document fragment. Unlike the `\input` built-in of TeX, `\markdownEscape` guarantees that the standard catcode regime of your TeX format will be used.

```
987 \let\markdownEscape\relax
```

### 2.2.2 Options

The plain TeX options are represented by TeX commands. Some of them map directly to the options recognized by the Lua interface (see Section 2.1.3), while some of them are specific to the plain TeX interface.

To determine whether plain TeX is the top layer or if there are other layers above plain TeX, we take a look on whether the `\c_@@_top_layer_tl` token list has already been defined. If not, we will assume that plain TeX is the top layer.

```
988 \ExplSyntaxOn
989 \tl_const:Nn \c_@@_option_layer_plain_tex_tl { plain_tex }
990 \cs_generate_variant:Nn
991 \tl_const:Nn
992 { NV }
993 \tl_if_exist:NF
994 \c_@@_top_layer_tl
995 {
996 \tl_const:NV
997 \c_@@_top_layer_tl
998 \c_@@_option_layer_plain_tex_tl
999 }
```

To enable the enumeration of plain TeX options, we will maintain the `\g_@@_plain_tex_options_seq` sequence.

```
1000 \seq_new:N \g_@@_plain_tex_options_seq
```

To enable the reflection of default/experimental plain TeX options and their types, we will maintain the `\g_@@_default_plain_tex_options_prop`, `\g_@@_experimental_plain_tex_options_seq` and `\g_@@_plain_tex_option_types_prop` property lists and sequences, respectively.

```
1001 \prop_new:N \g_@@_plain_tex_option_types_prop
1002 \prop_new:N \g_@@_default_plain_tex_options_prop
1003 \seq_new:N \g_@@_experimental_plain_tex_options_seq
1004 \seq_gput_right:NV
1005 \g_@@_option_layers_seq
1006 \c_@@_option_layer_plain_tex_tl
1007 \cs_new_protected:Nn
1008 \@@_add_plain_tex_option:nnn
1009 {
1010 \@@_add_option:Vnnn
```

```

1011 \c_@@_option_layer_plain_tex_tl
1012 { #1 }
1013 { #2 }
1014 { #3 }
1015 }

```

The plain TeX options may be also be specified via the `\markdownSetup` macro. Here, the plain TeX options are represented by a comma-delimited list of  $\langle key \rangle = \langle value \rangle$  pairs. For boolean options, the  $= \langle value \rangle$  part is optional, and  $\langle key \rangle$  will be interpreted as  $\langle key \rangle = \text{true}$  if the  $= \langle value \rangle$  part has been omitted. The `\markdownSetup` macro receives the options to set up as its only argument.

```

1016 \cs_new_protected:Nn
1017 \@@_setup:n
1018 {
1019 \keys_set:nn
1020 { markdown/options }
1021 { #1 }
1022 }
1023 \cs_gset_eq:NN
1024 \markdownSetup
1025 \@@_setup:n

```

The command `\yamlSetup` is also available as an alias for the command `\markdownSetup`.

```

1026 \cs_gset_eq:NN
1027 \yamlSetup
1028 \markdownSetup

```

The `\markdownIfOption{ $\langle name \rangle$ }{ $\langle iftrue \rangle$ }{ $\langle iffalse \rangle$ }` macro is provided for testing, whether the value of `\markdownOption $\langle name \rangle$`  is `true`. If the value is `true`, then  $\langle iftrue \rangle$  is expanded, otherwise  $\langle iffalse \rangle$  is expanded.

```

1029 \prg_new_protected_conditional:Nnn
1030 \@@_if_option:n
1031 { TF, T, F }
1032 {
1033 \@@_get_option_type:nN
1034 { #1 }
1035 \l_tmpa_tl
1036 \str_if_eq:NNF
1037 \l_tmpa_tl
1038 \c_@@_option_type_boolean_tl
1039 {
1040 \msg_error:nnxx
1041 { markdown }
1042 { expected-boolean-option }
1043 { #1 }
1044 { \l_tmpa_tl }

```

```

1045 }
1046 \@@_get_option_value:nN
1047 { #1 }
1048 \l_tmpa_tl
1049 \str_if_eq:NNTF
1050 \l_tmpa_tl
1051 \c_@@_option_value_true_tl
1052 { \prg_return_true: }
1053 { \prg_return_false: }
1054 }
1055 \msg_new:nnn
1056 { markdown }
1057 { expected-boolean-option }
1058 {
1059 Option~#1~has~type~#2,~
1060 but~a~boolean~was~expected.
1061 }
1062 \let
1063 \markdownIfOption
1064 \@@_if_option:nTF

```

### 2.2.2.1 Finalizing and Freezing the Cache

The `\markdownOptionFinalizeCache` option corresponds to the Lua interface `finalizeCache` option, which creates an output file `frozenCacheFileName` (frozen cache) that contains a mapping between an enumeration of the markdown documents in the plain T<sub>E</sub>X document and their auxiliary files cached in the `cacheDir` directory.

The `\markdownOptionFrozenCache` option uses the mapping previously created by the `finalizeCache` option, and uses it to typeset the plain T<sub>E</sub>X document without invoking Lua. As a result, the plain T<sub>E</sub>X document becomes more portable, but further changes in the order and the content of markdown documents will not be reflected. It defaults to `false`.

```

1065 \@@_add_plain_tex_option:nnn
1066 { frozenCache }
1067 { boolean }
1068 { false }

```

The standard usage of the above two options is as follows:

1. Remove the `cacheDir` cache directory with stale auxiliary cache files.
2. Enable the `finalizeCache` option.
4. Typeset the plain T<sub>E</sub>X document to populate and finalize the cache.
5. Enable the `frozenCache` option.
6. Publish the source code of the plain T<sub>E</sub>X document and the `cacheDir` directory.

**2.2.2.2 File and Directory Names** The `\markdownOptionInputTempFileName` macro sets the filename of the temporary input file that is created during the buffering of markdown text from a  $\text{\TeX}$  source. It defaults to `\jobname.markdown.in`.

The expansion of this macro must not contain quotation marks (") or backslash symbols (\).

```

1069 \tl_set:Nn
1070 \l_tmpa_tl
1071 {
1072 \str_use:N
1073 \g_@@_unquoted_jobname_str
1074 .markdown.in
1075 }
1076 \bool_if:NT
1077 \g_@@_jobname_quoted_bool
1078 {
1079 \tl_put_left:Nn
1080 \l_tmpa_tl
1081 { " }
1082 \tl_put_right:Nn
1083 \l_tmpa_tl
1084 { " }
1085 }
1086 \cs_generate_variant:Nn
1087 \@@_add_plain_tex_option:nnn
1088 { nnV }
1089 \@@_add_plain_tex_option:nnV
1090 { inputTempFileName }
1091 { path }
1092 \l_tmpa_tl

```

The `\markdownOptionOutputDir` macro sets the path to the directory that will contain the auxiliary cache files produced by the Lua implementation and also the auxiliary files produced by the plain  $\text{\TeX}$  implementation. The option defaults to `.` or, since  $\text{\TeX}$  Live 2024, to the value of the `-output-directory` option of your  $\text{\TeX}$  engine.

In  $\text{\MikTeX}$ , this automatic detection is currently only supported with  $\text{\LuaTeX}$ <sup>36</sup>. If you need to use  $\text{\MikTeX}$  and cannot use  $\text{\LuaTeX}$ , you can either a) fix the automatic detection by setting the environmental variable `TEXMF_OUTPUT_DIRECTORY` manually or by setting the `\markdownOptionOutputDir` option manually.

The path must be set to the same value as the `-output-directory` option of your  $\text{\TeX}$  engine for the package to function correctly. We need this macro to make the Lua implementation aware where it should store the helper files. The same limitations apply here as in the case of the `inputTempFileName` macro.

---

<sup>36</sup>See <https://github.com/MiKTeX/miktex/issues/1630>.



```

1093 \@@_add_plain_tex_option:nnn
1094 { outputDir }
1095 { path }
1096 { . }

```

### 2.2.2.3 No default token renderer prototypes

The Markdown package provides default definitions for token renderer prototypes using the [witiko/markdown/defaults](#) theme (see Section 2.2.3). Although these default definitions provide a useful starting point for authors, they use extra resources, especially with higher-level T<sub>E</sub>X formats such as L<sup>A</sup>T<sub>E</sub>X and ConT<sub>E</sub>Xt. Furthermore, the default definitions may change at any time, which may pose a problem for maintainers of Markdown themes and templates who may require a stable output.

The `\markdownOptionPlain` macro specifies whether higher-level T<sub>E</sub>X formats should only use the plain T<sub>E</sub>X default definitions or whether they should also use the format-specific default definitions. Whereas plain T<sub>E</sub>X default definitions only provide definitions for simple elements such as emphasis, strong emphasis, and paragraph separators, format-specific default definitions add support for more complex elements such as lists, tables, and citations. On the flip side, plain T<sub>E</sub>X default definitions load no extra resources and are rather stable, whereas format-specific default definitions load extra resources and are subject to a more rapid change.

Here is how you would enable the macro in a L<sup>A</sup>T<sub>E</sub>X document:

```
\usepackage[plain]{markdown}
```

Here is how you would enable the macro in a ConT<sub>E</sub>Xt document:

```

\def\markdownOptionPlain{true}
\usemodule[t][markdown]

```

The macro must be set before or during the loading of the package. Setting the macro after loading the package has no effect.

```

1097 \@@_add_plain_tex_option:nnn
1098 { plain }
1099 { boolean }
1100 { false }

```

The `\markdownOptionNoDefaults` macro specifies whether we should prevent the loading of default definitions or not. This is useful in contexts, where we want to have total control over how all elements are rendered.

Here is how you would enable the macro in a L<sup>A</sup>T<sub>E</sub>X document:

```
\usepackage[noDefaults]{markdown}
```

Here is how you would enable the macro in a ConT<sub>E</sub>Xt document:

```
\def\markdownOptionNoDefaults{true}
\usemodule[t][markdown]
```

The macro must be set before or during the loading of the package. Setting the macro after loading the package has no effect.

```
1101 \@@_add_plain_tex_option:nnn
1102 { noDefaults }
1103 { boolean }
1104 { false }
```

#### 2.2.2.4 Miscellaneous Options

The `\markdownOptionStripPercentSigns` macro controls whether a percent sign (%) at the beginning of a line will be discarded when buffering Markdown input (see sections 3.2.5 and 3.2.6) or not. Notably, this enables the use of markdown when writing T<sub>E</sub>X package documentation using the Doc L<sup>A</sup>T<sub>E</sub>X package [10] or similar. The recognized values of the macro are `true` (discard) and `false` (retain). It defaults to `false`.

```
1105 \seq_gput_right:Nn
1106 \g_@@_plain_tex_options_seq
1107 { stripPercentSigns }
1108 \prop_gput:Nnn
1109 \g_@@_plain_tex_option_types_prop
1110 { stripPercentSigns }
1111 { boolean }
1112 \prop_gput:Nnx
1113 \g_@@_default_plain_tex_options_prop
1114 { stripPercentSigns }
1115 { false }
```

#### 2.2.2.5 Generating Plain T<sub>E</sub>X Option Macros and Key-Values

We define the command `\@@_define_option_commands_and_keyvals:` that defines plain T<sub>E</sub>X macros and the key-value interface of the `\markdownSetup` macro for the above plain T<sub>E</sub>X options.

The command also defines macros and key-values that map directly to the options recognized by the Lua interface, such as `\markdownOptionHybrid` for the `hybrid` Lua option (see Section 2.1.3), which are not processed by the plain T<sub>E</sub>X implementation, only passed along to Lua.

Furthermore, the command also defines options and key-values for subsequently loaded layers that correspond to higher-level T<sub>E</sub>X formats such as L<sup>A</sup>T<sub>E</sub>X and ConT<sub>E</sub>Xt.

For the macros that correspond to the non-boolean options recognized by the Lua interface, the same limitations apply here in the case of the `inputTempFileName` macro.

```

1116 \cs_new_protected:Nn
1117 \@@_define_option_commands_and_keyvals:
1118 {
1119 \seq_map_inline:Nn
1120 \g_@@_option_layers_seq
1121 {
1122 \seq_map_inline:cn
1123 { g_@@_ ##1 _options_seq }
1124 {
1125 \@@_define_option_command:n
1126 { #####1 }

```

To make it easier to copy-and-paste options from Pandoc [7] such as `fancy_lists`, `header_attributes`, and `pipe_tables`, we accept snake\_case in addition to camel-Case variants of options. As a bonus, studies [8] also show that snake\_case is faster to read than camelCase.

```

1127 \@@_with_various_cases:nn
1128 { #####1 }
1129 {
1130 \@@_define_option_keyval:nnn
1131 { ##1 }
1132 { #####1 }
1133 { #####1 }
1134 }
1135 }
1136 }
1137 }
1138 \cs_new_protected:Nn
1139 \@@_define_option_command:n
1140 {

```

For experimental options, redirect the option command to the option command `\markdownOptionExperimental`.

```

1141 \bool_set_false:N
1142 \l_tmpa_bool
1143 \seq_map_inline:Nn
1144 \g_@@_option_layers_seq
1145 {
1146 \seq_if_in:cnT
1147 { g_@@_experimental_ ##1 _options_seq }
1148 { #1 }
1149 {
1150 \bool_set_true:N
1151 \l_tmpa_bool

```

```

1152 \seq_map_break:
1153 }
1154 }
1155 \bool_if:NTF
1156 \l_tmpa_bool
1157 {
1158 _@@_option_tl_to_csname:nN
1159 { #1 }
1160 \l_tmpa_tl
1161 \cs_if_exist:cF
1162 { \l_tmpa_tl }
1163 {
1164 \cs_gset:cpn
1165 { \l_tmpa_tl }
1166 { \markdownOptionExperimental }
1167 }
1168 }
1169 {

```

Use the `lt3luabridge` library to determine the default value of the `\markdownOptionOutputDir` macro.

```

1170 \str_if_eq:nnTF
1171 { #1 }
1172 { outputDir }
1173 { \@@_define_option_command_output_dir: }
1174 {

```

Do not override options defined before loading the package.

```

1175 _@@_option_tl_to_csname:nN
1176 { #1 }
1177 \l_tmpa_tl
1178 \cs_if_exist:cF
1179 { \l_tmpa_tl }
1180 {
1181 \@@_get_default_option_value:nN
1182 { #1 }
1183 \l_tmpa_tl
1184 \@@_set_option_value:nV
1185 { #1 }
1186 \l_tmpa_tl
1187 }
1188 }
1189 }
1190 }
1191 \ExplSyntaxOff
1192 \input lt3luabridge.tex

```

Use the `lt3luabridge` library to determine the default value of the `\markdownOptionOutputDir` macro by using one of the following:

1. The `status.output_directory` variable [2, Section 10.2], which is available since LuaTeX 1.18.0 from TeX Live 2024 and in other TeX distributions like MikTeX since ca March 2024. We are only able to read this variable in LuaTeX and not other TeX engines.
2. The `TEXMF_OUTPUT_DIRECTORY` environmental variable, which is available since TeX Live 2024. We are only able to read this variable in TeX Live and not some other TeX distributions like MikTeX.

```

1193 \ExplSyntaxOn
1194 \cs_new:Nn
1195 \@@_define_option_command_output_dir:
1196 {
1197 \cs_if_free:NT
1198 \markdownOptionOutputDir
1199 {
1200 \bool_if:nTF
1201 {
1202 \cs_if_exist_p:N
1203 \luabridge_tl_set:Nn &&
1204 (
1205 \int_compare_p:nNn
1206 { \g_luabridge_method_int }
1207 =
1208 { \c_luabridge_method_directlua_int } ||
1209 \sys_if_shell_unrestricted_p:
1210)
1211 }
1212 {

```

Set most catcodes to category 12 (other) to ensure that special characters in the output directory name such as backslashes (`\`) are not interpreted as control sequences.

```

1213 \group_begin:
1214 \cctab_select:N
1215 \c_str_cctab
1216 \luabridge_tl_set:Nn
1217 \l_tmpa_tl
1218 {
1219 print(
1220 (status.output_directory)
1221 or~os.getenv("TEXMF_OUTPUT_DIRECTORY")
1222 or~"."
1223)
1224 }

```

```

1225 \tl_gset:NV
1226 \markdownOptionOutputDir
1227 \l_tmpa_tl
1228 \group_end:
1229 }
1230 {
1231 \tl_gset:Nn
1232 \markdownOptionOutputDir
1233 { . }
1234 }
1235 }
1236 }
1237 \cs_new_protected:Nn
1238 \@@_set_option_value:nn
1239 {
1240 \@@_define_option:n
1241 { #1 }
1242 \@@_get_option_type:nN
1243 { #1 }
1244 \l_tmpa_tl
1245 \str_if_eq:NNTF
1246 \c_@@_option_type_counter_tl
1247 \l_tmpa_tl
1248 {
1249 \@@_option_tl_to_csname:nN
1250 { #1 }
1251 \l_tmpa_tl
1252 \int_gset:cn
1253 { \l_tmpa_tl }
1254 { #2 }
1255 }
1256 {
1257 \@@_option_tl_to_csname:nN
1258 { #1 }
1259 \l_tmpa_tl
1260 \cs_set:cpn
1261 { \l_tmpa_tl }
1262 { #2 }
1263 }
1264 }
1265 \cs_new_protected:Nn
1266 \@@_prepend_option_value:nn
1267 {
1268 \@@_get_option_value:nN
1269 { #1 }
1270 \l_tmpa_clist
1271 \clist_put_left:Nn

```

```

1272 \l_tmpa_clist
1273 { #2 }
1274 \@@_set_option_value:nV
1275 { #1 }
1276 \l_tmpa_clist
1277 }
1278 \cs_new_protected:Nn
1279 \@@_append_option_value:nn
1280 {
1281 \@@_get_option_value:nN
1282 { #1 }
1283 \l_tmpa_clist
1284 \clist_put_right:Nn
1285 \l_tmpa_clist
1286 { #2 }
1287 \@@_set_option_value:nV
1288 { #1 }
1289 \l_tmpa_clist
1290 }
1291 \cs_generate_variant:Nn
1292 \@@_set_option_value:nn
1293 { nV }
1294 \cs_new_protected:Nn
1295 \@@_define_option:n
1296 {
1297 \@@_option_tl_to_csname:nN
1298 { #1 }
1299 \l_tmpa_tl
1300 \cs_if_free:cT
1301 { \l_tmpa_tl }
1302 {
1303 \@@_get_option_type:nN
1304 { #1 }
1305 \l_tmpb_tl
1306 \str_if_eq:NNT
1307 \c_@@_option_type_counter_tl
1308 \l_tmpb_tl
1309 {
1310 \@@_option_tl_to_csname:nN
1311 { #1 }
1312 \l_tmpa_tl
1313 \int_new:c
1314 { \l_tmpa_tl }
1315 }
1316 }
1317 }
1318 \cs_new_protected:Nn

```

```

1319 \@@_define_option_keyval:nnn
1320 {
1321 \prop_get:cnN
1322 { g_@@_ #1 _option_types_prop }
1323 { #2 }
1324 \l_tmpa_tl
1325 \str_if_eq:VTF
1326 \l_tmpa_tl
1327 \c_@@_option_type_boolean_tl
1328 {
1329 \keys_define:nn
1330 { markdown/options }
1331 {

```

For boolean options, we also accept **yes** as an alias for **true** and **no** as an alias for **false**.

```

1332 #3 .code:n = {
1333 \tl_set:Nx
1334 \l_tmpa_tl
1335 {
1336 \str_case:nnF
1337 { ##1 }
1338 {
1339 { yes } { true }
1340 { no } { false }
1341 }
1342 { ##1 }
1343 }
1344 \@@_set_option_value:nV
1345 { #2 }
1346 \l_tmpa_tl
1347 },
1348 #3 .value_required:n = { false },
1349 #3 .default:n = { true },
1350 }
1351 }
1352 {
1353 \keys_define:nn
1354 { markdown/options }
1355 {
1356 #3 .value_required:n = { true },
1357 #3 .code:n = {
1358 \@@_set_option_value:nn
1359 { #2 }
1360 { ##1 }
1361 },
1362 }

```



```
1363 }
```

For comma-list options, we assume that  $\langle key \rangle$  is a regular English noun in plural (such as [extensions](#)) and we also define the  $\langle singular\ key \rangle = \langle value \rangle$  interface, where  $\langle singular\ key \rangle$  is  $\langle key \rangle$  after stripping the trailing -s (such as [extension](#)). Rather than setting the option to  $\langle value \rangle$ , this interface appends  $\langle value \rangle$  to the current value as the rightmost item in the list.

```
1364 \str_if_eq:VVT
1365 \l_tmpa_tl
1366 \c_@@_option_type_clist_tl
1367 {
1368 \tl_set:Nn
1369 \l_tmpa_tl
1370 { #3 }
1371 \tl_reverse:N
1372 \l_tmpa_tl
1373 \str_if_eq:enF
1374 {
1375 \tl_head:V
1376 \l_tmpa_tl
1377 }
1378 { s }
1379 {
1380 \msg_error:nnn
1381 { markdown }
1382 { malformed-name-for-clist-option }
1383 { #3 }
1384 }
1385 \tl_set:Nx
1386 \l_tmpa_tl
1387 {
1388 \tl_tail:V
1389 \l_tmpa_tl
1390 }
1391 \tl_reverse:N
1392 \l_tmpa_tl
1393 \tl_set_eq:NN
1394 \l_tmpb_tl
1395 \l_tmpa_tl
1396 \tl_put_right:Nn
1397 \l_tmpa_tl
1398 { .value_required:n = { true } }
1399 \tl_put_right:Nn
1400 \l_tmpb_tl
1401 {
1402 .code:n = {
1403 \@@_append_option_value:nn
```

```

1404 { #2 }
1405 { ##1 }
1406 }
1407 }
1408 \keys_define:nV
1409 { markdown/options }
1410 \l_tmpa_tl
1411 \keys_define:nV
1412 { markdown/options }
1413 \l_tmpb_tl

```

To achieve parity with token renderers and renderer prototypes (see sections 2.2.5.48 and 2.2.6.2, respectively) the syntax  $\langle key \rangle += \langle value \rangle$  and  $\langle key \rangle \$ = \langle value \rangle$  with the same appending semantics as  $\langle singular\ key \rangle = \langle value \rangle$  is also supported.

```

1414 \keys_define:nn
1415 { markdown/options }
1416 {
1417 #3~+ .value_required:n = { true },
1418 #3~+ .code:n = {
1419 \@@_append_option_value:nn
1420 { #2 }
1421 { ##1 }
1422 },
1423 #3 + .value_required:n = { true },
1424 #3 + .code:n = {
1425 \@@_append_option_value:nn
1426 { #2 }
1427 { ##1 }
1428 },
1429 #3~$.value_required:n = { true },
1430 #3~$.code:n = {
1431 \@@_append_option_value:nn
1432 { #2 }
1433 { ##1 }
1434 },
1435 #3 $.value_required:n = { true },
1436 #3 $.code:n = {
1437 \@@_append_option_value:nn
1438 { #2 }
1439 { ##1 }
1440 },

```

Furthermore, similar to token renderers and renderer prototypes, the syntax  $\langle key \rangle ^ = \langle value \rangle$  is also supported. This syntax prepends  $\langle value \rangle$  to the current value as the leftmost item in the list.

```

1441 #3~^ .value_required:n = { true },
1442 #3~^ .code:n = {

```

```

1443 \@@_prepend_option_value:nn
1444 { #2 }
1445 { ##1 }
1446 },
1447 #3 ^ .value_required:n = { true },
1448 #3 ^ .code:n = {
1449 \@@_prepend_option_value:nn
1450 { #2 }
1451 { ##1 }
1452 },
1453 }
1454 }
1455 }
1456 \cs_generate_variant:Nn
1457 \clist_set:Nn
1458 { NV }
1459 \cs_generate_variant:Nn
1460 \keys_define:nn
1461 { nV }
1462 \prg_generate_conditional_variant:Nnn
1463 \str_if_eq:nn
1464 { en }
1465 { p, F }
1466 \msg_new:nnn
1467 { markdown }
1468 { malformed-name-for-clist-option }
1469 {
1470 Clist-option-name~#1~does~not~end~with~-s.
1471 }

```

If plain TeX is the top layer, we use the `\@@_define_option_commands_and_keyvals:` macro to define plain TeX option macros and key-values immediately. Otherwise, we postpone the definition until the upper layers have been loaded.

```

1472 \str_if_eq:VVT
1473 \c_@@_top_layer_tl
1474 \c_@@_option_layer_plain_tex_tl
1475 {
1476 \@@_define_option_commands_and_keyvals:
1477 }
1478 \ExplSyntaxOff

```

### 2.2.3 Themes

User-defined themes for the Markdown package provide a domain-specific interpretation of Markdown tokens. Themes allow the authors to achieve a specific look and other high-level goals without low-level programming.

The key-values `theme=<theme name>` and `import=<theme name>`, optionally followed by `@<theme version>`, load a T<sub>E</sub>X document (further referred to as a *theme*) named `markdowntheme<munged theme name>.tex`, where the *munged theme name* is the *theme name* after the substitution of all forward slashes (/) for an underscore (\_). The theme name must be *qualified* and contain no underscores or at signs (@). Themes are inspired by the Beamer L<sup>A</sup>T<sub>E</sub>X package, which provides similar functionality with its `\usetheme` macro [11, Section 15.1].

A theme name is qualified if and only if it contains at least one forward slash. Theme names must be qualified to minimize naming conflicts between different themes with a similar purpose. The preferred format of a theme name is `<theme author>/<theme purpose>/<private naming scheme>`, where the *private naming scheme* may contain additional forward slashes. For example, a theme by a user `witiko` for the MU theme of the Beamer document class may have the name `witiko/beamer/MU`.

Theme names are munged to allow structure inside theme names without dictating where the themes should be located inside the T<sub>E</sub>X directory structure. For example, loading a theme named `witiko/beamer/MU` would load a T<sub>E</sub>X document package named `markdownthemewitiko_beamer_MU.tex`.

If `@<theme version>` is specified after `<theme name>`, then the text *theme version* will be available in the macro `\markdownThemeVersion` when the theme is loaded. If `@<theme version>` is not specified, the macro `\markdownThemeVersion` will contain the text `latest` [12].

```

1479 \ExplSyntaxOn
1480 \keys_define:nn
1481 { markdown/options }
1482 {
1483 theme .value_required:n = { true },
1484 theme .code:n = {
1485 \@@_set_theme:n
1486 { #1 }
1487 },
1488 import .value_required:n = { true },
1489 import .code:n = {
1490 \tl_set:Nn
1491 \l_tmpa_tl
1492 { #1 }

```

To ensure that keys containing forward slashes get passed correctly, we replace all forward slashes in the input with backslash tokens with category code letter and then undo the replacement. This means that if any unbraced backslash tokens with category code letter exist in the input, they will be replaced with forward slashes. However, this should be extremely rare.

```

1493 \tl_replace_all:NnV
1494 \l_tmpa_tl
1495 { / }

```

```

1496 \c_backslash_str
1497 \keys_set:nV
1498 { markdown/options/import }
1499 \l_tmpa_tl
1500 },
1501 }

```

To keep track of the current theme when themes are nested, we will maintain the stacks `\g_@@_theme_names_seq` and `\g_@@_theme_versions_seq` stack of theme names and versions, respectively. For convenience, the name of the current theme and version is also available in the macros `\g_@@_current_theme_tl` and `\markdownThemeVersion`, respectively.

```

1502 \seq_new:N
1503 \g_@@_theme_names_seq
1504 \seq_new:N
1505 \g_@@_theme_versions_seq
1506 \tl_new:N
1507 \g_@@_current_theme_tl
1508 \tl_gset:Nn
1509 \g_@@_current_theme_tl
1510 { }
1511 \seq_gput_right:NV
1512 \g_@@_theme_names_seq
1513 \g_@@_current_theme_tl
1514 \cs_new:Npn
1515 \markdownThemeVersion
1516 { }
1517 \seq_gput_right:NV
1518 \g_@@_theme_versions_seq
1519 \g_@@_current_theme_tl
1520 \cs_new_protected:Nn
1521 \@@_set_theme:n
1522 {

```

First, we validate the theme name.

```

1523 \str_if_in:nnF
1524 { #1 }
1525 { / }
1526 {
1527 \msg_error:nnn
1528 { markdown }
1529 { unqualified-theme-name }
1530 { #1 }
1531 }
1532 \str_if_in:nnT
1533 { #1 }
1534 { _ }

```

```

1535 {
1536 \msg_error:nnn
1537 { markdown }
1538 { underscores-in-theme-name }
1539 { #1 }
1540 }

```

Next, we extract the theme version.

```

1541 \str_if_in:nnTF
1542 { #1 }
1543 { @ }
1544 {
1545 \regex_extract_once:nnN
1546 { (.*?) @ (.*?) }
1547 { #1 }
1548 \l_tmpa_seq
1549 \seq_gpop_left:NN
1550 \l_tmpa_seq
1551 \l_tmpa_tl
1552 \seq_gpop_left:NN
1553 \l_tmpa_seq
1554 \l_tmpa_tl
1555 \tl_gset:NV
1556 \g_@@_current_theme_tl
1557 \l_tmpa_tl
1558 \seq_gpop_left:NN
1559 \l_tmpa_seq
1560 \l_tmpa_tl
1561 \cs_gset:Npe
1562 \markdownThemeVersion
1563 {
1564 \tl_use:N
1565 \l_tmpa_tl
1566 }
1567 }
1568 {
1569 \tl_gset:Nn
1570 \g_@@_current_theme_tl
1571 { #1 }
1572 \cs_gset:Npn
1573 \markdownThemeVersion
1574 { latest }
1575 }

```

Next, we strip a leading slash, if present, for consistency with snippets, where a leading slash distinguishes absolute snippet names from relative ones. Theme names, however, are currently always absolute, so stripping the slash is only a syntactic normalization and has no semantic effect.

```

1576 \str_if_eq:enT
1577 {
1578 \tl_head:V
1579 \g_@@_current_theme_tl
1580 }
1581 { / }
1582 {
1583 \tl_gset:Ne
1584 \g_@@_current_theme_tl
1585 {
1586 \tl_tail:V
1587 \g_@@_current_theme_tl
1588 }
1589 }

```

Next, we munge the theme name.

```

1590 \str_set:NV
1591 \l_tmpa_str
1592 \g_@@_current_theme_tl
1593 \str_replace_all:Nnn
1594 \l_tmpa_str
1595 { / }
1596 { _ }

```

Finally, we load the theme. Before loading the theme, we push down the current name and version of the theme on the stack.

```

1597 \tl_set:NV
1598 \l_tmpa_tl
1599 \g_@@_current_theme_tl
1600 \tl_put_right:Nn
1601 \g_@@_current_theme_tl
1602 { / }
1603 \seq_gput_right:NV
1604 \g_@@_theme_names_seq
1605 \g_@@_current_theme_tl
1606 \seq_gput_right:NV
1607 \g_@@_theme_versions_seq
1608 \markdownThemeVersion
1609 \@@_load_theme:VeV
1610 \l_tmpa_tl
1611 { \markdownThemeVersion }
1612 \l_tmpa_str

```

After the theme has been loaded, we recover the name and version of the previous theme from the stack.

```

1613 \seq_gpop_right:NN
1614 \g_@@_theme_names_seq
1615 \l_tmpa_tl

```

```

1616 \seq_get_right:NN
1617 \g_@@_theme_names_seq
1618 \l_tmpa_tl
1619 \tl_gset:NV
1620 \g_@@_current_theme_tl
1621 \l_tmpa_tl
1622 \seq_gpop_right:NN
1623 \g_@@_theme_versions_seq
1624 \l_tmpa_tl
1625 \seq_get_right:NN
1626 \g_@@_theme_versions_seq
1627 \l_tmpa_tl
1628 \cs_gset:Npe
1629 \markdownThemeVersion
1630 {
1631 \tl_use:N
1632 \l_tmpa_tl
1633 }
1634 }
1635 \msg_new:nnnn
1636 { markdown }
1637 { unqualified-theme-name }
1638 { Won't load theme with unqualified name #1 }
1639 { Theme names must contain at least one forward slash }
1640 \msg_new:nnnn
1641 { markdown }
1642 { underscores-in-theme-name }
1643 { Won't load theme with an underscore in its name #1 }
1644 { Theme names must not contain underscores in their names }
1645 \cs_generate_variant:Nn
1646 \tl_replace_all:Nnn
1647 { NnV }
1648 \cs_generate_variant:Nn
1649 \cs_gset:Npn
1650 { Npe }
1651 \prg_generate_conditional_variant:Nnn
1652 \str_if_eq:nn
1653 { en }
1654 { T }

```

We also define the prop `\g_@@_plain_tex_built_in_themes_prop` that contains the code of built-in themes. This is a packaging optimization, so that built-in themes does not need to be distributed in many small files.

```

1655 \prop_new:N
1656 \g_@@_plain_tex_built_in_themes_prop

```

Built-in plain T<sub>E</sub>X themes provided with the Markdown package include:



**witiko/diagrams** A theme that typesets fenced code blocks with the infostrings `dot`, `mermaid`, and `plantuml` as figures with diagrams produced with the command `dot` from Graphviz tools, the command `mmdc` from the npm package `@mermaid-js/mermaid-cli`, and the command `plantuml` from the package `PlantUML`, respectively.

The key-value attribute `caption` can be used to specify the caption of the figure and for the infostrings `dot` and `plantuml`, the key-value attribute `format` can be used to specify the output image format. The remaining attributes are treated as image attributes.

```
\documentclass{article}
\usepackage[relativeReferences, texComments]{markdown}
\markdownSetup{import=witiko/diagrams@v2}
\begin{document}
\begin{markdown}
``` dot {caption="An example directed graph" %
        format=svg width=12cm #dot}
digraph tree {
    margin = 0;
    rankdir = "LR";

    latex -> pmml;
    latex -> cmml;
    pmml -> slt;
    cmml -> opt;
    cmml -> prefix;
    cmml -> infix;
    pmml -> mterms [style=dashed];
    cmml -> mterms;

    latex [label = "LaTeX"];
    pmml [label = "Presentation MathML"];
    cmml [label = "Content MathML"];
    slt [label = "Symbol Layout Tree"];
    opt [label = "Operator Tree"];
    prefix [label = "Prefix"];
    infix [label = "Infix"];
    mterms [label = "M-Terms"];
}
```

``` mermaid {caption="An example mindmap" %
```

```

width=9cm #mermaid}
mindmap
  root )base-idea(
    sub<br/>idea 1
      ((?))
    sub<br/>idea 2
      ((?))
    sub<br/>idea 3
      ((?))
    sub<br/>idea 4
      ((?))
  ...

... plantuml {caption="An example UML sequence diagram" %
width=7cm #plantuml}
@startuml
' Define participants (actors)
participant "Client" as C
participant "Server" as S
participant "Database" as DB

' Diagram title
title Simple Request-Response Flow

' Messages
C -> S: Send Request
note over S: Process request

alt Request is valid
  S -> DB: Query Data
  DB -> S: Return Data
  S -> C: Respond with Data
else Request is invalid
  S -> C: Return Error
end
@enduml
...

See the diagrams in figures <#dot>, <#mermaid>, and <#plantuml>.
\end{markdown}
\end{document}

```

Typesetting the above document produces the output shown in figures 4, 5, and 6.

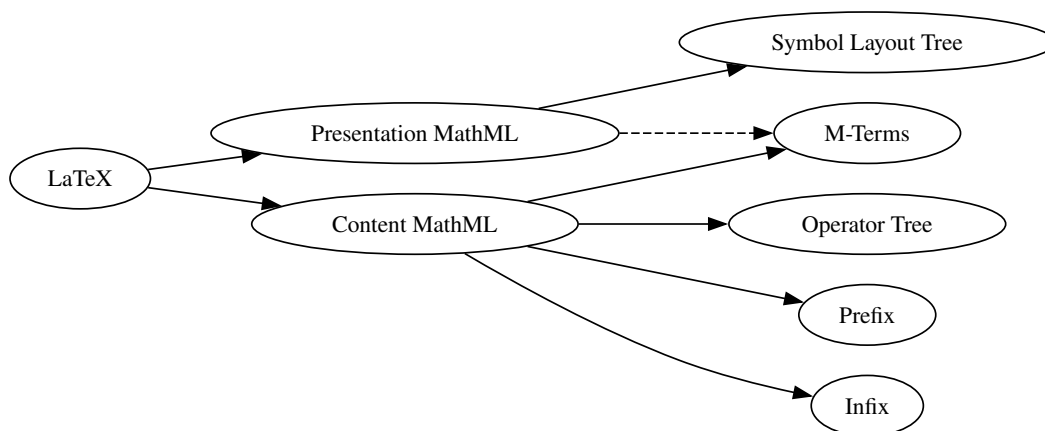


Figure 4: An example directed graph

The theme requires a Unix-like operating system with GNU Diffutils, Graphviz, the npm package [@mermaid-js/mermaid-cli](#), and PlantUML installed. All these packages are already included in the Docker image [witiko/markdown](#); consult [Dockerfile](#) to see how they are installed. The theme also requires shell access unless the [frozenCache](#) plain \TeX option is enabled.

witiko/glossaries A theme that defines snippets with integrations for the \LaTeX package glossaries. See Section 2.3.5 for more details.

witiko/graphicx/http A theme that adds support for downloading images whose URL has the HTTP or HTTPS protocol.

```

\documentclass{article}
\usepackage[import=witiko/graphicx/http]{markdown}
\begin{document}
\begin{markdown}
! [img] (https://github.com/witiko/markdown/raw/main/markdown.png
    "The banner of the Markdown package")
\end{markdown}
\end{document}
  
```

Typesetting the above document produces the output shown in Figure 7. The theme requires the catchfile \LaTeX package and a Unix-like operating system with GNU Coreutils [md5sum](#) and either GNU Wget or [cURL](#) installed. The

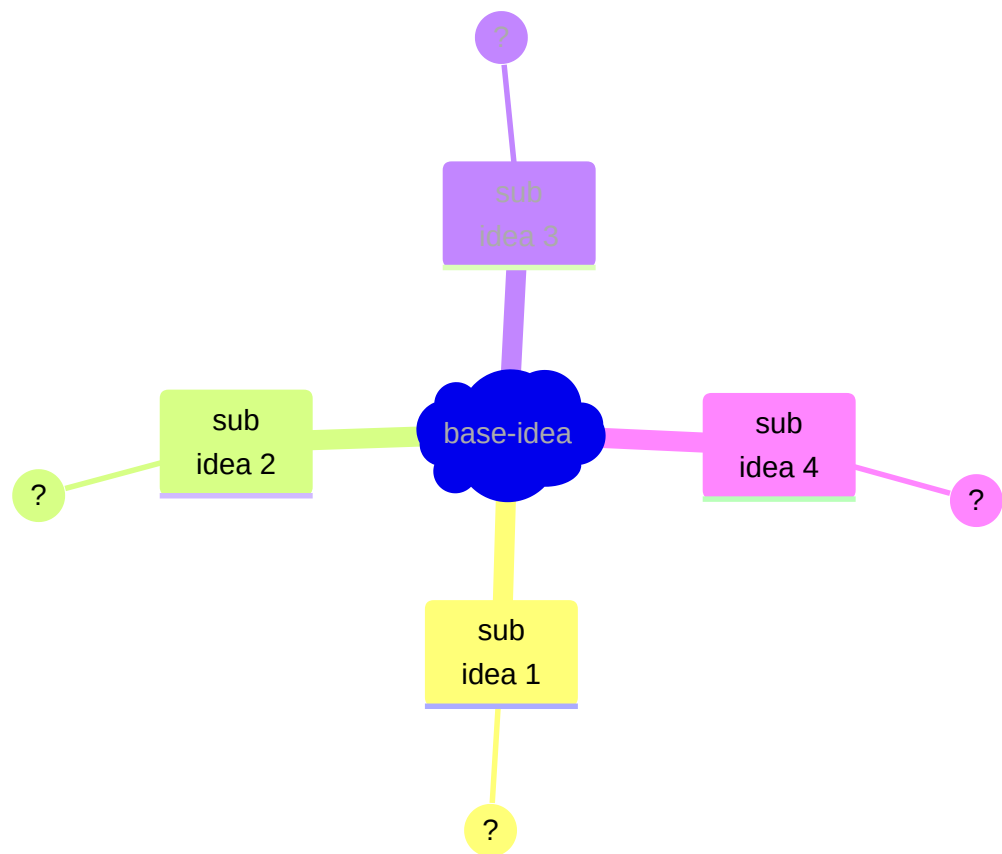


Figure 5: An example mindmap

Simple Request-Response Flow

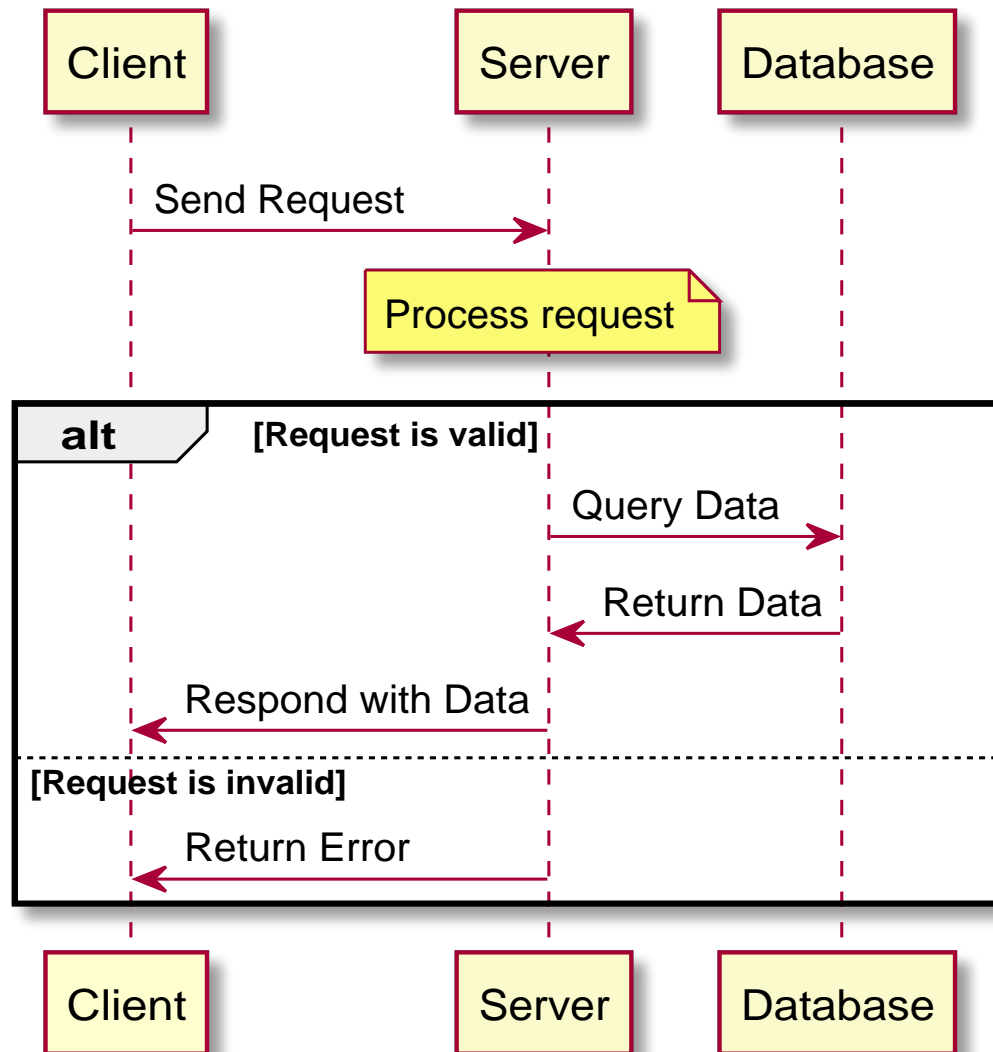


Figure 6: An example UML sequence diagram

```

\documentclass{book}
\usepackage{markdown}
\markdownSetup{pipeTables,tableCaptions}
\begin{document}
\begin{markdown}
Introduction
=====
## Section
### Subsection
Hello *Markdown*!

| Right | Left | Default | Center |
| :---: | :---: | :---: | :---: |
| 12 | 12 | 12 | 12 |
| 123 | 123 | 123 | 123 |
| 1 | 1 | 1 | 1 |

: Table
\end{markdown}
\end{document}

```



Chapter 1

Introduction

1.1 Section

1.1.1 Subsection

Hello *Markdown*!

Right	Left	Default	Center
12	12	12	12
123	123	123	123
1	1	1	1

Table 1.1: Table

Figure 7: The banner of the Markdown package

theme also requires shell access unless the `frozenCache` plain TeX option is enabled.

witiko/tilde A theme that makes tilde (~) always typeset the non-breaking space even when the `hybrid` Lua option is disabled.

```

\input markdown
\markdownSetup{import=witiko/tilde}
\markdownBegin
Bartel~Leendert van~der~Waerden
\markdownEnd
\bye

```

Typesetting the above document produces the following text: “Bartel Leendert van der Waerden”.

witiko/markdown/defaults A plain TeX theme with the default definitions of token renderer prototypes for plain TeX. This theme is loaded automatically together with the package and explicitly loading it has no effect.

See Section 3.2.2 for implementation details of the built-in plain TeX themes.

2.2.4 Snippets

We may set up options as *snippets* using the `\markdownSetupSnippet` macro and invoke them later. The `\markdownSetupSnippet` macro receives two arguments: the name of the snippet and the options to store.

```
1657 \prop_new:N
1658   \g_@@_snippets_prop
1659 \cs_new_protected:Nn
1660   \@@_setup_snippet:nn
1661   {
1662     \tl_if_empty:nT
1663       { #1 }
1664       {
1665         \msg_error:nnn
1666           { markdown }
1667           { empty-snippet-name }
1668           { #1 }
1669       }
1670     \@@_resolve_snippet_name:nN
1671       { #1 }
1672     \l_tmpa_tl
1673     \@@_if_snippet_exists:nT
1674       { #1 }
1675       {
1676         \msg_warning:nnV
1677           { markdown }
1678           { redefined-snippet }
1679         \l_tmpa_tl
1680       }
1681     \keys_precompile:nnN
1682       { markdown/options }
1683       { #2 }
1684     \l_tmpb_tl
1685     \prop_gput:NVV
1686       \g_@@_snippets_prop
1687       \l_tmpa_tl
1688       \l_tmpb_tl
1689   }
1690 \cs_gset_eq:NN
1691   \markdownSetupSnippet
1692   \@@_setup_snippet:nn
1693 \msg_new:nnnn
1694   { markdown }
1695   { empty-snippet-name }
1696   { Empty~snippet~name~#1 }
1697   { Pick~a~non-empty~name~for~your~snippet }
1698 \msg_new:nnn
```

```

1699 { markdown }
1700 { redefined-snippet }
1701 { Redefined~snippet~#1 }

```

To decide whether a snippet exists, we can use the `\markdownIfSnippetExists` macro.

```

1702 \tl_new:N
1703   \l_@@_current_snippet_tl
1704 \prg_new_protected_conditional:Nnn
1705   \@@_if_snippet_exists:n
1706   { TF, T }
1707   {
1708     \@@_resolve_snippet_name:nN
1709     { #1 }
1710     \l_@@_current_snippet_tl
1711     \prop_if_in:NVTF
1712     \g_@@_snippets_prop
1713     \l_@@_current_snippet_tl
1714     { \prg_return_true: }
1715     { \prg_return_false: }
1716   }
1717 \cs_gset_eq:NN
1718   \markdownIfSnippetExists
1719   \@@_if_snippet_exists:nTF
1720 \cs_new_protected:Nn
1721   \@@_resolve_snippet_name:nN
1722   {

```

If the provided snippet name starts with a slash (/), consider it as *absolute* and take the rest of the name as the full name of the defined snippet, regardless of the currently processed theme.

```

1723   \str_if_eq:enTF
1724   {
1725     \tl_head:n
1726     { #1 }
1727   }
1728   { / }
1729   {
1730     \tl_set:Ne
1731     #2
1732     {
1733       \tl_tail:n
1734       { #1 }
1735     }
1736   }
1737   {

```

Otherwise, consider the provided snippet name as *relative* and prepend the name of

the currently processed theme to it, if any. The result is then the full name of the defined snippet.

```

1738     \tl_set:NV
1739     #2
1740     \g_@@_current_theme_tl
1741     \tl_put_right:Nn
1742     #2
1743     { #1 }
1744   }
1745 }
1746 \prg_generate_conditional_variant:Nnn
1747   \str_if_eq:nn
1748   { en }
1749   { TF }

```

The option with key `snippet` invokes a snippet named $\langle value \rangle$.

```

1750 \keys_define:nn
1751   { markdown/options }
1752   {
1753     snippet .value_required:n = { true },
1754     snippet .code:n = {
1755       \@@_resolve_snippet_name:nN
1756       { #1 }
1757       \l_tmpa_tl
1758       \@@_if_snippet_exists:nTF
1759       { #1 }
1760       {
1761         \prop_get:NVN
1762         \g_@@_snippets_prop
1763         \l_tmpa_tl
1764         \l_tmpb_tl
1765         \tl_use:N
1766         \l_tmpb_tl
1767       }
1768       {
1769         \msg_error:nnV
1770         { markdown }
1771         { undefined-snippet }
1772         \l_tmpa_tl
1773       }
1774     },
1775   }
1776 \msg_new:nnn
1777   { markdown }
1778   { undefined-snippet }
1779   { Can't~invoke~undefined~snippet~#1 }
1780 \ExplSyntaxOff

```

Here is how we can use snippets to store options and invoke them later in \LaTeX :

```
\markdownSetupSnippet{romanNumerals}{  
  renderers = {  
    olItemWithNumber = {\item[\romannumeral#1\relax.]},  
  },  
}  
\begin{markdown}
```

The following ordered list will be preceded by arabic numerals:

1. wahid
2. aithnayn

```
\end{markdown}  
\begin{markdown}[snippet=romanNumerals]
```

The following ordered list will be preceded by roman numerals:

3. tres
4. quattuor

```
\end{markdown}
```

If the `romanNumerals` snippet were defined in the `jdooe/lists` theme, we could import the `jdooe/lists` theme and use the qualified name `jdooe/lists/romanNumerals` to invoke the snippet:

```
\markdownSetup{import=jdooe/lists}  
\begin{markdown}[snippet=jdooe/lists/romanNumerals]
```

The following ordered list will be preceded by roman numerals:

3. tres
4. quattuor

```
\end{markdown}
```

Alternatively, we can use the extended variant of the `import` \LaTeX option that allows us to import the `romanNumerals` snippet to the current namespace for easier access:

```
\markdownSetup{
```

```

import = {
  jdoe/lists = romanNumerals,
},
}
\begin{markdown}[snippet=romanNumerals]

```

The following ordered list will be preceded by roman numerals:

3. tres
4. quattuor

```

\end{markdown}

```

Furthermore, we can also specify the name of the snippet in the current namespace, which can be different from the name of the snippet in the `jdoe/lists` theme. For example, we can make the snippet `jdoe/lists/romanNumerals` available under the name `roman`.

```

\markdownSetup{
  import = {
    jdoe/lists = romanNumerals as roman,
  },
}
\begin{markdown}[snippet=roman]

```

The following ordered list will be preceded by roman numerals:

3. tres
4. quattuor

```

\end{markdown}

```

Several themes and/or snippets can be loaded at once using the extended variant of the `import` \LaTeX option:

```

\markdownSetup{
  import = {
    jdoe/longpackagename/lists = {
      arabic as arabic1,
      roman,
      alphabetic,
    },
  },
}

```

```

jdoe/anotherlongpackagename/lists = {
    arabic as arabic2,
},
jdoe/yetanotherlongpackagename,
},
}

```

```

1781 \ExplSyntaxOn
1782 \tl_new:N
1783   \l_@@_import_current_theme_tl
1784 \keys_define:nn
1785   { markdown/options/import }
1786   {

```

If a theme name is given without a list of snippets to import, we assume that an empty list was given.

```

1787     unknown .value_required:n = { false },
1788     unknown .default:n = {},
1789     unknown .code:n = {

```

To ensure that keys containing forward slashes get passed correctly, we replace all forward slashes in the input with backslash tokens with category code letter and then undo the replacement. This means that if any unbraced backslash tokens with category code letter exist in the input, they will be replaced with forward slashes. However, this should be extremely rare.

```

1790     \tl_set_eq:NN
1791     \l_@@_import_current_theme_tl
1792     \l_keys_key_str
1793 \tl_replace_all:NVN
1794   \l_@@_import_current_theme_tl
1795   \c_backslash_str
1796   { / }

```

Here, we import the snippets.

```

1797     \clist_map_inline:nn
1798     { #1 }
1799     {
1800       \regex_extract_once:nnNTF
1801       { ^(.*)\s+as\s+(.*)$ }
1802       { ##1 }
1803       \l_tmpa_seq
1804       {
1805         \seq_pop:NN
1806         \l_tmpa_seq
1807         \l_tmpa_tl
1808         \seq_pop:NN

```

```

1809         \l_tmpa_seq
1810         \l_tmpa_tl
1811         \seq_pop:NN
1812         \l_tmpa_seq
1813         \l_tmpb_tl
1814     }
1815     {
1816         \tl_set:Nn
1817         \l_tmpa_tl
1818         { ##1 }
1819         \tl_set:Nn
1820         \l_tmpb_tl
1821         { ##1 }
1822     }
1823     \tl_put_left:Nn
1824     \l_tmpa_tl
1825     { / }
1826     \tl_put_left:NV
1827     \l_tmpa_tl
1828     \l_@@_import_current_theme_tl
1829     \@@_setup_snippet:Vx
1830     \l_tmpb_tl
1831     { snippet = { \l_tmpa_tl } }
1832 }

```

Here, we load the theme.

```

1833     \@@_set_theme:V
1834     \l_@@_import_current_theme_tl
1835 },
1836 }
1837 \cs_generate_variant:Nn
1838 \tl_replace_all:Nnn
1839 { NVn }
1840 \cs_generate_variant:Nn
1841 \@@_set_theme:n
1842 { V }
1843 \cs_generate_variant:Nn
1844 \@@_setup_snippet:nn
1845 { Vx }

```

2.2.5 Token Renderers

The following T_EX macros may occur inside the output of the converter functions exposed by the Lua interface (see Section 2.1.1) and represent the parsed markdown tokens. These macros are intended to be redefined by the user who is typesetting a document. By default, they point to the corresponding prototypes (see Section 2.2.6).

To enable the enumeration of token renderers, we will maintain the `\g_@@_renderers_seq` sequence.

```
1846 \seq_new:N \g_@@_renderers_seq
```

To enable the reflection of token renderers and their parameters, we will maintain the `\g_@@_renderer_arities_prop` property list.

```
1847 \prop_new:N \g_@@_renderer_arities_prop
```

```
1848 \ExplSyntaxOff
```

2.2.5.1 Acronym Renderers

The following macro is only produced when the option `acronyms` is non-empty.

`\markdownRendererAcronym` represents an acronym, initialism, or another all-caps sequence. The macro receives a single attribute that corresponds to the sequence.

```
1849 \ExplSyntaxOn
1850 \cs_gset_protected:Npn
1851   \markdownRendererAcronym
1852   {
1853     \markdownRendererAcronymPrototype
1854   }
1855 \seq_gput_right:Nn
1856   \g_@@_renderers_seq
1857   { acronym }
1858 \prop_gput:Nnn
1859   \g_@@_renderer_arities_prop
1860   { acronym }
1861   { 1 }
1862 \ExplSyntaxOff
```

2.2.5.2 Attribute Renderers

The following macros are only produced, when at least one of the following options for markdown attributes on different elements is enabled:

- `autoIdentifiers`
- `fencedCodeAttributes`
- `gfmAutoIdentifiers`
- `headerAttributes`
- `inlineCodeAttributes`
- `linkAttributes`

`\markdownRendererAttributeIdentifier` represents the $\langle identifier \rangle$ of a markdown element (`id="⟨identifier⟩"` in HTML and `#⟨identifier⟩` in markdown attributes). The macro receives a single attribute that corresponds to the $\langle identifier \rangle$.

`\markdownRendererAttributeClassName` represents the $\langle class name \rangle$ of a markdown element (`class="⟨class name⟩ ..."` in HTML and `.⟨class name⟩` in markdown

attributes). The macro receives a single attribute that corresponds to the $\langle class\ name \rangle$.

`\markdownRendererAttributeKeyValue` represents an HTML attribute in the form $\langle key \rangle = \langle value \rangle$ that is neither an identifier nor a class name. The macro receives two attributes that correspond to the $\langle key \rangle$ and the $\langle value \rangle$, respectively.

```

1863 \ExplSyntaxOn
1864 \cs_gset_protected:Npn
1865   \markdownRendererAttributeIdentifier
1866   {
1867     \markdownRendererAttributeIdentifierPrototype
1868   }
1869 \seq_gput_right:Nn
1870   \g_@@_renderers_seq
1871   { attributeIdentifier }
1872 \prop_gput:Nnn
1873   \g_@@_renderer_arities_prop
1874   { attributeIdentifier }
1875   { 1 }
1876 \cs_gset_protected:Npn
1877   \markdownRendererAttributeClassName
1878   {
1879     \markdownRendererAttributeClassNamePrototype
1880   }
1881 \seq_gput_right:Nn
1882   \g_@@_renderers_seq
1883   { attributeClassName }
1884 \prop_gput:Nnn
1885   \g_@@_renderer_arities_prop
1886   { attributeClassName }
1887   { 1 }
1888 \cs_gset_protected:Npn
1889   \markdownRendererAttributeKeyValue
1890   {
1891     \markdownRendererAttributeKeyValuePrototype
1892   }
1893 \seq_gput_right:Nn
1894   \g_@@_renderers_seq
1895   { attributeKeyValue }
1896 \prop_gput:Nnn
1897   \g_@@_renderer_arities_prop
1898   { attributeKeyValue }
1899   { 2 }
1900 \ExplSyntaxOff

```

2.2.5.3 Basic html Renderers

The `\markdownRendererInlineHtmlComment` macro represents the contents of an inline HTML comment. The macro receives a single argument that corresponds to the contents of the HTML comment.

The `\markdownRendererInlineHtmlTag` macro represents an opening, closing, or empty inline HTML tag. The macro receives a single argument that corresponds to the contents of the HTML tag.

The `\markdownRendererInputBlockHtmlElement` macro represents a block HTML element. This macro will only be produced, when the `html` option is enabled. The macro receives a single argument that filename of a file containing the contents of the HTML element.

These macros will only be produced when the `html` option is enabled and the `htmlOutput` option is set to `basic`.

```

1901 \ExplSyntaxOn
1902 \cs_gset_protected:Npn
1903   \markdownRendererInlineHtmlComment
1904   {
1905     \markdownRendererInlineHtmlCommentPrototype
1906   }
1907 \seq_gput_right:Nn
1908   \g_@@_renderers_seq
1909   { inlineHtmlComment }
1910 \prop_gput:Nnn
1911   \g_@@_renderer_arities_prop
1912   { inlineHtmlComment }
1913   { 1 }
1914 \cs_gset_protected:Npn
1915   \markdownRendererInlineHtmlTag
1916   {
1917     \markdownRendererInlineHtmlTagPrototype
1918   }
1919 \seq_gput_right:Nn
1920   \g_@@_renderers_seq
1921   { inlineHtmlTag }
1922 \prop_gput:Nnn
1923   \g_@@_renderer_arities_prop
1924   { inlineHtmlTag }
1925   { 1 }
1926 \cs_gset_protected:Npn
1927   \markdownRendererInputBlockHtmlElement
1928   {
1929     \markdownRendererInputBlockHtmlElementPrototype
1930   }
1931 \seq_gput_right:Nn
1932   \g_@@_renderers_seq
1933   { inputBlockHtmlElement }

```



```

1934 \prop_gput:Nnn
1935   \g_@@_renderer_arities_prop
1936   { inputBlockHtmlElement }
1937   { 1 }
1938 \ExplSyntaxOff

```

2.2.5.4 Block Quote Renderers

The `\markdownRendererBlockQuoteBegin` macro represents the beginning of a block quote. The macro receives no arguments.

```

1939 \ExplSyntaxOn
1940 \cs_gset_protected:Npn
1941   \markdownRendererBlockQuoteBegin
1942   {
1943     \markdownRendererBlockQuoteBeginPrototype
1944   }
1945 \seq_gput_right:Nn
1946   \g_@@_renderers_seq
1947   { blockQuoteBegin }
1948 \prop_gput:Nnn
1949   \g_@@_renderer_arities_prop
1950   { blockQuoteBegin }
1951   { 0 }
1952 \ExplSyntaxOff

```

The `\markdownRendererBlockQuoteEnd` macro represents the end of a block quote. The macro receives no arguments.

```

1953 \ExplSyntaxOn
1954 \cs_gset_protected:Npn
1955   \markdownRendererBlockQuoteEnd
1956   {
1957     \markdownRendererBlockQuoteEndPrototype
1958   }
1959 \seq_gput_right:Nn
1960   \g_@@_renderers_seq
1961   { blockQuoteEnd }
1962 \prop_gput:Nnn
1963   \g_@@_renderer_arities_prop
1964   { blockQuoteEnd }
1965   { 0 }
1966 \ExplSyntaxOff

```

2.2.5.5 Bracketed Spans

The following macros are only produced, when the `bracketedSpans` option is enabled.

The `\markdownRendererBracketedSpan` macro represents an inline bracketed span. It receives a single argument that corresponds to the inline bracketed span.

```

1967 \ExplSyntaxOn
1968 \cs_gset_protected:Npn
1969   \markdownRendererBracketedSpan
1970   {
1971     \markdownRendererBracketedSpanPrototype
1972   }
1973 \seq_gput_right:Nn
1974   \g_@@_renderers_seq
1975   { bracketedSpan }
1976 \prop_gput:Nnn
1977   \g_@@_renderer_arities_prop
1978   { bracketedSpan }
1979   { 1 }
1980 \ExplSyntaxOff

```

2.2.5.6 Bracketed Span Attribute Context Renderers

The following macros are only produced, when the `bracketedSpans` option is enabled.

The `\markdownRendererBracketedSpanAttributeContextBegin` and `\markdownRendererBracketedSpanAttributeContextEnd` macros represent the beginning and the end of a context in which the attributes of an inline bracketed span apply. The macros receive no arguments.

```

1981 \ExplSyntaxOn
1982 \cs_gset_protected:Npn
1983   \markdownRendererBracketedSpanAttributeContextBegin
1984   {
1985     \markdownRendererBracketedSpanAttributeContextBeginPrototype
1986   }
1987 \seq_gput_right:Nn
1988   \g_@@_renderers_seq
1989   { bracketedSpanAttributeContextBegin }
1990 \prop_gput:Nnn
1991   \g_@@_renderer_arities_prop
1992   { bracketedSpanAttributeContextBegin }
1993   { 0 }
1994 \cs_gset_protected:Npn
1995   \markdownRendererBracketedSpanAttributeContextEnd
1996   {
1997     \markdownRendererBracketedSpanAttributeContextEndPrototype
1998   }
1999 \seq_gput_right:Nn
2000   \g_@@_renderers_seq
2001   { bracketedSpanAttributeContextEnd }
2002 \prop_gput:Nnn

```

```

2003 \g_@@_renderer_arities_prop
2004 { bracketedSpanAttributeContextEnd }
2005 { 0 }
2006 \ExplSyntaxOff

```

2.2.5.7 Bullet List Renderers

The `\markdownRendererUlBegin` macro represents the beginning of a bulleted list that contains an item with several paragraphs of text (the list is not tight). The macro receives no arguments.

```

2007 \ExplSyntaxOn
2008 \cs_gset_protected:Npn
2009 \markdownRendererUlBegin
2010 {
2011   \markdownRendererUlBeginPrototype
2012 }
2013 \seq_gput_right:Nn
2014 \g_@@_renderers_seq
2015 { ulBegin }
2016 \prop_gput:Nnn
2017 \g_@@_renderer_arities_prop
2018 { ulBegin }
2019 { 0 }
2020 \ExplSyntaxOff

```

The `\markdownRendererUlBeginTight` macro represents the beginning of a bulleted list that contains no item with several paragraphs of text (the list is tight). This macro will only be produced, when the `tightLists` option is disabled. The macro receives no arguments.

```

2021 \ExplSyntaxOn
2022 \cs_gset_protected:Npn
2023 \markdownRendererUlBeginTight
2024 {
2025   \markdownRendererUlBeginTightPrototype
2026 }
2027 \seq_gput_right:Nn
2028 \g_@@_renderers_seq
2029 { ulBeginTight }
2030 \prop_gput:Nnn
2031 \g_@@_renderer_arities_prop
2032 { ulBeginTight }
2033 { 0 }
2034 \ExplSyntaxOff

```

The `\markdownRendererUlItem` macro represents an item in a bulleted list. The macro receives no arguments.

```

2035 \ExplSyntaxOn
2036 \cs_gset_protected:Npn
2037   \markdownRendererUListItem
2038   {
2039     \markdownRendererUListItemPrototype
2040   }
2041 \seq_gput_right:Nn
2042   \g_@@_renderers_seq
2043   { ulItem }
2044 \prop_gput:Nnn
2045   \g_@@_renderer_arities_prop
2046   { ulItem }
2047   { 0 }
2048 \ExplSyntaxOff

```

The `\markdownRendererUListItemEnd` macro represents the end of an item in a bulleted list. The macro receives no arguments.

```

2049 \ExplSyntaxOn
2050 \cs_gset_protected:Npn
2051   \markdownRendererUListItemEnd
2052   {
2053     \markdownRendererUListItemEndPrototype
2054   }
2055 \seq_gput_right:Nn
2056   \g_@@_renderers_seq
2057   { ulItemEnd }
2058 \prop_gput:Nnn
2059   \g_@@_renderer_arities_prop
2060   { ulItemEnd }
2061   { 0 }
2062 \ExplSyntaxOff

```

The `\markdownRendererUlEnd` macro represents the end of a bulleted list that contains an item with several paragraphs of text (the list is not tight). The macro receives no arguments.

```

2063 \ExplSyntaxOn
2064 \cs_gset_protected:Npn
2065   \markdownRendererUlEnd
2066   {
2067     \markdownRendererUlEndPrototype
2068   }
2069 \seq_gput_right:Nn
2070   \g_@@_renderers_seq
2071   { ulEnd }
2072 \prop_gput:Nnn
2073   \g_@@_renderer_arities_prop
2074   { ulEnd }

```

```

2075 { 0 }
2076 \ExplSyntaxOff

```

The `\markdownRendererUlEndTight` macro represents the end of a bulleted list that contains no item with several paragraphs of text (the list is tight). This macro will only be produced, when the `tightLists` option is disabled. The macro receives no arguments.

```

2077 \ExplSyntaxOn
2078 \cs_gset_protected:Npn
2079   \markdownRendererUlEndTight
2080   {
2081     \markdownRendererUlEndTightPrototype
2082   }
2083 \seq_gput_right:Nn
2084   \g_@@_renderers_seq
2085   { ulEndTight }
2086 \prop_gput:Nnn
2087   \g_@@_renderer_arities_prop
2088   { ulEndTight }
2089   { 0 }
2090 \ExplSyntaxOff

```

2.2.5.8 Citation Renderers

The `\markdownRendererCite` macro represents a string of one or more parenthetical citations. This macro will only be produced, when the `citations` option is enabled. The macro receives the parameter `{<number of citations>}` followed by `<suppress author> {<prenote>}{<postnote>}{<name>}` repeated `<number of citations>` times. The `<suppress author>` parameter is either the token `-`, when the author's name is to be suppressed, or `+` otherwise.

```

2091 \ExplSyntaxOn
2092 \cs_gset_protected:Npn
2093   \markdownRendererCite
2094   {
2095     \markdownRendererCitePrototype
2096   }
2097 \seq_gput_right:Nn
2098   \g_@@_renderers_seq
2099   { cite }
2100 \prop_gput:Nnn
2101   \g_@@_renderer_arities_prop
2102   { cite }
2103   { 1 }
2104 \ExplSyntaxOff

```

The `\markdownRendererTextCite` macro represents a string of one or more text citations. This macro will only be produced, when the `citations` option is enabled.

The macro receives parameters in the same format as the `\markdownRendererCite` macro.

```

2105 \ExplSyntaxOn
2106 \cs_gset_protected:Npn
2107   \markdownRendererTextCite
2108   {
2109     \markdownRendererTextCitePrototype
2110   }
2111 \seq_gput_right:Nn
2112   \g_@@_renderers_seq
2113   { textCite }
2114 \prop_gput:Nnn
2115   \g_@@_renderer_arities_prop
2116   { textCite }
2117   { 1 }
2118 \ExplSyntaxOff

```

2.2.5.9 Code Block Renderers

The `\markdownRendererInputVerbatim` macro represents a code block. The macro receives a single argument that corresponds to the filename of a file containing the code block contents.

```

2119 \ExplSyntaxOn
2120 \cs_gset_protected:Npn
2121   \markdownRendererInputVerbatim
2122   {
2123     \markdownRendererInputVerbatimPrototype
2124   }
2125 \seq_gput_right:Nn
2126   \g_@@_renderers_seq
2127   { inputVerbatim }
2128 \prop_gput:Nnn
2129   \g_@@_renderer_arities_prop
2130   { inputVerbatim }
2131   { 1 }
2132 \ExplSyntaxOff

```

The `\markdownRendererInputFencedCode` macro represents a fenced code block. This macro will only be produced, when the `fencedCode` option is enabled. The macro receives three arguments that correspond to the filename of a file containing the code block contents, the fully escaped code fence infostring that can be directly typeset, and the raw code fence infostring that can be used outside typesetting.

```

2133 \ExplSyntaxOn
2134 \cs_gset_protected:Npn
2135   \markdownRendererInputFencedCode
2136   {

```

```

2137     \markdownRendererInputFencedCodePrototype
2138   }
2139   \seq_gput_right:Nn
2140   \g_@@_renderers_seq
2141   { inputFencedCode }
2142   \prop_gput:Nnn
2143   \g_@@_renderer_arities_prop
2144   { inputFencedCode }
2145   { 3 }
2146   \ExplSyntaxOff

```

2.2.5.10 Code Span Renderer

The `\markdownRendererCodeSpan` macro represents inline code span in the input text. It receives a single argument that corresponds to the inline code span.

```

2147   \ExplSyntaxOn
2148   \cs_gset_protected:Npn
2149     \markdownRendererCodeSpan
2150     {
2151       \markdownRendererCodeSpanPrototype
2152     }
2153   \seq_gput_right:Nn
2154   \g_@@_renderers_seq
2155   { codeSpan }
2156   \prop_gput:Nnn
2157   \g_@@_renderer_arities_prop
2158   { codeSpan }
2159   { 1 }
2160   \ExplSyntaxOff

```

2.2.5.11 Code Span Attribute Context Renderers

The following macros are only produced, when the `inlineCodeAttributes` option is enabled.

The `\markdownRendererCodeSpanAttributeContextBegin` and `\markdownRendererCodeSpanAttributeContextEnd` macros represent the beginning and the end of a context in which the attributes of an inline code span apply. The macros receive no arguments.

```

2161   \ExplSyntaxOn
2162   \cs_gset_protected:Npn
2163     \markdownRendererCodeSpanAttributeContextBegin
2164     {
2165       \markdownRendererCodeSpanAttributeContextBeginPrototype
2166     }
2167   \seq_gput_right:Nn
2168   \g_@@_renderers_seq
2169   { codeSpanAttributeContextBegin }

```

```

2170 \prop_gput:Nnn
2171   \g_@@_renderer_arities_prop
2172   { codeSpanAttributeContextBegin }
2173   { 0 }
2174 \cs_gset_protected:Npn
2175   \markdownRendererCodeSpanAttributeContextEnd
2176   {
2177     \markdownRendererCodeSpanAttributeContextEndPrototype
2178   }
2179 \seq_gput_right:Nn
2180   \g_@@_renderers_seq
2181   { codeSpanAttributeContextEnd }
2182 \prop_gput:Nnn
2183   \g_@@_renderer_arities_prop
2184   { codeSpanAttributeContextEnd }
2185   { 0 }
2186 \ExplSyntaxOff

```

2.2.5.12 CommonMark Block html Renderers

When the `html` option is enabled and `htmlOutput` is set to `commonmark`, the following fine-grained renderers are produced instead of `\markdownRendererInputBlockHtmlElement` to distinguish between different top-level non-terminal elements of CommonMark’s grammar for raw HTML³⁷:

1. `\markdownRendererInputBlockHtmlCdataElement` – A CDATA block-level HTML element such as `<script>`, `<pre>`, `<style>`, or `<textarea>` that starts on a line of its own
2. `\markdownRendererBlockHtmlComment` – A comment that starts on a line of its own
3. `\markdownRendererInputBlockHtmlProcessingInstruction` – A processing instruction that starts on a line of its own
4. `\markdownRendererInputBlockHtmlDeclaration` – A declaration that starts on a line of its own
5. `\markdownRendererInputBlockHtmlCdataSection` – A CDATA section that starts on a line of its own
6. `\markdownRendererInputBlockHtmlPcdataElement` – A PCDATA block-level HTML element that starts on a line of its own
7. `\markdownRendererBlockHtmlStandaloneTag` – A non-CDATA HTML tag on a line of its own

Each of these macros receive a single argument. For all macros except 2 and 7, it is the filename of a file containing the corresponding HTML text. In contrast, macros 2 and 7 receive the text within the HTML comment and the HTML text, respectively.

³⁷See <https://spec.commonmark.org/0.31.2/#html-blocks>.


```

2187 \ExplSyntaxOn
2188 \cs_gset_protected:Npn
2189   \markdownRendererInputBlockHtmlCdataElement
2190   {
2191     \markdownRendererInputBlockHtmlCdataElementPrototype
2192   }
2193 \seq_gput_right:Nn
2194   \g_@@_renderers_seq
2195   { inputBlockHtmlCdataElement }
2196 \prop_gput:Nnn
2197   \g_@@_renderer_arities_prop
2198   { inputBlockHtmlCdataElement }
2199   { 1 }
2200 \cs_gset_protected:Npn
2201   \markdownRendererBlockHtmlComment
2202   {
2203     \markdownRendererBlockHtmlCommentPrototype
2204   }
2205 \seq_gput_right:Nn
2206   \g_@@_renderers_seq
2207   { blockHtmlComment }
2208 \prop_gput:Nnn
2209   \g_@@_renderer_arities_prop
2210   { blockHtmlComment }
2211   { 1 }
2212 \cs_gset_protected:Npn
2213   \markdownRendererInputBlockHtmlProcessingInstruction
2214   {
2215     \markdownRendererInputBlockHtmlProcessingInstructionPrototype
2216   }
2217 \seq_gput_right:Nn
2218   \g_@@_renderers_seq
2219   { inputBlockHtmlProcessingInstruction }
2220 \prop_gput:Nnn
2221   \g_@@_renderer_arities_prop
2222   { inputBlockHtmlProcessingInstruction }
2223   { 1 }
2224 \cs_gset_protected:Npn
2225   \markdownRendererInputBlockHtmlDeclaration
2226   {
2227     \markdownRendererInputBlockHtmlDeclarationPrototype
2228   }
2229 \seq_gput_right:Nn
2230   \g_@@_renderers_seq
2231   { inputBlockHtmlDeclaration }
2232 \prop_gput:Nnn
2233   \g_@@_renderer_arities_prop

```

```

2234 { inputBlockHtmlDeclaration }
2235 { 1 }
2236 \cs_gset_protected:Npn
2237 \markdownRendererInputBlockHtmlCdataSection
2238 {
2239     \markdownRendererInputBlockHtmlCdataSectionPrototype
2240 }
2241 \seq_gput_right:Nn
2242 \g_@@_renderers_seq
2243 { inputBlockHtmlCdataSection }
2244 \prop_gput:Nnn
2245 \g_@@_renderer_arities_prop
2246 { inputBlockHtmlCdataSection }
2247 { 1 }
2248 \cs_gset_protected:Npn
2249 \markdownRendererInputBlockHtmlPcdataElement
2250 {
2251     \markdownRendererInputBlockHtmlPcdataElementPrototype
2252 }
2253 \seq_gput_right:Nn
2254 \g_@@_renderers_seq
2255 { inputBlockHtmlPcdataElement }
2256 \prop_gput:Nnn
2257 \g_@@_renderer_arities_prop
2258 { inputBlockHtmlPcdataElement }
2259 { 1 }
2260 \cs_gset_protected:Npn
2261 \markdownRendererBlockHtmlStandaloneTag
2262 {
2263     \markdownRendererBlockHtmlStandaloneTagPrototype
2264 }
2265 \seq_gput_right:Nn
2266 \g_@@_renderers_seq
2267 { blockHtmlStandaloneTag }
2268 \prop_gput:Nnn
2269 \g_@@_renderer_arities_prop
2270 { blockHtmlStandaloneTag }
2271 { 1 }
2272 \ExplSyntaxOff

```

2.2.5.13 CommonMark Raw html Renderers

When the `html` option is enabled and `htmlOutput` is set to `commonmark`, the following renderers are produced instead of `\markdownRendererInlineHtmlTag` to distinguish between different top-level non-terminal elements of CommonMark's grammar for raw HTML³⁸:

³⁸See <https://spec.commonmark.org/0.31.2/#raw-html>.

- `\markdownRendererInlineHtmlProcessingInstruction` – A processing instruction
- `\markdownRendererInlineHtmlDeclaration` – A declaration
- `\markdownRendererInlineHtmlCdataSection` – A CDATA section
- `\markdownRendererInlineHtmlOpenTag` – An opening tag
- `\markdownRendererInlineHtmlCloseTag` – A closing tag
- `\markdownRendererInlineHtmlEmptyTag` – An empty tag

Each of these macros receives a single argument with the HTML text.

```

2273 \ExplSyntaxOn
2274 \cs_gset_protected:Npn
2275   \markdownRendererInlineHtmlProcessingInstruction
2276   {
2277     \markdownRendererInlineHtmlProcessingInstructionPrototype
2278   }
2279 \seq_gput_right:Nn
2280   \g_@@_renderers_seq
2281   { inlineHtmlProcessingInstruction }
2282 \prop_gput:Nnn
2283   \g_@@_renderer_arities_prop
2284   { inlineHtmlProcessingInstruction }
2285   { 1 }
2286 \cs_gset_protected:Npn
2287   \markdownRendererInlineHtmlDeclaration
2288   {
2289     \markdownRendererInlineHtmlDeclarationPrototype
2290   }
2291 \seq_gput_right:Nn
2292   \g_@@_renderers_seq
2293   { inlineHtmlDeclaration }
2294 \prop_gput:Nnn
2295   \g_@@_renderer_arities_prop
2296   { inlineHtmlDeclaration }
2297   { 1 }
2298 \cs_gset_protected:Npn
2299   \markdownRendererInlineHtmlCdataSection
2300   {
2301     \markdownRendererInlineHtmlCdataSectionPrototype
2302   }
2303 \seq_gput_right:Nn
2304   \g_@@_renderers_seq
2305   { inlineHtmlCdataSection }
2306 \prop_gput:Nnn
2307   \g_@@_renderer_arities_prop
2308   { inlineHtmlCdataSection }
2309   { 1 }

```

```

2310 \cs_gset_protected:Npn
2311   \markdownRendererInlineHtmlOpenTag
2312   {
2313     \markdownRendererInlineHtmlOpenTagPrototype
2314   }
2315 \seq_gput_right:Nn
2316   \g_@@_renderers_seq
2317   { inlineHtmlOpenTag }
2318 \prop_gput:Nnn
2319   \g_@@_renderer_arities_prop
2320   { inlineHtmlOpenTag }
2321   { 1 }
2322 \cs_gset_protected:Npn
2323   \markdownRendererInlineHtmlCloseTag
2324   {
2325     \markdownRendererInlineHtmlCloseTagPrototype
2326   }
2327 \seq_gput_right:Nn
2328   \g_@@_renderers_seq
2329   { inlineHtmlCloseTag }
2330 \prop_gput:Nnn
2331   \g_@@_renderer_arities_prop
2332   { inlineHtmlCloseTag }
2333   { 1 }
2334 \cs_gset_protected:Npn
2335   \markdownRendererInlineHtmlEmptyTag
2336   {
2337     \markdownRendererInlineHtmlEmptyTagPrototype
2338   }
2339 \seq_gput_right:Nn
2340   \g_@@_renderers_seq
2341   { inlineHtmlEmptyTag }
2342 \prop_gput:Nnn
2343   \g_@@_renderer_arities_prop
2344   { inlineHtmlEmptyTag }
2345   { 1 }
2346 \ExplSyntaxOff

```

2.2.5.14 Content Block Renderers

The `\markdownRendererContentBlock` macro represents an iA Writer content block. It receives four arguments: the local file or online image filename extension cast to the lower case, the fully escaped URI that can be directly typeset, the raw URI that can be used outside typesetting, and the title of the content block.

```

2347 \ExplSyntaxOn
2348 \cs_gset_protected:Npn
2349   \markdownRendererContentBlock

```

```

2350 {
2351   \markdownRendererContentBlockPrototype
2352 }
2353 \seq_gput_right:Nn
2354   \g_@@_renderers_seq
2355   { contentBlock }
2356 \prop_gput:Nnn
2357   \g_@@_renderer_arities_prop
2358   { contentBlock }
2359   { 4 }
2360 \ExplSyntaxOff

```

The `\markdownRendererContentBlockOnlineImage` macro represents an iA Writer online image content block. The macro receives the same arguments as `\markdownRendererContentBlock`.

```

2361 \ExplSyntaxOn
2362 \cs_gset_protected:Npn
2363   \markdownRendererContentBlockOnlineImage
2364   {
2365     \markdownRendererContentBlockOnlineImagePrototype
2366   }
2367 \seq_gput_right:Nn
2368   \g_@@_renderers_seq
2369   { contentBlockOnlineImage }
2370 \prop_gput:Nnn
2371   \g_@@_renderer_arities_prop
2372   { contentBlockOnlineImage }
2373   { 4 }
2374 \ExplSyntaxOff

```

The `\markdownRendererContentBlockCode` macro represents an iA Writer content block that was recognized as a file in a known programming language by its filename extension s . If any `markdown-languages.json` file found by `kpathsea`³⁹ contains a record (k, v) , then a non-online-image content block with the filename extension $s, s:\text{lower}() = k$ is considered to be in a known programming language v . The macro receives five arguments: the local file name extension s cast to the lower case, the language v , the fully escaped URI that can be directly typeset, the raw URI that can be used outside typesetting, and the title of the content block.

Note that you will need to place a `markdown-languages.json` file inside your working directory or inside your local T_EX directory structure. In this file, you will define a mapping between filename extensions and the language names recognized by your favorite syntax highlighter; there may exist other creative uses

³⁹ Filenames other than `markdown-languages.json` may be specified using the `contentBlocksLanguageMap` Lua option.

beside syntax highlighting. The `Languages.json` file provided by Sotkov [6] is a good starting point.

```

2375 \ExplSyntaxOn
2376 \cs_gset_protected:Npn
2377   \markdownRendererContentBlockCode
2378   {
2379     \markdownRendererContentBlockCodePrototype
2380   }
2381 \seq_gput_right:Nn
2382   \g_@@_renderers_seq
2383   { contentBlockCode }
2384 \prop_gput:Nnn
2385   \g_@@_renderer_arities_prop
2386   { contentBlockCode }
2387   { 5 }
2388 \ExplSyntaxOff

```

2.2.5.15 Definition List Renderers

The following macros are only produced, when the `definitionLists` option is enabled.

The `\markdownRendererDlBegin` macro represents the beginning of a definition list that contains an item with several paragraphs of text (the list is not tight). The macro receives no arguments.

```

2389 \ExplSyntaxOn
2390 \cs_gset_protected:Npn
2391   \markdownRendererDlBegin
2392   {
2393     \markdownRendererDlBeginPrototype
2394   }
2395 \seq_gput_right:Nn
2396   \g_@@_renderers_seq
2397   { dlBegin }
2398 \prop_gput:Nnn
2399   \g_@@_renderer_arities_prop
2400   { dlBegin }
2401   { 0 }
2402 \ExplSyntaxOff

```

The `\markdownRendererDlBeginTight` macro represents the beginning of a definition list that contains no item with several paragraphs of text (the list is tight). This macro will only be produced, when the `tightLists` option is disabled. The macro receives no arguments.

```

2403 \ExplSyntaxOn
2404 \cs_gset_protected:Npn
2405   \markdownRendererDlBeginTight

```

```

2406 {
2407     \markdownRendererDlBeginTightPrototype
2408 }
2409 \seq_gput_right:Nn
2410 \g_@@_renderers_seq
2411 { dlBeginTight }
2412 \prop_gput:Nnn
2413 \g_@@_renderer_arities_prop
2414 { dlBeginTight }
2415 { 0 }
2416 \ExplSyntaxOff

```

The `\markdownRendererDlItem` macro represents a term in a definition list. The macro receives a single argument that corresponds to the term being defined.

```

2417 \ExplSyntaxOn
2418 \cs_gset_protected:Npn
2419 \markdownRendererDlItem
2420 {
2421     \markdownRendererDlItemPrototype
2422 }
2423 \seq_gput_right:Nn
2424 \g_@@_renderers_seq
2425 { dlItem }
2426 \prop_gput:Nnn
2427 \g_@@_renderer_arities_prop
2428 { dlItem }
2429 { 1 }
2430 \ExplSyntaxOff

```

The `\markdownRendererDlItemEnd` macro represents the end of a list of definitions for a single term.

```

2431 \ExplSyntaxOn
2432 \cs_gset_protected:Npn
2433 \markdownRendererDlItemEnd
2434 {
2435     \markdownRendererDlItemEndPrototype
2436 }
2437 \seq_gput_right:Nn
2438 \g_@@_renderers_seq
2439 { dlItemEnd }
2440 \prop_gput:Nnn
2441 \g_@@_renderer_arities_prop
2442 { dlItemEnd }
2443 { 0 }
2444 \ExplSyntaxOff

```

The `\markdownRendererDlDefinitionBegin` macro represents the beginning of a definition in a definition list. There can be several definitions for a single term.

```

2445 \ExplSyntaxOn
2446 \cs_gset_protected:Npn
2447   \markdownRendererDlDefinitionBegin
2448   {
2449     \markdownRendererDlDefinitionBeginPrototype
2450   }
2451 \seq_gput_right:Nn
2452   \g_@@_renderers_seq
2453   { dlDefinitionBegin }
2454 \prop_gput:Nnn
2455   \g_@@_renderer_arities_prop
2456   { dlDefinitionBegin }
2457   { 0 }
2458 \ExplSyntaxOff

```

The `\markdownRendererDlDefinitionEnd` macro represents the end of a definition in a definition list. There can be several definitions for a single term.

```

2459 \ExplSyntaxOn
2460 \cs_gset_protected:Npn
2461   \markdownRendererDlDefinitionEnd
2462   {
2463     \markdownRendererDlDefinitionEndPrototype
2464   }
2465 \seq_gput_right:Nn
2466   \g_@@_renderers_seq
2467   { dlDefinitionEnd }
2468 \prop_gput:Nnn
2469   \g_@@_renderer_arities_prop
2470   { dlDefinitionEnd }
2471   { 0 }
2472 \ExplSyntaxOff

```

The `\markdownRendererDlEnd` macro represents the end of a definition list that contains an item with several paragraphs of text (the list is not tight). The macro receives no arguments.

```

2473 \ExplSyntaxOn
2474 \cs_gset_protected:Npn
2475   \markdownRendererDlEnd
2476   {
2477     \markdownRendererDlEndPrototype
2478   }
2479 \seq_gput_right:Nn
2480   \g_@@_renderers_seq
2481   { dlEnd }

```



```

2482 \prop_gput:Nnn
2483   \g_@@_renderer_arities_prop
2484   { dlEnd }
2485   { 0 }
2486 \ExplSyntaxOff

```

The `\markdownRendererDlEndTight` macro represents the end of a definition list that contains no item with several paragraphs of text (the list is tight). This macro will only be produced, when the `tightLists` option is disabled. The macro receives no arguments.

```

2487 \ExplSyntaxOn
2488 \cs_gset_protected:Npn
2489   \markdownRendererDlEndTight
2490   {
2491     \markdownRendererDlEndTightPrototype
2492   }
2493 \seq_gput_right:Nn
2494   \g_@@_renderers_seq
2495   { dlEndTight }
2496 \prop_gput:Nnn
2497   \g_@@_renderer_arities_prop
2498   { dlEndTight }
2499   { 0 }
2500 \ExplSyntaxOff

```

2.2.5.16 Ellipsis Renderer

The `\markdownRendererEllipsis` macro replaces any occurrence of ASCII ellipses in the input text. This macro will only be produced, when the `smartEllipses` option is enabled. The macro receives no arguments.

```

2501 \ExplSyntaxOn
2502 \cs_gset_protected:Npn
2503   \markdownRendererEllipsis
2504   {
2505     \markdownRendererEllipsisPrototype
2506   }
2507 \seq_gput_right:Nn
2508   \g_@@_renderers_seq
2509   { ellipsis }
2510 \prop_gput:Nnn
2511   \g_@@_renderer_arities_prop
2512   { ellipsis }
2513   { 0 }
2514 \ExplSyntaxOff

```

2.2.5.17 Emphasis Renderers

The `\markdownRendererEmphasis` macro represents an emphasized span of text. The macro receives a single argument that corresponds to the emphasized span of text.

```

2515 \ExplSyntaxOn
2516 \cs_gset_protected:Npn
2517   \markdownRendererEmphasis
2518   {
2519     \markdownRendererEmphasisPrototype
2520   }
2521 \seq_gput_right:Nn
2522   \g_@@_renderers_seq
2523   { emphasis }
2524 \prop_gput:Nnn
2525   \g_@@_renderer_arities_prop
2526   { emphasis }
2527   { 1 }
2528 \ExplSyntaxOff

```

The `\markdownRendererStrongEmphasis` macro represents a strongly emphasized span of text. The macro receives a single argument that corresponds to the emphasized span of text.

```

2529 \ExplSyntaxOn
2530 \cs_gset_protected:Npn
2531   \markdownRendererStrongEmphasis
2532   {
2533     \markdownRendererStrongEmphasisPrototype
2534   }
2535 \seq_gput_right:Nn
2536   \g_@@_renderers_seq
2537   { strongEmphasis }
2538 \prop_gput:Nnn
2539   \g_@@_renderer_arities_prop
2540   { strongEmphasis }
2541   { 1 }
2542 \ExplSyntaxOff

```

2.2.5.18 Fenced Code Attribute Context Renderers

The following macros are only produced, when the `fencedCode` and `fencedCodeAttributes` options are enabled.

The `\markdownRendererFencedCodeAttributeContextBegin` and `\markdownRendererFencedCodeAttributeContextEnd` macros represent the beginning and the end of a context in which the attributes of a fenced code apply. The macros receive no arguments.

```

2543 \ExplSyntaxOn
2544 \cs_gset_protected:Npn
2545   \markdownRendererFencedCodeAttributeContextBegin

```

```

2546 {
2547   \markdownRendererFencedCodeAttributeContextBeginPrototype
2548 }
2549 \seq_gput_right:Nn
2550 \g_@@_renderers_seq
2551 { fencedCodeAttributeContextBegin }
2552 \prop_gput:Nnn
2553 \g_@@_renderer_arities_prop
2554 { fencedCodeAttributeContextBegin }
2555 { 0 }
2556 \cs_gset_protected:Npn
2557 \markdownRendererFencedCodeAttributeContextEnd
2558 {
2559   \markdownRendererFencedCodeAttributeContextEndPrototype
2560 }
2561 \seq_gput_right:Nn
2562 \g_@@_renderers_seq
2563 { fencedCodeAttributeContextEnd }
2564 \prop_gput:Nnn
2565 \g_@@_renderer_arities_prop
2566 { fencedCodeAttributeContextEnd }
2567 { 0 }
2568 \ExplSyntaxOff

```

2.2.5.19 Fenced Div Attribute Context Renderers

The following macros are only produced, when the `fencedDivs` option is enabled.

The `\markdownRendererFencedDivAttributeContextBegin` and `\markdownRendererFencedDivAttributeContextEnd` macros represent the beginning and the end of a context in which the attributes of a div apply. The macros receive no arguments.

```

2569 \ExplSyntaxOn
2570 \cs_gset_protected:Npn
2571   \markdownRendererFencedDivAttributeContextBegin
2572   {
2573     \markdownRendererFencedDivAttributeContextBeginPrototype
2574   }
2575 \seq_gput_right:Nn
2576 \g_@@_renderers_seq
2577 { fencedDivAttributeContextBegin }
2578 \prop_gput:Nnn
2579 \g_@@_renderer_arities_prop
2580 { fencedDivAttributeContextBegin }
2581 { 0 }
2582 \cs_gset_protected:Npn
2583 \markdownRendererFencedDivAttributeContextEnd
2584 {
2585   \markdownRendererFencedDivAttributeContextEndPrototype

```

```

2586 }
2587 \seq_gput_right:Nn
2588 \g_@@_renderers_seq
2589 { fencedDivAttributeContextEnd }
2590 \prop_gput:Nnn
2591 \g_@@_renderer_arities_prop
2592 { fencedDivAttributeContextEnd }
2593 { 0 }
2594 \ExplSyntaxOff

```

2.2.5.20 Header Attribute Context Renderers

The following macros are only produced, when the `autoIdentifiers`, `gfmAutoIdentifiers`, or `headerAttributes` options are enabled.

The `\markdownRendererHeaderAttributeContextBegin` and `\markdownRendererHeaderAttributeContextEnd` macros represent the beginning and the end of a context in which the attributes of a heading apply. The macros receive no arguments.

```

2595 \ExplSyntaxOn
2596 \cs_gset_protected:Npn
2597 \markdownRendererHeaderAttributeContextBegin
2598 {
2599   \markdownRendererHeaderAttributeContextBeginPrototype
2600 }
2601 \seq_gput_right:Nn
2602 \g_@@_renderers_seq
2603 { headerAttributeContextBegin }
2604 \prop_gput:Nnn
2605 \g_@@_renderer_arities_prop
2606 { headerAttributeContextBegin }
2607 { 0 }
2608 \cs_gset_protected:Npn
2609 \markdownRendererHeaderAttributeContextEnd
2610 {
2611   \markdownRendererHeaderAttributeContextEndPrototype
2612 }
2613 \seq_gput_right:Nn
2614 \g_@@_renderers_seq
2615 { headerAttributeContextEnd }
2616 \prop_gput:Nnn
2617 \g_@@_renderer_arities_prop
2618 { headerAttributeContextEnd }
2619 { 0 }
2620 \ExplSyntaxOff

```

2.2.5.21 Heading Renderers

The `\markdownRendererHeadingOne` macro represents a first level heading. The macro receives a single argument that corresponds to the heading text.

```

2621 \ExplSyntaxOn
2622 \cs_gset_protected:Npn
2623   \markdownRendererHeadingOne
2624   {
2625     \markdownRendererHeadingOnePrototype
2626   }
2627 \seq_gput_right:Nn
2628   \g_@@_renderers_seq
2629   { headingOne }
2630 \prop_gput:Nnn
2631   \g_@@_renderer_arities_prop
2632   { headingOne }
2633   { 1 }
2634 \ExplSyntaxOff

```

The `\markdownRendererHeadingTwo` macro represents a second level heading. The macro receives a single argument that corresponds to the heading text.

```

2635 \ExplSyntaxOn
2636 \cs_gset_protected:Npn
2637   \markdownRendererHeadingTwo
2638   {
2639     \markdownRendererHeadingTwoPrototype
2640   }
2641 \seq_gput_right:Nn
2642   \g_@@_renderers_seq
2643   { headingTwo }
2644 \prop_gput:Nnn
2645   \g_@@_renderer_arities_prop
2646   { headingTwo }
2647   { 1 }
2648 \ExplSyntaxOff

```

The `\markdownRendererHeadingThree` macro represents a third level heading. The macro receives a single argument that corresponds to the heading text.

```

2649 \ExplSyntaxOn
2650 \cs_gset_protected:Npn
2651   \markdownRendererHeadingThree
2652   {
2653     \markdownRendererHeadingThreePrototype
2654   }
2655 \seq_gput_right:Nn
2656   \g_@@_renderers_seq
2657   { headingThree }
2658 \prop_gput:Nnn

```

```

2659 \g_@@_renderer_arities_prop
2660 { headingThree }
2661 { 1 }
2662 \ExplSyntaxOff

```

The `\markdownRendererHeadingFour` macro represents a fourth level heading. The macro receives a single argument that corresponds to the heading text.

```

2663 \ExplSyntaxOn
2664 \cs_gset_protected:Npn
2665 \markdownRendererHeadingFour
2666 {
2667   \markdownRendererHeadingFourPrototype
2668 }
2669 \seq_gput_right:Nn
2670 \g_@@_renderers_seq
2671 { headingFour }
2672 \prop_gput:Nnn
2673 \g_@@_renderer_arities_prop
2674 { headingFour }
2675 { 1 }
2676 \ExplSyntaxOff

```

The `\markdownRendererHeadingFive` macro represents a fifth level heading. The macro receives a single argument that corresponds to the heading text.

```

2677 \ExplSyntaxOn
2678 \cs_gset_protected:Npn
2679 \markdownRendererHeadingFive
2680 {
2681   \markdownRendererHeadingFivePrototype
2682 }
2683 \seq_gput_right:Nn
2684 \g_@@_renderers_seq
2685 { headingFive }
2686 \prop_gput:Nnn
2687 \g_@@_renderer_arities_prop
2688 { headingFive }
2689 { 1 }
2690 \ExplSyntaxOff

```

The `\markdownRendererHeadingSix` macro represents a sixth level heading. The macro receives a single argument that corresponds to the heading text.

```

2691 \ExplSyntaxOn
2692 \cs_gset_protected:Npn
2693 \markdownRendererHeadingSix
2694 {
2695   \markdownRendererHeadingSixPrototype
2696 }

```

```

2697 \seq_gput_right:Nn
2698   \g_@@_renderers_seq
2699   { headingSix }
2700 \prop_gput:Nnn
2701   \g_@@_renderer_arities_prop
2702   { headingSix }
2703   { 1 }
2704 \ExplSyntaxOff

```

2.2.5.22 Image Renderer

The `\markdownRendererImage` macro represents an image. It receives four arguments: the label, the fully escaped URI that can be directly typeset, the raw URI that can be used outside typesetting, and the title of the link.

```

2705 \ExplSyntaxOn
2706 \cs_gset_protected:Npn
2707   \markdownRendererImage
2708   {
2709     \markdownRendererImagePrototype
2710   }
2711 \seq_gput_right:Nn
2712   \g_@@_renderers_seq
2713   { image }
2714 \prop_gput:Nnn
2715   \g_@@_renderer_arities_prop
2716   { image }
2717   { 4 }
2718 \ExplSyntaxOff

```

2.2.5.23 Image Attribute Context Renderers

The following macros are only produced, when the `linkAttributes` option is enabled.

The `\markdownRendererImageAttributeContextBegin` and `\markdownRendererImageAttributeContextEnd` macros represent the beginning and the end of a context in which the attributes of an image apply. The macros receive no arguments.

```

2719 \ExplSyntaxOn
2720 \cs_gset_protected:Npn
2721   \markdownRendererImageAttributeContextBegin
2722   {
2723     \markdownRendererImageAttributeContextBeginPrototype
2724   }
2725 \seq_gput_right:Nn
2726   \g_@@_renderers_seq
2727   { imageAttributeContextBegin }
2728 \prop_gput:Nnn

```

```

2729 \g_@@_renderer_arities_prop
2730 { imageAttributeContextBegin }
2731 { 0 }
2732 \cs_gset_protected:Npn
2733 \markdownRendererImageAttributeContextEnd
2734 {
2735     \markdownRendererImageAttributeContextEndPrototype
2736 }
2737 \seq_gput_right:Nn
2738 \g_@@_renderers_seq
2739 { imageAttributeContextEnd }
2740 \prop_gput:Nnn
2741 \g_@@_renderer_arities_prop
2742 { imageAttributeContextEnd }
2743 { 0 }
2744 \ExplSyntaxOff

```

2.2.5.24 Interblock Separator Renderers

The `\markdownRendererInterblockSeparator` macro represents an interblock separator between two markdown block elements. The macro receives no arguments.

```

2745 \ExplSyntaxOn
2746 \cs_gset_protected:Npn
2747 \markdownRendererInterblockSeparator
2748 {
2749     \markdownRendererInterblockSeparatorPrototype
2750 }
2751 \seq_gput_right:Nn
2752 \g_@@_renderers_seq
2753 { interblockSeparator }
2754 \prop_gput:Nnn
2755 \g_@@_renderer_arities_prop
2756 { interblockSeparator }
2757 { 0 }
2758 \ExplSyntaxOff

```

Users can use more than one blank line to delimit two block to indicate the end of a series of blocks that make up a logical paragraph. This produces a paragraph separator instead of an interblock separator. Between some blocks, such as markdown paragraphs, a paragraph separator is always produced.

The `\markdownRendererParagraphSeparator` macro represents a paragraph separator. The macro receives no arguments.

```

2759 \ExplSyntaxOn
2760 \cs_gset_protected:Npn
2761 \markdownRendererParagraphSeparator
2762 {

```



```

2763     \markdownRendererParagraphSeparatorPrototype
2764   }
2765   \seq_gput_right:Nn
2766     \g_@@_renderers_seq
2767     { paragraphSeparator }
2768   \prop_gput:Nnn
2769     \g_@@_renderer_arities_prop
2770     { paragraphSeparator }
2771     { 0 }
2772   \ExplSyntaxOff

```

2.2.5.25 Line Block Renderers

The following macros are only produced, when the `lineBlocks` option is enabled.

The `\markdownRendererLineBlockBegin` and `\markdownRendererLineBlockEnd` macros represent the beginning and the end of a line block. The macros receive no arguments.

```

2773   \ExplSyntaxOn
2774   \cs_gset_protected:Npn
2775     \markdownRendererLineBlockBegin
2776     {
2777       \markdownRendererLineBlockBeginPrototype
2778     }
2779   \seq_gput_right:Nn
2780     \g_@@_renderers_seq
2781     { lineBlockBegin }
2782   \prop_gput:Nnn
2783     \g_@@_renderer_arities_prop
2784     { lineBlockBegin }
2785     { 0 }
2786   \cs_gset_protected:Npn
2787     \markdownRendererLineBlockEnd
2788     {
2789       \markdownRendererLineBlockEndPrototype
2790     }
2791   \seq_gput_right:Nn
2792     \g_@@_renderers_seq
2793     { lineBlockEnd }
2794   \prop_gput:Nnn
2795     \g_@@_renderer_arities_prop
2796     { lineBlockEnd }
2797     { 0 }
2798   \ExplSyntaxOff

```

2.2.5.26 Line Break Renderers

The `\markdownRendererSoftLineBreak` macro represents a soft line break. The macro receives no arguments.

```

2799 \ExplSyntaxOn
2800 \cs_gset_protected:Npn
2801   \markdownRendererSoftLineBreak
2802   {
2803     \markdownRendererSoftLineBreakPrototype
2804   }
2805 \seq_gput_right:Nn
2806   \g_@@_renderers_seq
2807   { softLineBreak }
2808 \prop_gput:Nnn
2809   \g_@@_renderer_arities_prop
2810   { softLineBreak }
2811   { 0 }
2812 \ExplSyntaxOff

```

The `\markdownRendererHardLineBreak` macro represents a hard line break. The macro receives no arguments.

```

2813 \ExplSyntaxOn
2814 \cs_gset_protected:Npn
2815   \markdownRendererHardLineBreak
2816   {
2817     \markdownRendererHardLineBreakPrototype
2818   }
2819 \seq_gput_right:Nn
2820   \g_@@_renderers_seq
2821   { hardLineBreak }
2822 \prop_gput:Nnn
2823   \g_@@_renderer_arities_prop
2824   { hardLineBreak }
2825   { 0 }
2826 \ExplSyntaxOff

```

2.2.5.27 Link Renderer

The `\markdownRendererLink` macro represents a hyperlink. It receives four arguments: the label, the fully escaped URI that can be directly typeset, the raw URI that can be used outside typesetting, and the title of the link.

```

2827 \ExplSyntaxOn
2828 \cs_gset_protected:Npn
2829   \markdownRendererLink
2830   {
2831     \markdownRendererLinkPrototype
2832   }
2833 \seq_gput_right:Nn

```

```

2834 \g_@@_renderers_seq
2835 { link }
2836 \prop_gput:Nnn
2837 \g_@@_renderer_arities_prop
2838 { link }
2839 { 4 }
2840 \ExplSyntaxOff

```

2.2.5.28 Link Attribute Context Renderers

The following macros are only produced, when the `linkAttributes` option is enabled.

The `\markdownRendererLinkAttributeContextBegin` and `\markdownRendererLinkAttributeContextEnd` macros represent the beginning and the end of a context in which the attributes of a hyperlink apply. The macros receive no arguments.

```

2841 \ExplSyntaxOn
2842 \cs_gset_protected:Npn
2843 \markdownRendererLinkAttributeContextBegin
2844 {
2845   \markdownRendererLinkAttributeContextBeginPrototype
2846 }
2847 \seq_gput_right:Nn
2848 \g_@@_renderers_seq
2849 { linkAttributeContextBegin }
2850 \prop_gput:Nnn
2851 \g_@@_renderer_arities_prop
2852 { linkAttributeContextBegin }
2853 { 0 }
2854 \cs_gset_protected:Npn
2855 \markdownRendererLinkAttributeContextEnd
2856 {
2857   \markdownRendererLinkAttributeContextEndPrototype
2858 }
2859 \seq_gput_right:Nn
2860 \g_@@_renderers_seq
2861 { linkAttributeContextEnd }
2862 \prop_gput:Nnn
2863 \g_@@_renderer_arities_prop
2864 { linkAttributeContextEnd }
2865 { 0 }
2866 \ExplSyntaxOff

```

2.2.5.29 Marked Text Renderer

The following macro is only produced, when the `mark` option is enabled.

The `\markdownRendererMark` macro represents a span of marked or highlighted text. The macro receives a single argument that corresponds to the marked text.

```

2867 \ExplSyntaxOn
2868 \cs_gset_protected:Npn
2869   \markdownRendererMark
2870   {
2871     \markdownRendererMarkPrototype
2872   }
2873 \seq_gput_right:Nn
2874   \g_@@_renderers_seq
2875   { mark }
2876 \prop_gput:Nnn
2877   \g_@@_renderer_arities_prop
2878   { mark }
2879   { 1 }
2880 \ExplSyntaxOff

```

2.2.5.30 Markdown Document Renderers

The `\markdownRendererDocumentBegin` and `\markdownRendererDocumentEnd` macros represent the beginning and the end of a *markdown* document. The macros receive no arguments.

A \TeX document may contain any number of markdown documents. Additionally, markdown documents may appear not only in a sequence, but several markdown documents may also be *nested*. Redefinitions of the macros should take this into account.

```

2881 \ExplSyntaxOn
2882 \cs_gset_protected:Npn
2883   \markdownRendererDocumentBegin
2884   {
2885     \markdownRendererDocumentBeginPrototype
2886   }
2887 \seq_gput_right:Nn
2888   \g_@@_renderers_seq
2889   { documentBegin }
2890 \prop_gput:Nnn
2891   \g_@@_renderer_arities_prop
2892   { documentBegin }
2893   { 0 }
2894 \cs_gset_protected:Npn
2895   \markdownRendererDocumentEnd
2896   {
2897     \markdownRendererDocumentEndPrototype
2898   }
2899 \seq_gput_right:Nn
2900   \g_@@_renderers_seq

```

```

2901 { documentEnd }
2902 \prop_gput:Nnn
2903 \g_@@_renderer_arities_prop
2904 { documentEnd }
2905 { 0 }
2906 \ExplSyntaxOff

```

2.2.5.31 Non-Breaking Space Renderer

The `\markdownRendererNbsp` macro represents a non-breaking space.

```

2907 \ExplSyntaxOn
2908 \cs_gset_protected:Npn
2909 \markdownRendererNbsp
2910 {
2911   \markdownRendererNbspPrototype
2912 }
2913 \seq_gput_right:Nn
2914 \g_@@_renderers_seq
2915 { nbsp }
2916 \prop_gput:Nnn
2917 \g_@@_renderer_arities_prop
2918 { nbsp }
2919 { 0 }
2920 \ExplSyntaxOff

```

2.2.5.32 Note Renderer

The `\markdownRendererNote` macro represents a note. This macro will only be produced, when the `notes` option is enabled. The macro receives a single argument that corresponds to the note text.

```

2921 \def\markdownRendererNote{%
2922   \markdownRendererNotePrototype}%
2923 \ExplSyntaxOn
2924 \seq_gput_right:Nn
2925 \g_@@_renderers_seq
2926 { note }
2927 \prop_gput:Nnn
2928 \g_@@_renderer_arities_prop
2929 { note }
2930 { 1 }
2931 \ExplSyntaxOff

```

2.2.5.33 Ordered List Renderers

The `\markdownRendererOlBegin` macro represents the beginning of an ordered list that contains an item with several paragraphs of text (the list is not tight). This

macro will only be produced, when the `fancyLists` option is disabled. The macro receives no arguments.

```

2932 \ExplSyntaxOn
2933 \cs_gset_protected:Npn
2934   \markdownRendererOlBegin
2935   {
2936     \markdownRendererOlBeginPrototype
2937   }
2938 \seq_gput_right:Nn
2939   \g_@@_renderers_seq
2940   { olBegin }
2941 \prop_gput:Nnn
2942   \g_@@_renderer_arities_prop
2943   { olBegin }
2944   { 0 }
2945 \ExplSyntaxOff

```

The `\markdownRendererOlBeginTight` macro represents the beginning of an ordered list that contains no item with several paragraphs of text (the list is tight). This macro will only be produced, when the `tightLists` option is enabled and the `fancyLists` option is disabled. The macro receives no arguments.

```

2946 \ExplSyntaxOn
2947 \cs_gset_protected:Npn
2948   \markdownRendererOlBeginTight
2949   {
2950     \markdownRendererOlBeginTightPrototype
2951   }
2952 \seq_gput_right:Nn
2953   \g_@@_renderers_seq
2954   { olBeginTight }
2955 \prop_gput:Nnn
2956   \g_@@_renderer_arities_prop
2957   { olBeginTight }
2958   { 0 }
2959 \ExplSyntaxOff

```

The `\markdownRendererFancyOlBegin` macro represents the beginning of a fancy ordered list that contains an item with several paragraphs of text (the list is not tight). This macro will only be produced, when the `fancyLists` option is enabled. The macro receives two arguments: the style of the list item labels (`Decimal`, `LowerRoman`, `UpperRoman`, `LowerAlpha`, and `UpperAlpha`), and the style of delimiters between list item labels and texts (`Default`, `OneParen`, and `Period`).

```

2960 \ExplSyntaxOn
2961 \cs_gset_protected:Npn
2962   \markdownRendererFancyOlBegin

```

```

2963 {
2964   \markdownRendererFancyOlBeginPrototype
2965 }
2966 \seq_gput_right:Nn
2967   \g_@@_renderers_seq
2968   { fancyOlBegin }
2969 \prop_gput:Nnn
2970   \g_@@_renderer_arities_prop
2971   { fancyOlBegin }
2972   { 2 }
2973 \ExplSyntaxOff

```

The `\markdownRendererFancyOlBeginTight` macro represents the beginning of a fancy ordered list that contains no item with several paragraphs of text (the list is tight). This macro will only be produced, when the `fancyLists` and `tightLists` options are enabled. The macro receives two arguments: the style of the list item labels, and the style of delimiters between list item labels and texts. See the `\markdownRendererFancyOlBegin` macro for the valid style values.

```

2974 \ExplSyntaxOn
2975 \cs_gset_protected:Npn
2976   \markdownRendererFancyOlBeginTight
2977   {
2978     \markdownRendererFancyOlBeginTightPrototype
2979   }
2980 \seq_gput_right:Nn
2981   \g_@@_renderers_seq
2982   { fancyOlBeginTight }
2983 \prop_gput:Nnn
2984   \g_@@_renderer_arities_prop
2985   { fancyOlBeginTight }
2986   { 2 }
2987 \ExplSyntaxOff

```

The `\markdownRendererOlItem` macro represents an item in an ordered list. This macro will only be produced, when the `startNumber` option is disabled and the `fancyLists` option is disabled. The macro receives no arguments.

```

2988 \ExplSyntaxOn
2989 \cs_gset_protected:Npn
2990   \markdownRendererOlItem
2991   {
2992     \markdownRendererOlItemPrototype
2993   }
2994 \seq_gput_right:Nn
2995   \g_@@_renderers_seq
2996   { olItem }
2997 \prop_gput:Nnn

```

```

2998 \g_@@_renderer_arities_prop
2999 { olItem }
3000 { 0 }
3001 \ExplSyntaxOff

```

The `\markdownRendererOlItemEnd` macro represents the end of an item in an ordered list. This macro will only be produced, when the `fancyLists` option is disabled. The macro receives no arguments.

```

3002 \ExplSyntaxOn
3003 \cs_gset_protected:Npn
3004 \markdownRendererOlItemEnd
3005 {
3006 \markdownRendererOlItemEndPrototype
3007 }
3008 \seq_gput_right:Nn
3009 \g_@@_renderers_seq
3010 { olItemEnd }
3011 \prop_gput:Nnn
3012 \g_@@_renderer_arities_prop
3013 { olItemEnd }
3014 { 0 }
3015 \ExplSyntaxOff

```

The `\markdownRendererOlItemWithNumber` macro represents an item in an ordered list. This macro will only be produced, when the `startNumber` option is enabled and the `fancyLists` option is disabled. The macro receives a single numeric argument that corresponds to the item number.

```

3016 \ExplSyntaxOn
3017 \cs_gset_protected:Npn
3018 \markdownRendererOlItemWithNumber
3019 {
3020 \markdownRendererOlItemWithNumberPrototype
3021 }
3022 \seq_gput_right:Nn
3023 \g_@@_renderers_seq
3024 { olItemWithNumber }
3025 \prop_gput:Nnn
3026 \g_@@_renderer_arities_prop
3027 { olItemWithNumber }
3028 { 1 }
3029 \ExplSyntaxOff

```

The `\markdownRendererFancyOlItem` macro represents an item in a fancy ordered list. This macro will only be produced, when the `startNumber` option is disabled and the `fancyLists` option is enabled. The macro receives no arguments.

```

3030 \ExplSyntaxOn

```



```

3031 \cs_gset_protected:Npn
3032   \markdownRendererFancy01Item
3033   {
3034     \markdownRendererFancy01ItemPrototype
3035   }
3036 \seq_gput_right:Nn
3037   \g_@@_renderers_seq
3038   { fancy01Item }
3039 \prop_gput:Nnn
3040   \g_@@_renderer_arities_prop
3041   { fancy01Item }
3042   { 0 }
3043 \ExplSyntaxOff

```

The `\markdownRendererFancy01ItemEnd` macro represents the end of an item in a fancy ordered list. This macro will only be produced, when the `fancyLists` option is enabled. The macro receives no arguments.

```

3044 \ExplSyntaxOn
3045 \cs_gset_protected:Npn
3046   \markdownRendererFancy01ItemEnd
3047   {
3048     \markdownRendererFancy01ItemEndPrototype
3049   }
3050 \seq_gput_right:Nn
3051   \g_@@_renderers_seq
3052   { fancy01ItemEnd }
3053 \prop_gput:Nnn
3054   \g_@@_renderer_arities_prop
3055   { fancy01ItemEnd }
3056   { 0 }
3057 \ExplSyntaxOff

```

The `\markdownRendererFancy01ItemWithNumber` macro represents an item in a fancy ordered list. This macro will only be produced, when the `startNumber` and `fancyLists` options are enabled. The macro receives a single numeric argument that corresponds to the item number.

```

3058 \ExplSyntaxOn
3059 \cs_gset_protected:Npn
3060   \markdownRendererFancy01ItemWithNumber
3061   {
3062     \markdownRendererFancy01ItemWithNumberPrototype
3063   }
3064 \seq_gput_right:Nn
3065   \g_@@_renderers_seq
3066   { fancy01ItemWithNumber }
3067 \prop_gput:Nnn

```

```

3068 \g_@@_renderer_arities_prop
3069 { fancyO1ItemWithNumber }
3070 { 1 }
3071 \ExplSyntaxOff

```

The `\markdownRendererO1End` macro represents the end of an ordered list that contains an item with several paragraphs of text (the list is not tight). This macro will only be produced, when the `fancyLists` option is disabled. The macro receives no arguments.

```

3072 \ExplSyntaxOn
3073 \cs_gset_protected:Npn
3074 \markdownRendererO1End
3075 {
3076   \markdownRendererO1EndPrototype
3077 }
3078 \seq_gput_right:Nn
3079 \g_@@_renderers_seq
3080 { olEnd }
3081 \prop_gput:Nnn
3082 \g_@@_renderer_arities_prop
3083 { olEnd }
3084 { 0 }
3085 \ExplSyntaxOff

```

The `\markdownRendererO1EndTight` macro represents the end of an ordered list that contains no item with several paragraphs of text (the list is tight). This macro will only be produced, when the `tightLists` option is enabled and the `fancyLists` option is disabled. The macro receives no arguments.

```

3086 \ExplSyntaxOn
3087 \cs_gset_protected:Npn
3088 \markdownRendererO1EndTight
3089 {
3090   \markdownRendererO1EndTightPrototype
3091 }
3092 \seq_gput_right:Nn
3093 \g_@@_renderers_seq
3094 { olEndTight }
3095 \prop_gput:Nnn
3096 \g_@@_renderer_arities_prop
3097 { olEndTight }
3098 { 0 }
3099 \ExplSyntaxOff

```

The `\markdownRendererFancyO1End` macro represents the end of a fancy ordered list that contains an item with several paragraphs of text (the list is not tight). This

macro will only be produced, when the `fancyLists` option is enabled. The macro receives no arguments.

```

3100 \ExplSyntaxOn
3101 \cs_gset_protected:Npn
3102   \markdownRendererFancyO1End
3103   {
3104     \markdownRendererFancyO1EndPrototype
3105   }
3106 \seq_gput_right:Nn
3107   \g_@@_renderers_seq
3108   { fancyO1End }
3109 \prop_gput:Nnn
3110   \g_@@_renderer_arities_prop
3111   { fancyO1End }
3112   { 0 }
3113 \ExplSyntaxOff

```

The `\markdownRendererFancyO1EndTight` macro represents the end of a fancy ordered list that contains no item with several paragraphs of text (the list is tight). This macro will only be produced, when the `fancyLists` and `tightLists` options are enabled. The macro receives no arguments.

```

3114 \ExplSyntaxOn
3115 \cs_gset_protected:Npn
3116   \markdownRendererFancyO1EndTight
3117   {
3118     \markdownRendererFancyO1EndTightPrototype
3119   }
3120 \seq_gput_right:Nn
3121   \g_@@_renderers_seq
3122   { fancyO1EndTight }
3123 \prop_gput:Nnn
3124   \g_@@_renderer_arities_prop
3125   { fancyO1EndTight }
3126   { 0 }
3127 \ExplSyntaxOff

```

2.2.5.34 Raw Content Renderers

The `\markdownRendererInputRawInline` macro represents an inline raw span. The macro receives two arguments: the filename of a file containing the inline raw span contents and the raw attribute that designates the format of the inline raw span. This macro will only be produced, when the `rawAttribute` option is enabled.

```

3128 \ExplSyntaxOn
3129 \cs_gset_protected:Npn
3130   \markdownRendererInputRawInline
3131   {

```

```

3132     \markdownRendererInputRawInlinePrototype
3133   }
3134 \seq_gput_right:Nn
3135   \g_@@_renderers_seq
3136   { inputRawInline }
3137 \prop_gput:Nnn
3138   \g_@@_renderer_arities_prop
3139   { inputRawInline }
3140   { 2 }
3141 \ExplSyntaxOff

```

The `\markdownRendererInputRawBlock` macro represents a raw block. The macro receives two arguments: the filename of a file containing the raw block and the raw attribute that designates the format of the raw block. This macro will only be produced, when the `rawAttribute` and `fencedCode` options are enabled.

```

3142 \ExplSyntaxOn
3143 \cs_gset_protected:Npn
3144   \markdownRendererInputRawBlock
3145   {
3146     \markdownRendererInputRawBlockPrototype
3147   }
3148 \seq_gput_right:Nn
3149   \g_@@_renderers_seq
3150   { inputRawBlock }
3151 \prop_gput:Nnn
3152   \g_@@_renderer_arities_prop
3153   { inputRawBlock }
3154   { 2 }
3155 \ExplSyntaxOff

```

2.2.5.35 Section Renderers

The `\markdownRendererSectionBegin` and `\markdownRendererSectionEnd` macros represent the beginning and the end of a section based on headings.

```

3156 \ExplSyntaxOn
3157 \cs_gset_protected:Npn
3158   \markdownRendererSectionBegin
3159   {
3160     \markdownRendererSectionBeginPrototype
3161   }
3162 \seq_gput_right:Nn
3163   \g_@@_renderers_seq
3164   { sectionBegin }
3165 \prop_gput:Nnn
3166   \g_@@_renderer_arities_prop
3167   { sectionBegin }
3168   { 0 }

```

```

3169 \cs_gset_protected:Npn
3170   \markdownRendererSectionEnd
3171   {
3172     \markdownRendererSectionEndPrototype
3173   }
3174 \seq_gput_right:Nn
3175   \g_@@_renderers_seq
3176   { sectionEnd }
3177 \prop_gput:Nnn
3178   \g_@@_renderer_arities_prop
3179   { sectionEnd }
3180   { 0 }
3181 \ExplSyntaxOff

```

2.2.5.36 Replacement Character Renderers

The `\markdownRendererReplacementCharacter` macro represents the U+0000 and U+FFFD Unicode characters. The macro receives no arguments.

```

3182 \ExplSyntaxOn
3183 \cs_gset_protected:Npn
3184   \markdownRendererReplacementCharacter
3185   {
3186     \markdownRendererReplacementCharacterPrototype
3187   }
3188 \seq_gput_right:Nn
3189   \g_@@_renderers_seq
3190   { replacementCharacter }
3191 \prop_gput:Nnn
3192   \g_@@_renderer_arities_prop
3193   { replacementCharacter }
3194   { 0 }
3195 \ExplSyntaxOff

```

2.2.5.37 Special Character Renderers

The following macros replace any special plain T_EX characters, including the active pipe character (|) of ConT_EXt, in the input text. These macros will only be produced, when the `hybrid` option is `false`.

```

3196 \ExplSyntaxOn
3197 \cs_gset_protected:Npn
3198   \markdownRendererLeftBrace
3199   {
3200     \markdownRendererLeftBracePrototype
3201   }
3202 \seq_gput_right:Nn
3203   \g_@@_renderers_seq
3204   { leftBrace }

```

```

3205 \prop_gput:Nnn
3206   \g_@@_renderer_arities_prop
3207   { leftBrace }
3208   { 0 }
3209 \cs_gset_protected:Npn
3210   \markdownRendererRightBrace
3211   {
3212     \markdownRendererRightBracePrototype
3213   }
3214 \seq_gput_right:Nn
3215   \g_@@_renderers_seq
3216   { rightBrace }
3217 \prop_gput:Nnn
3218   \g_@@_renderer_arities_prop
3219   { rightBrace }
3220   { 0 }
3221 \cs_gset_protected:Npn
3222   \markdownRendererDollarSign
3223   {
3224     \markdownRendererDollarSignPrototype
3225   }
3226 \seq_gput_right:Nn
3227   \g_@@_renderers_seq
3228   { dollarSign }
3229 \prop_gput:Nnn
3230   \g_@@_renderer_arities_prop
3231   { dollarSign }
3232   { 0 }
3233 \cs_gset_protected:Npn
3234   \markdownRendererPercentSign
3235   {
3236     \markdownRendererPercentSignPrototype
3237   }
3238 \seq_gput_right:Nn
3239   \g_@@_renderers_seq
3240   { percentSign }
3241 \prop_gput:Nnn
3242   \g_@@_renderer_arities_prop
3243   { percentSign }
3244   { 0 }
3245 \cs_gset_protected:Npn
3246   \markdownRendererAmpersand
3247   {
3248     \markdownRendererAmpersandPrototype
3249   }
3250 \seq_gput_right:Nn
3251   \g_@@_renderers_seq

```

```

3252 { ampersand }
3253 \prop_gput:Nnn
3254 \g_@@_renderer_arities_prop
3255 { ampersand }
3256 { 0 }
3257 \cs_gset_protected:Npn
3258 \markdownRendererUnderscore
3259 {
3260   \markdownRendererUnderscorePrototype
3261 }
3262 \seq_gput_right:Nn
3263 \g_@@_renderers_seq
3264 { underscore }
3265 \prop_gput:Nnn
3266 \g_@@_renderer_arities_prop
3267 { underscore }
3268 { 0 }
3269 \cs_gset_protected:Npn
3270 \markdownRendererHash
3271 {
3272   \markdownRendererHashPrototype
3273 }
3274 \seq_gput_right:Nn
3275 \g_@@_renderers_seq
3276 { hash }
3277 \prop_gput:Nnn
3278 \g_@@_renderer_arities_prop
3279 { hash }
3280 { 0 }
3281 \cs_gset_protected:Npn
3282 \markdownRendererCircumflex
3283 {
3284   \markdownRendererCircumflexPrototype
3285 }
3286 \seq_gput_right:Nn
3287 \g_@@_renderers_seq
3288 { circumflex }
3289 \prop_gput:Nnn
3290 \g_@@_renderer_arities_prop
3291 { circumflex }
3292 { 0 }
3293 \cs_gset_protected:Npn
3294 \markdownRendererBackslash
3295 {
3296   \markdownRendererBackslashPrototype
3297 }
3298 \seq_gput_right:Nn

```

```

3299 \g_@@_renderers_seq
3300 { backslash }
3301 \prop_gput:Nnn
3302 \g_@@_renderer_arities_prop
3303 { backslash }
3304 { 0 }
3305 \cs_gset_protected:Npn
3306 \markdownRendererTilde
3307 {
3308   \markdownRendererTildePrototype
3309 }
3310 \seq_gput_right:Nn
3311 \g_@@_renderers_seq
3312 { tilde }
3313 \prop_gput:Nnn
3314 \g_@@_renderer_arities_prop
3315 { tilde }
3316 { 0 }
3317 \cs_gset_protected:Npn
3318 \markdownRendererPipe
3319 {
3320   \markdownRendererPipePrototype
3321 }
3322 \seq_gput_right:Nn
3323 \g_@@_renderers_seq
3324 { pipe }
3325 \prop_gput:Nnn
3326 \g_@@_renderer_arities_prop
3327 { pipe }
3328 { 0 }
3329 \ExplSyntaxOff

```

2.2.5.38 Strike-Through Renderer

The `\markdownRendererStrikeThrough` macro represents a strike-through span of text. The macro receives a single argument that corresponds to the striked-out span of text. This macro will only be produced, when the `strikeThrough` option is enabled.

```

3330 \ExplSyntaxOn
3331 \cs_gset_protected:Npn
3332 \markdownRendererStrikeThrough
3333 {
3334   \markdownRendererStrikeThroughPrototype
3335 }
3336 \seq_gput_right:Nn
3337 \g_@@_renderers_seq
3338 { strikeThrough }

```



```

3339 \prop_gput:Nnn
3340   \g_@@_renderer_arities_prop
3341   { strikeThrough }
3342   { 1 }
3343 \ExplSyntaxOff

```

2.2.5.39 Subscript Renderer

The `\markdownRendererSubscript` macro represents a subscript span of text. The macro receives a single argument that corresponds to the subscript span of text. This macro will only be produced, when the `subscripts` option is enabled.

```

3344 \ExplSyntaxOn
3345 \cs_gset_protected:Npn
3346   \markdownRendererSubscript
3347   {
3348     \markdownRendererSubscriptPrototype
3349   }
3350 \seq_gput_right:Nn
3351   \g_@@_renderers_seq
3352   { subscript }
3353 \prop_gput:Nnn
3354   \g_@@_renderer_arities_prop
3355   { subscript }
3356   { 1 }

```

2.2.5.40 Superscript Renderer

The `\markdownRendererSuperscript` macro represents a superscript span of text. The macro receives a single argument that corresponds to the superscript span of text. This macro will only be produced, when the `superscripts` option is enabled.

```

3357 \cs_gset_protected:Npn
3358   \markdownRendererSuperscript
3359   {
3360     \markdownRendererSuperscriptPrototype
3361   }
3362 \seq_gput_right:Nn
3363   \g_@@_renderers_seq
3364   { superscript }
3365 \prop_gput:Nnn
3366   \g_@@_renderer_arities_prop
3367   { superscript }
3368   { 1 }
3369 \ExplSyntaxOff

```

2.2.5.41 Table Attribute Context Renderers

The following macros are only produced, when the `tableCaptions` and `tableAttributes` options are enabled.

The `\markdownRendererTableAttributeContextBegin` and `\markdownRendererTableAttributeContextEnd` macros represent the beginning and the end of a context in which the attributes of a table apply. The macros receive no arguments.

```

3370 \ExplSyntaxOn
3371 \cs_gset_protected:Npn
3372   \markdownRendererTableAttributeContextBegin
3373   {
3374     \markdownRendererTableAttributeContextBeginPrototype
3375   }
3376 \seq_gput_right:Nn
3377   \g_@@_renderers_seq
3378   { tableAttributeContextBegin }
3379 \prop_gput:Nnn
3380   \g_@@_renderer_arities_prop
3381   { tableAttributeContextBegin }
3382   { 0 }
3383 \cs_gset_protected:Npn
3384   \markdownRendererTableAttributeContextEnd
3385   {
3386     \markdownRendererTableAttributeContextEndPrototype
3387   }
3388 \seq_gput_right:Nn
3389   \g_@@_renderers_seq
3390   { tableAttributeContextEnd }
3391 \prop_gput:Nnn
3392   \g_@@_renderer_arities_prop
3393   { tableAttributeContextEnd }
3394   { 0 }
3395 \ExplSyntaxOff

```

2.2.5.42 Table Renderer

The `\markdownRendererTable` macro represents a table. This macro will only be produced, when the `pipeTables` option is enabled. The macro receives the parameters `{<caption>}{<number of rows>}{<number of columns>}` followed by `{<alignments>}` and then by `{<row>}` repeated `<number of rows>` times, where `<row>` is `{<column>}` repeated `<number of columns>` times, `<alignments>` is `<alignment>` repeated `<number of columns>` times, and `<alignment>` is one of the following:

- **d** – The corresponding column has an unspecified (default) alignment.
- **l** – The corresponding column is left-aligned.
- **c** – The corresponding column is centered.
- **r** – The corresponding column is right-aligned.

```

3396 \ExplSyntaxOn
3397 \cs_gset_protected:Npn
3398   \markdownRendererTable
3399   {
3400     \markdownRendererTablePrototype
3401   }
3402 \seq_gput_right:Nn
3403   \g_@@_renderers_seq
3404   { table }
3405 \prop_gput:Nnn
3406   \g_@@_renderer_arities_prop
3407   { table }
3408   { 3 }
3409 \ExplSyntaxOff

```

2.2.5.43 T_EX Math Renderers

The `\markdownRendererInlineMath` and `\markdownRendererDisplayMath` macros represent inline and display T_EX math. Both macros receive a single argument that corresponds to the T_EX math content. These macros will only be produced, when the `texMathDollars`, `texMathSingleBackslash`, or `texMathDoubleBackslash` option are enabled.

```

3410 \ExplSyntaxOn
3411 \cs_gset_protected:Npn
3412   \markdownRendererInlineMath
3413   {
3414     \markdownRendererInlineMathPrototype
3415   }
3416 \seq_gput_right:Nn
3417   \g_@@_renderers_seq
3418   { inlineMath }
3419 \prop_gput:Nnn
3420   \g_@@_renderer_arities_prop
3421   { inlineMath }
3422   { 1 }
3423 \cs_gset_protected:Npn
3424   \markdownRendererDisplayMath
3425   {
3426     \markdownRendererDisplayMathPrototype
3427   }
3428 \seq_gput_right:Nn
3429   \g_@@_renderers_seq
3430   { displayMath }
3431 \prop_gput:Nnn
3432   \g_@@_renderer_arities_prop
3433   { displayMath }
3434   { 1 }

```

```
3435 \ExplSyntaxOff
```

2.2.5.44 Thematic Break Renderer

The `\markdownRendererThematicBreak` macro represents a thematic break. The macro receives no arguments.

```
3436 \ExplSyntaxOn
3437 \cs_gset_protected:Npn
3438   \markdownRendererThematicBreak
3439   {
3440     \markdownRendererThematicBreakPrototype
3441   }
3442 \seq_gput_right:Nn
3443   \g_@@_renderers_seq
3444   { thematicBreak }
3445 \prop_gput:Nnn
3446   \g_@@_renderer_arities_prop
3447   { thematicBreak }
3448   { 0 }
3449 \ExplSyntaxOff
```

2.2.5.45 Tickbox Renderers

The macros named `\markdownRendererTickedBox`, `\markdownRendererHalfTickedBox`, and `\markdownRendererUntickedBox` represent ticked and unticked boxes, respectively. These macros will either be produced, when the `taskLists` option is enabled, or when the Ballot Box with X (☒, U+2612), Hourglass (⌚, U+231B) or Ballot Box (☐, U+2610) Unicode characters are encountered in the markdown input, respectively.

```
3450 \ExplSyntaxOn
3451 \cs_gset_protected:Npn
3452   \markdownRendererTickedBox
3453   {
3454     \markdownRendererTickedBoxPrototype
3455   }
3456 \seq_gput_right:Nn
3457   \g_@@_renderers_seq
3458   { tickedBox }
3459 \prop_gput:Nnn
3460   \g_@@_renderer_arities_prop
3461   { tickedBox }
3462   { 0 }
3463 \cs_gset_protected:Npn
3464   \markdownRendererHalfTickedBox
3465   {
3466     \markdownRendererHalfTickedBoxPrototype
3467   }
```

```

3468 \seq_gput_right:Nn
3469   \g_@@_renderers_seq
3470   { halfTickedBox }
3471 \prop_gput:Nnn
3472   \g_@@_renderer_arities_prop
3473   { halfTickedBox }
3474   { 0 }
3475 \cs_gset_protected:Npn
3476   \markdownRendererUntickedBox
3477   {
3478     \markdownRendererUntickedBoxPrototype
3479   }
3480 \seq_gput_right:Nn
3481   \g_@@_renderers_seq
3482   { untickedBox }
3483 \prop_gput:Nnn
3484   \g_@@_renderer_arities_prop
3485   { untickedBox }
3486   { 0 }
3487 \ExplSyntaxOff

```

2.2.5.46 Warning and Error Renderers

The `\markdownRendererWarning` and `\markdownRendererError` macros represent warnings and errors produced by the markdown parser. Both macros receive four parameters:

1. The fully escaped text of the warning or error that can be directly typeset
2. The raw text of the warning or error that can be used outside typesetting for e.g. logging the warning or error.
3. The fully escaped text with more details about the warning or error that can be directly typeset. Can be empty, unlike the first two parameters.
4. The raw text with more details about the warning or error that can be used outside typesetting for e.g. logging the warning or error. Can be empty, unlike the first two parameters.

```

3488 \ExplSyntaxOn
3489 \cs_gset_protected:Npn
3490   \markdownRendererWarning
3491   {
3492     \markdownRendererWarningPrototype
3493   }
3494 \cs_gset_protected:Npn
3495   \markdownRendererError
3496   {
3497     \markdownRendererErrorPrototype
3498   }

```

```

3499 \seq_gput_right:Nn
3500   \g_@@_renderers_seq
3501   { warning }
3502 \prop_gput:Nnn
3503   \g_@@_renderer_arities_prop
3504   { warning }
3505   { 4 }
3506 \seq_gput_right:Nn
3507   \g_@@_renderers_seq
3508   { error }
3509 \prop_gput:Nnn
3510   \g_@@_renderer_arities_prop
3511   { error }
3512   { 4 }
3513 \ExplSyntaxOff

```

2.2.5.47 yaml Metadata Renderers

The `\markdownRendererJekyllDataBegin` macro represents the beginning of a YAML document. This macro will only be produced when the `jekyllData` option is enabled. The macro receives no arguments.

```

3514 \ExplSyntaxOn
3515 \cs_gset_protected:Npn
3516   \markdownRendererJekyllDataBegin
3517   {
3518     \markdownRendererJekyllDataBeginPrototype
3519   }
3520 \seq_gput_right:Nn
3521   \g_@@_renderers_seq
3522   { jekyllDataBegin }
3523 \prop_gput:Nnn
3524   \g_@@_renderer_arities_prop
3525   { jekyllDataBegin }
3526   { 0 }
3527 \ExplSyntaxOff

```

The `\markdownRendererJekyllDataEnd` macro represents the end of a YAML document. This macro will only be produced when the `jekyllData` option is enabled. The macro receives no arguments.

```

3528 \ExplSyntaxOn
3529 \cs_gset_protected:Npn
3530   \markdownRendererJekyllDataEnd
3531   {
3532     \markdownRendererJekyllDataEndPrototype
3533   }
3534 \seq_gput_right:Nn
3535   \g_@@_renderers_seq

```

```

3536 { jekyllDataEnd }
3537 \prop_gput:Nnn
3538 \g_@@_renderer_arities_prop
3539 { jekyllDataEnd }
3540 { 0 }
3541 \ExplSyntaxOff

```

The `\markdownRendererJekyllDataMappingBegin` macro represents the beginning of a mapping in a YAML document. This macro will only be produced when the `jekyllData` option is enabled. The macro receives two arguments: the scalar key in the parent structure, cast to a string following YAML serialization rules, and the number of items in the mapping.

```

3542 \ExplSyntaxOn
3543 \cs_gset_protected:Npn
3544 \markdownRendererJekyllDataMappingBegin
3545 {
3546   \markdownRendererJekyllDataMappingBeginPrototype
3547 }
3548 \seq_gput_right:Nn
3549 \g_@@_renderers_seq
3550 { jekyllDataMappingBegin }
3551 \prop_gput:Nnn
3552 \g_@@_renderer_arities_prop
3553 { jekyllDataMappingBegin }
3554 { 2 }
3555 \ExplSyntaxOff

```

The `\markdownRendererJekyllDataMappingEnd` macro represents the end of a mapping in a YAML document. This macro will only be produced when the `jekyllData` option is enabled. The macro receives no arguments.

```

3556 \ExplSyntaxOn
3557 \cs_gset_protected:Npn
3558 \markdownRendererJekyllDataMappingEnd
3559 {
3560   \markdownRendererJekyllDataMappingEndPrototype
3561 }
3562 \seq_gput_right:Nn
3563 \g_@@_renderers_seq
3564 { jekyllDataMappingEnd }
3565 \prop_gput:Nnn
3566 \g_@@_renderer_arities_prop
3567 { jekyllDataMappingEnd }
3568 { 0 }
3569 \ExplSyntaxOff

```

The `\markdownRendererJekyllDataSequenceBegin` macro represents the beginning of a sequence in a YAML document. This macro will only be produced when

the `jeekyllData` option is enabled. The macro receives two arguments: the scalar key in the parent structure, cast to a string following YAML serialization rules, and the number of items in the sequence.

```

3570 \ExplSyntaxOn
3571 \cs_gset_protected:Npn
3572   \markdownRendererJekyllDataSequenceBegin
3573   {
3574     \markdownRendererJekyllDataSequenceBeginPrototype
3575   }
3576 \seq_gput_right:Nn
3577   \g_@@_renderers_seq
3578   { jekyllDataSequenceBegin }
3579 \prop_gput:Nnn
3580   \g_@@_renderer_arities_prop
3581   { jekyllDataSequenceBegin }
3582   { 2 }
3583 \ExplSyntaxOff

```

The `\markdownRendererJekyllDataSequenceEnd` macro represents the end of a sequence in a YAML document. This macro will only be produced when the `jeekyllData` option is enabled. The macro receives no arguments.

```

3584 \ExplSyntaxOn
3585 \cs_gset_protected:Npn
3586   \markdownRendererJekyllDataSequenceEnd
3587   {
3588     \markdownRendererJekyllDataSequenceEndPrototype
3589   }
3590 \seq_gput_right:Nn
3591   \g_@@_renderers_seq
3592   { jekyllDataSequenceEnd }
3593 \prop_gput:Nnn
3594   \g_@@_renderer_arities_prop
3595   { jekyllDataSequenceEnd }
3596   { 0 }
3597 \ExplSyntaxOff

```

The `\markdownRendererJekyllDataBoolean` macro represents a boolean scalar value in a YAML document. This macro will only be produced when the `jeekyllData` option is enabled. The macro receives two arguments: the scalar key in the parent structure, and the scalar value, both cast to a string following YAML serialization rules.

```

3598 \ExplSyntaxOn
3599 \cs_gset_protected:Npn
3600   \markdownRendererJekyllDataBoolean
3601   {
3602     \markdownRendererJekyllDataBooleanPrototype

```



```

3603   }
3604   \seq_gput_right:Nn
3605   \g_@@_renderers_seq
3606   { jekyllDataBoolean }
3607   \prop_gput:Nnn
3608   \g_@@_renderer_arities_prop
3609   { jekyllDataBoolean }
3610   { 2 }
3611   \ExplSyntaxOff

```

The `\markdownRendererJekyllDataNumber` macro represents a numeric scalar value in a YAML document. This macro will only be produced when the `jekyllData` option is enabled. The macro receives two arguments: the scalar key in the parent structure, and the scalar value, both cast to a string following YAML serialization rules.

```

3612 \ExplSyntaxOn
3613 \cs_gset_protected:Npn
3614   \markdownRendererJekyllDataNumber
3615   {
3616     \markdownRendererJekyllDataNumberPrototype
3617   }
3618   \seq_gput_right:Nn
3619   \g_@@_renderers_seq
3620   { jekyllDataNumber }
3621   \prop_gput:Nnn
3622   \g_@@_renderer_arities_prop
3623   { jekyllDataNumber }
3624   { 2 }
3625   \ExplSyntaxOff

```

The `\markdownRendererJekyllDataTypographicString` and `\markdownRendererJekyllDataProgrammaticString` macros represent string scalar values in a YAML document. This macro will only be produced when the `jekyllData` option is enabled. The macro receives two arguments: the scalar key in the parent structure, cast to a string following YAML serialization rules, and the scalar value.

For each string scalar value, both macros are produced. Whereas `\markdownRendererJekyllDataTypographicString` receives the scalar value after all markdown markup and special \TeX characters in the string have been replaced by \TeX macros, `\markdownRendererJekyllDataProgrammaticString` receives the raw scalar value. Therefore, whereas the `\markdownRendererJekyllDataTypographicString` macro is more appropriate for texts that are supposed to be typeset with \TeX , such as document titles, author names, or exam questions, the `\markdownRendererJekyllDataProgrammaticString` macro is more appropriate for identifiers and other programmatic text that won't be typeset by \TeX .

```

3626 \ExplSyntaxOn
3627 \cs_gset_protected:Npn

```

```

3628 \markdownRendererJekyllDataTypographicString
3629 {
3630     \markdownRendererJekyllDataTypographicStringPrototype
3631 }
3632 \cs_gset_protected:Npn
3633 \markdownRendererJekyllDataProgrammaticString
3634 {
3635     \markdownRendererJekyllDataProgrammaticStringPrototype
3636 }
3637 \seq_gput_right:Nn
3638 \g_@@_renderers_seq
3639 { jekyllDataTypographicString }
3640 \prop_gput:Nnn
3641 \g_@@_renderer_arities_prop
3642 { jekyllDataTypographicString }
3643 { 2 }
3644 \seq_gput_right:Nn
3645 \g_@@_renderers_seq
3646 { jekyllDataProgrammaticString }
3647 \prop_gput:Nnn
3648 \g_@@_renderer_arities_prop
3649 { jekyllDataProgrammaticString }
3650 { 2 }
3651 \ExplSyntaxOff

```

Before Markdown 3.7.0, the `\markdownRendererJekyllDataTypographicString` macro was named `\markdownRendererJekyllDataString` and the `\markdownRendererJekyllData` macro was not produced. The `\markdownRendererJekyllDataString` macro has been deprecated and will be removed in Markdown 4.0.0.

```

3652 \ExplSyntaxOn
3653 \cs_gset:Npn
3654 \markdownRendererJekyllDataTypographicString
3655 {
3656     \cs_if_exist:NTF
3657     \markdownRendererJekyllDataString
3658     {
3659         \@@_if_option:nTF
3660         { experimental }
3661         {
3662             \markdownError
3663             {
3664                 The~jekyllDataString~renderer~has~been~deprecated,~
3665                 to~be~removed~in~Markdown~4.0.0
3666             }
3667         }
3668         {
3669             \markdownWarning

```

```

3670         {
3671             The~jekyllDataString~renderer~has~been~deprecated,~
3672             to~be~removed~in~Markdown~4.0.0
3673         }
3674         \markdownRendererJekyllDataString
3675     }
3676 }
3677 {
3678     \cs_if_exist:NTF
3679     \markdownRendererJekyllDataStringPrototype
3680     {
3681         \@@_if_option:nTF
3682         { experimental }
3683         {
3684             \markdownError
3685             {
3686                 The~jekyllDataString~renderer~prototype~
3687                 has~been~deprecated,~
3688                 to~be~removed~in~Markdown~4.0.0
3689             }
3690         }
3691         {
3692             \markdownWarning
3693             {
3694                 The~jekyllDataString~renderer~prototype~
3695                 has~been~deprecated,~
3696                 to~be~removed~in~Markdown~4.0.0
3697             }
3698             \markdownRendererJekyllDataStringPrototype
3699         }
3700     }
3701     {
3702         \markdownRendererJekyllDataTypographicStringPrototype
3703     }
3704 }
3705 }
3706 \seq_gput_right:Nn
3707   \g_@@_renderers_seq
3708   { jekyllDataString }
3709 \prop_gput:Nnn
3710   \g_@@_renderer_arities_prop
3711   { jekyllDataString }
3712   { 2 }
3713 \ExplSyntaxOff

```

The `\markdownRendererJekyllDataEmpty` macro represents an empty scalar value in a YAML document. This macro will only be produced when the `jekyllData` option

is enabled. The macro receives one argument: the scalar key in the parent structure, cast to a string following YAML serialization rules.

See also Section 2.2.6.1 for the description of the high-level expl3 interface that you can also use to react to YAML metadata.

```

3714 \ExplSyntaxOn
3715 \cs_gset_protected:Npn
3716   \markdownRendererJekyllDataEmpty
3717   {
3718     \markdownRendererJekyllDataEmptyPrototype
3719   }
3720 \seq_gput_right:Nn
3721   \g_@@_renderers_seq
3722   { jekyllDataEmpty }
3723 \prop_gput:Nnn
3724   \g_@@_renderer_arities_prop
3725   { jekyllDataEmpty }
3726   { 1 }
3727 \ExplSyntaxOff

```

2.2.5.48 Generating Plain T_EX Token Renderer Macros and Key-Values

We define the command `\@@_define_renderers:` that defines plain T_EX macros for token renderers. Furthermore, the `\markdownSetup` macro also accepts the `renderers` and `unprotectedRenderers` keys. The value for these keys must be a list of key–values, where the keys correspond to the markdown token renderer macros and the values are new definitions of these token renderers.

Whereas the key `renderers` defines protected functions, which are usually preferable for typesetting, the key `unprotectedRenderers` defines unprotected functions, which are easier to expand and may be preferable for programming.

```

3728 \ExplSyntaxOn
3729 \cs_new_protected:Nn \@@_define_renderers:
3730   {
3731     \seq_map_inline:Nn
3732       \g_@@_renderers_seq
3733       {
3734         \@@_define_renderer:n
3735         { ##1 }
3736       }
3737   }
3738 \cs_new_protected:Nn \@@_define_renderer:n
3739   {
3740     \@@_renderer_tl_to_csname:nN
3741     { #1 }
3742     \l_tmpa_tl
3743     \prop_get:NnN
3744     \g_@@_renderer_arities_prop

```

```

3745     { #1 }
3746     \l_tmpb_tl
3747     \@@_define_renderer:ncV
3748     { #1 }
3749     { \l_tmpa_tl }
3750     \l_tmpb_tl
3751   }
3752   \cs_new_protected:Nn \@@_renderer_tl_to_csname:nN
3753   {
3754     \tl_set:Nn
3755       \l_tmpa_tl
3756       { \str_uppercase:n { #1 } }
3757     \tl_set:Nx
3758       #2
3759       {
3760         markdownRenderer
3761         \tl_head:f { \l_tmpa_tl }
3762         \tl_tail:n { #1 }
3763       }
3764   }
3765   \tl_new:N
3766     \l_@@_renderer_definition_tl
3767   \bool_new:N
3768     \g_@@_prepending_renderer_bool
3769   \bool_new:N
3770     \g_@@_appending_renderer_bool
3771   \bool_new:N
3772     \g_@@_unprotected_renderer_bool
3773   \cs_new_protected:Nn \@@_define_renderer:nNn
3774   {
3775     \keys_define:nn
3776       { markdown/options/renderers }
3777     {
3778       #1 .value_required:n = { true },
3779       #1 .code:n = {
3780         \tl_set:Nn
3781           \l_@@_renderer_definition_tl
3782           { ##1 }
3783         \regex_replace_all:nnN
3784           { \cP\#0 }
3785           { #1 }
3786         \l_@@_renderer_definition_tl
3787         \bool_if:nT
3788         {
3789           \g_@@_prepending_renderer_bool ||
3790           \g_@@_appending_renderer_bool
3791         }

```

```

3792         {
3793             \@@_tl_set_from_cs:NNn
3794             \l_tmpa_tl
3795             #2
3796             { #3 }
3797             \bool_if:NTF
3798             \g_@@_prepending_renderer_bool
3799             {
3800                 \tl_put_right:NV
3801                 \l_@@_renderer_definition_tl
3802                 \l_tmpa_tl
3803             }
3804             {
3805                 \tl_put_left:NV
3806                 \l_@@_renderer_definition_tl
3807                 \l_tmpa_tl
3808             }
3809         }
3810     \bool_if:NTF
3811     \g_@@_unprotected_renderer_bool
3812     {
3813         \tl_set:Nn
3814         \l_tmpa_tl
3815         { \cs_set:Npn }
3816     }
3817     {
3818         \tl_set:Nn
3819         \l_tmpa_tl
3820         { \cs_set_protected:Npn }
3821     }
3822     \exp_last_unbraced:NNV
3823     \cs_generate_from_arg_count:NNnV
3824     #2
3825     \l_tmpa_tl
3826     { #3 }
3827     \l_@@_renderer_definition_tl
3828 },
3829 }

```

If the token renderer macro has been deprecated, we undefine it.

The `\markdownRendererJekyllDataString` macro has been deprecated and will be removed in Markdown 4.0.0.

```

3830     \str_if_eq:nnT
3831     { #1 }
3832     { jekyllDataString }
3833     {
3834         \cs_undefine:N

```

```

3835         #2
3836     }
3837 }

```

We define the function `\@@_tl_set_from_cs:NNn` [13]. The function takes a token list, a control sequence with undelimited parameters, and the number of parameters the control sequence accepts, and locally assigns the replacement text of the control sequence to the token list.

```

3838 \cs_new_protected:Nn
3839   \@@_tl_set_from_cs:NNn
3840   {
3841     \tl_set:Nn
3842       \l_tmpa_tl
3843       { #2 }
3844     \int_step_inline:nn
3845       { #3 }
3846       {
3847         \exp_args:Nnc
3848           \tl_put_right:Nn
3849             \l_tmpa_tl
3850             { @@_tl_set_from_cs_parameter_ ##1 }
3851       }
3852     \exp_args:NNV
3853       \tl_set:No
3854         \l_tmpb_tl
3855         \l_tmpa_tl
3856     \regex_replace_all:nnN
3857       { \cP. }
3858       { \0\0 }
3859       \l_tmpb_tl
3860     \int_step_inline:nn
3861       { #3 }
3862       {
3863         \regex_replace_all:nnN
3864           { \c { @@_tl_set_from_cs_parameter_ ##1 } }
3865           { \cP\# ##1 }
3866           \l_tmpb_tl
3867       }
3868     \tl_set:NV
3869       #1
3870       \l_tmpb_tl
3871   }
3872 \cs_generate_variant:Nn
3873   \@@_define_renderer:nNn
3874   { ncV }
3875 \cs_generate_variant:Nn
3876   \cs_generate_from_arg_count:NNnn

```

```

3877 { NNnV }
3878 \cs_generate_variant:Nn
3879 \tl_put_left:Nn
3880 { Nv }
3881 \keys_define:nn
3882 { markdown/options }
3883 {
3884   renderers .value_required:n = { true },
3885   renderers .code:n = {
3886     \bool_gset_false:N
3887     \g_@@_unprotected_renderer_bool
3888     \keys_set:nn
3889     { markdown/options/renderers }
3890     { #1 }
3891   },
3892   unprotectedRenderers .value_required:n = { true },
3893   unprotectedRenderers .code:n = {
3894     \bool_gset_true:N
3895     \g_@@_unprotected_renderer_bool
3896     \keys_set:nn
3897     { markdown/options/renderers }
3898     { #1 }
3899   },
3900 }

```

The following example code showcases a possible configuration of the `\markdownRendererLink` and `\markdownRendererEmphasis` token renderer macros.

```

\markdownSetup{
  renderers = {
    link = {#4}, % Render links as the link title.
    emphasis = {{\it #1}}, % Render emphasized text using italics.
  }
}

```

```

3901 \tl_new:N
3902 \l_@@_renderer_glob_definition_tl
3903 \seq_new:N
3904 \l_@@_renderer_glob_results_seq
3905 \regex_const:Nn
3906 \c_@@_prepending_key_regex
3907 { \^$ }
3908 \regex_const:Nn
3909 \c_@@_appending_key_regex
3910 { [\$+]\$ }
3911 \regex_const:Nn
3912 \c_@@_prepending_or_appending_key_regex

```



```

3913 { [\^\$+]\$ }
3914 \keys_define:nn
3915 { markdown/options/renderers }
3916 {
3917     unknown .value_required:n = { true },
3918     unknown .code:n = {

```

Besides defining renderers at once, we can also define them incrementally using the prepending (^=) and appending ($\text{\$=}$ or +=) operators. This can be especially useful in defining rules for processing different HTML class names and identifiers:

```

\markdownSetup{
  renderers = {
    % Start with empty renderers.
    headerAttributeContextBegin = \begingroup,
    headerAttributeContextEnd = \endgroup,
    attributeClassName = {},
    attributeIdentifier = {},
    % Define the processing of a single specific HTML class name.
    headerAttributeContextBegin += {
      \markdownSetup{
        renderers = {
          attributeClassName += {...},
        },
      }
    },
    % Define the processing of a single specific HTML identifier.
    headerAttributeContextBegin += {
      \markdownSetup{
        renderers = {
          attributeIdentifier += {...},
        },
      }
    },
  },
}

```

```

3919 % TODO: Use `regex_if_match` in TeX Live 2025.
3920 \regex_match:NVT
3921 \c_@@_prepending_key_regex
3922 \l_keys_key_str
3923 {
3924     \bool_gset_true:N
3925     \g_@@_prepending_renderer_bool

```

```

3926     }
3927     % TODO: Use `\\regex_if_match` in TeX Live 2025.
3928     \\regex_match:NVT
3929     \\c_@@_appending_key_regex
3930     \\l_keys_key_str
3931     {
3932         \\bool_gset_true:N
3933         \\g_@@_appending_renderer_bool
3934     }
3935     % TODO: Use `\\regex_if_match` in TeX Live 2025.
3936     \\regex_match:NVTF
3937     \\c_@@_prepending_or_appending_key_regex
3938     \\l_keys_key_str
3939     {
3940         \\tl_set:NV
3941         \\l_tmpa_tl
3942         \\l_keys_key_str
3943         \\regex_replace_once:NnN
3944         \\c_@@_prepending_or_appending_key_regex
3945         { }
3946         \\l_tmpa_tl
3947         \\tl_set:Nx
3948         \\l_tmpb_tl
3949         { { \\l_tmpa_tl } = }
3950         \\tl_put_right:Nn
3951         \\l_tmpb_tl
3952         { { #1 } }
3953         \\keys_set:nV
3954         { markdown/options/renderers }
3955         \\l_tmpb_tl
3956         \\bool_gset_false:N
3957         \\g_@@_prepending_renderer_bool
3958         \\bool_gset_false:N
3959         \\g_@@_appending_renderer_bool
3960     }

```

In addition to exact token renderer names, we also support wildcards (*) and enumerations (l) that match multiple token renderer names:

```

\\markdownSetup{
  renderers = {
    heading* = {{\\bf #1}},      % Render headings using the bold face.
    jekyllData(String|Number) = {% % Render YAML string and numbers
      {\\it #2}%                % using italics.
    },
  }
}

```

```
}
```

Wildcards and enumerations can be combined:

```
\markdownSetup{
  renderers = {
    *lItem(|End) = {""},           % Quote ordered/bullet list items.
  }
}
```

To determine the current token renderer, you can use the pseudo-parameter #0:

```
\markdownSetup{
  renderers = {
    heading* = {#0: #1},           % Render headings as the renderer name
                                   % followed by the heading text.
  }
}
```

```
3961 {
3962   \@@_glob_seq:VnN
3963   \l_keys_key_str
3964   { g_@@_renderers_seq }
3965   \l_@@_renderer_glob_results_seq
3966   \seq_if_empty:NTF
3967   \l_@@_renderer_glob_results_seq
3968   {
3969     \msg_error:nnV
3970     { markdown }
3971     { undefined-renderer }
3972     \l_keys_key_str
3973   }
3974   {
3975     \tl_set:Nn
3976     \l_@@_renderer_glob_definition_tl
3977     { \exp_not:n { #1 } }
3978     \seq_map_inline:Nn
3979     \l_@@_renderer_glob_results_seq
3980     {
3981       \tl_set:Nn
3982       \l_tmpa_tl
3983       { { ##1 } = }
3984       \tl_put_right:Nx
3985       \l_tmpa_tl
3986       { { \l_@@_renderer_glob_definition_tl } }
```

```

3987             \keys_set:nV
3988             { markdown/options/renderers }
3989             \l_tmpa_tl
3990         }
3991     }
3992 }
3993 },
3994 }
3995 \msg_new:nnn
3996 { markdown }
3997 { undefined-renderer }
3998 {
3999     Renderer~#1~is~undefined.
4000 }
4001 \cs_generate_variant:Nn
4002 \@@_glob_seq:nnN
4003 { VnN }
4004 \cs_generate_variant:Nn
4005 \cs_generate_from_arg_count:NNnn
4006 { cNvV }
4007 \cs_generate_variant:Nn
4008 \msg_error:nnn
4009 { nnV }
4010 \prg_generate_conditional_variant:Nnn
4011 % TODO: Use `regex_if_match` in TeX Live 2025.
4012 \regex_match:Nn % noqa: w202
4013 { NV }
4014 { T, TF }
4015 \prop_new:N
4016 \g_@@_glob_cache_prop
4017 \tl_new:N
4018 \l_@@_current_glob_tl
4019 \cs_new_protected:Nn
4020 \@@_glob_seq:nnN
4021 {
4022     \tl_set:Nn
4023     \l_@@_current_glob_tl
4024     { ^ #1 $ }
4025     \prop_get:NeNTF
4026     \g_@@_glob_cache_prop
4027     { #2 / \l_@@_current_glob_tl }
4028     \l_tmpa_clist
4029     {
4030         \seq_set_from_clist:NN
4031         #3
4032         \l_tmpa_clist
4033     }

```

```

4034     {
4035         \seq_clear:N
4036         #3
4037         \regex_replace_all:nnN
4038         { \* }
4039         { .* }
4040         \l_@@_current_glob_tl
4041         \regex_set:NV
4042         \l_tmpa_regex
4043         \l_@@_current_glob_tl
4044         \seq_map_inline:cn
4045         { #2 }
4046         {
4047             % TODO: Use \regex_if_match in TeX Live 2025.
4048             \regex_match:NnT % noqa: w202
4049             \l_tmpa_regex
4050             { ##1 }
4051             {
4052                 \seq_put_right:Nn
4053                 #3
4054                 { ##1 }
4055             }
4056         }
4057         \clist_set_from_seq:NN
4058         \l_tmpa_clist
4059         #3
4060         \prop_gput:NeV
4061         \g_@@_glob_cache_prop
4062         { #2 / \l_@@_current_glob_tl }
4063         \l_tmpa_clist
4064     }
4065 }
4066 \cs_generate_variant:Nn
4067 \regex_set:Nn
4068 { NV }
4069 \cs_generate_variant:Nn
4070 \prop_gput:Nnn
4071 { NeV }

```

If plain \TeX is the top layer, we use the `\@@_define_renderers:` macro to define plain \TeX token renderer macros and key-values immediately. Otherwise, we postpone the definition until the upper layers have been loaded.

```

4072 \str_if_eq:VVT
4073 \c_@@_top_layer_tl
4074 \c_@@_option_layer_plain_tex_tl
4075 {
4076     \@@_define_renderers:

```

```

4077   }
4078 \ExplSyntaxOff

```

2.2.6 Token Renderer Prototypes

2.2.6.1 yaml Metadata Renderer Prototypes

For simple YAML metadata, a simple high-level interface is provided that can be programmed by setting the expl3 key-values [3] for the module `markdown/jekyllData`.

```

4079 \ExplSyntaxOn
4080 \keys_define:nn
4081   { markdown/jekyllData }
4082   { }
4083 \ExplSyntaxOff

```

The option `jekyllDataRenderers=<key-values>` can be used to set the $\langle key-values \rangle$ for the module `markdown/jekyllData` without using the expl3 syntax.

```

4084 \ExplSyntaxOn
4085 \@@_with_various_cases:nn
4086   { jekyllDataRenderers }
4087   {
4088     \keys_define:nn
4089       { markdown/options }
4090       {
4091         #1 .value_required:n = { true },
4092         #1 .code:n = {
4093           \tl_set:Nn
4094             \l_tmpa_tl
4095             { ##1 }

```

To ensure that keys containing forward slashes get passed correctly, we replace all forward slashes in the input with backslash tokens with category code letter and then undo the replacement. This means that if any unbraced backslash tokens with category code letter exist in the input, they will be replaced with forward slashes. However, this should be extremely rare.

```

4096         \tl_replace_all:NnV
4097         \l_tmpa_tl
4098         { / }
4099         \c_backslash_str
4100       \keys_set:nV
4101         { markdown/options/jekyll-data-renderers }
4102         \l_tmpa_tl
4103     },
4104   }
4105 }
4106 \keys_define:nn
4107   { markdown/options/jekyll-data-renderers }
4108   {

```

```

4109     unknown .value_required:n = { true },
4110     unknown .code:n = {
4111         \tl_set_eq:NN
4112         \l_tmpa_tl
4113         \l_keys_key_str
4114         \tl_replace_all:NVn
4115         \l_tmpa_tl
4116         \c_backslash_str
4117         { / }
4118         \tl_put_right:Nn
4119         \l_tmpa_tl
4120         {
4121             .code:n = { #1 }
4122         }
4123         \keys_define:nV
4124         { markdown/jekyllData }
4125         \l_tmpa_tl
4126     }
4127 }
4128 \ExplSyntaxOff

```

For complex YAML metadata, the option `jekyllDataKeyValue=<module>` [14] can be used to route the processing of all YAML metadata in the current \TeX group to the key-values from `<module>`.

2.2.6.2 Generating Plain \TeX Token Renderer Prototype Macros and Key-Values

We define the command `\@@_define_renderer_prototypes:` that defines plain \TeX macros for token renderer prototypes. Furthermore, the `\markdownSetup` macro also accepts the `rendererPrototypes` and `unprotectedRendererPrototypes` keys. The value for these keys must be a list of key-values, where the keys correspond to the markdown token renderer prototype macros and the values are new definitions of these token renderer prototypes.

Whereas the key `rendererPrototypes` defines protected functions, which are usually preferable for typesetting, the key `unprotectedRendererPrototypes` defines unprotected functions, which are easier to expand and may be preferable for programming.

```

4129 \ExplSyntaxOn
4130 \cs_new_protected:Nn \@@_define_renderer_prototypes:
4131 {
4132     \seq_map_inline:Nn
4133     \g_@@_renderers_seq
4134     {
4135         \@@_define_renderer_prototype:n
4136         { ##1 }

```

```

4137     }
4138 }
4139 \cs_new_protected:Nn \@@_define_renderer_prototype:n
4140 {
4141     \@@_renderer_prototype_tl_to_csname:nN
4142     { #1 }
4143     \l_tmpa_tl
4144     \prop_get:NnN
4145     \g_@@_renderer_arities_prop
4146     { #1 }
4147     \l_tmpb_tl
4148     \@@_define_renderer_prototype:ncV
4149     { #1 }
4150     { \l_tmpa_tl }
4151     \l_tmpb_tl
4152 }
4153 \cs_new_protected:Nn \@@_renderer_prototype_tl_to_csname:nN
4154 {
4155     \tl_set:Nn
4156     \l_tmpa_tl
4157     { \str_uppercase:n { #1 } }
4158     \tl_set:Nx
4159     #2
4160     {
4161         markdownRenderer
4162         \tl_head:f { \l_tmpa_tl }
4163         \tl_tail:n { #1 }
4164         Prototype
4165     }
4166 }
4167 \tl_new:N
4168 \l_@@_renderer_prototype_definition_tl
4169 \bool_new:N
4170 \g_@@_prepending_renderer_prototype_bool
4171 \bool_new:N
4172 \g_@@_appending_renderer_prototype_bool
4173 \bool_new:N
4174 \g_@@_unprotected_renderer_prototype_bool
4175 \cs_new_protected:Nn \@@_define_renderer_prototype:nNn
4176 {
4177     \keys_define:nn
4178     { markdown/options/renderer-prototypes }
4179     {
4180         #1 .value_required:n = { true },
4181         #1 .code:n = {
4182             \tl_set:Nn
4183             \l_@@_renderer_prototype_definition_tl

```



```

4184         { ##1 }
4185     \regex_replace_all:nnN
4186     { \cP\#0 }
4187     { #1 }
4188     \l_@@_renderer_prototype_definition_tl
4189 \bool_if:nT
4190 {
4191     \g_@@_prepending_renderer_prototype_bool ||
4192     \g_@@_appending_renderer_prototype_bool
4193 }
4194 {
4195     \@@_tl_set_from_cs:NNn
4196     \l_tmpa_tl
4197     #2
4198     { #3 }
4199 \bool_if:NTF
4200     \g_@@_prepending_renderer_prototype_bool
4201     {
4202         \tl_put_right:NV
4203         \l_@@_renderer_prototype_definition_tl
4204         \l_tmpa_tl
4205     }
4206     {
4207         \tl_put_left:NV
4208         \l_@@_renderer_prototype_definition_tl
4209         \l_tmpa_tl
4210     }
4211 }
4212 \bool_if:NTF
4213     \g_@@_unprotected_renderer_prototype_bool
4214     {
4215         \tl_set:Nn
4216         \l_tmpa_tl
4217         { \cs_set:Npn }
4218     }
4219     {
4220         \tl_set:Nn
4221         \l_tmpa_tl
4222         { \cs_set_protected:Npn }
4223     }
4224 \exp_last_unbraced:NNV
4225     \cs_generate_from_arg_count:NNnV
4226     #2
4227     \l_tmpa_tl
4228     { #3 }
4229     \l_@@_renderer_prototype_definition_tl
4230 },

```

```
4231 }
```

Unless the token renderer prototype macro has already been defined or unless, it has been deprecated, we provide an empty definition.

The `\markdownRendererJekyllDataStringPrototype` macro has been deprecated and will be removed in Markdown 4.0.0.

```
4232 \str_if_eq:nnF
4233 { #1 }
4234 { jekyllDataString }
4235 {
4236   \cs_if_free:NT
4237   #2
4238   {
4239     \cs_generate_from_arg_count:NNnn
4240     #2
4241     \cs_gset_protected:Npn
4242     { #3 }
4243     { }
4244   }
4245 }
4246 }
4247 \cs_generate_variant:Nn
4248 \@@_define_renderer_prototype:nNn
4249 { ncV }
```

The following example code showcases a possible configuration of the `\markdownRendererImagePrototype` and `\markdownRendererCodeSpanPrototype` token renderer prototype macros.

```
\markdownSetup{
  rendererPrototypes = {
    image = {\pdfximage{#2}},      % Embed PDF images in the document.
    codeSpan = {\tt #1},          % Render inline code using monospace.
  }
}
```

```
4250 \keys_define:nn
4251 { markdown/options/renderer-prototypes }
4252 {
4253   unknown .value_required:n = { true },
4254   unknown .code:n = {
```

Besides defining renderer prototypes at once, we can also define them incrementally using the prepending (`^=`) and appending (`$=` or `+=`) operators. This can be especially useful in defining rules for processing different HTML class names and identifiers:

```
\markdownSetup{
```

```

rendererPrototypes = {
  % Start with empty renderer prototypes.
  headerAttributeContextBegin = \beginngroup,
  headerAttributeContextEnd = \endgroup,
  attributeClassName = {},
  attributeIdentifier = {},
  % Define the processing of a single specific HTML class name.
  headerAttributeContextBegin += {
    \markdownSetup{
      rendererPrototypes = {
        attributeClassName += {...},
      },
    }
  },
  % Define the processing of a single specific HTML identifier.
  headerAttributeContextBegin += {
    \markdownSetup{
      rendererPrototypes = {
        attributeIdentifier += {...},
      },
    }
  },
},
}

```

```

4255 % TODO: Use `\\regex_if_match` in TeX Live 2025.
4256 \\regex_match:NVT
4257   \\c_@@_prepending_key_regex
4258   \\l_keys_key_str
4259   {
4260     \\bool_gset_true:N
4261     \\g_@@_prepending_renderer_prototype_bool
4262   }
4263 % TODO: Use `\\regex_if_match` in TeX Live 2025.
4264 \\regex_match:NVT
4265   \\c_@@_appending_key_regex
4266   \\l_keys_key_str
4267   {
4268     \\bool_gset_true:N
4269     \\g_@@_appending_renderer_prototype_bool
4270   }
4271 % TODO: Use `\\regex_if_match` in TeX Live 2025.
4272 \\regex_match:NVTF
4273   \\c_@@_prepending_or_appending_key_regex

```

```

4274     \l_keys_key_str
4275     {
4276         \tl_set:NV
4277         \l_tmpa_tl
4278         \l_keys_key_str
4279         \regex_replace_once:NnN
4280         \c_@@_prepending_or_appending_key_regex
4281         { }
4282         \l_tmpa_tl
4283         \tl_set:Nx
4284         \l_tmpb_tl
4285         { { \l_tmpa_tl } = }
4286         \tl_put_right:Nn
4287         \l_tmpb_tl
4288         { { #1 } }
4289         \keys_set:nV
4290         { markdown/options/renderer-prototypes }
4291         \l_tmpb_tl
4292         \bool_gset_false:N
4293         \g_@@_prepending_renderer_prototype_bool
4294         \bool_gset_false:N
4295         \g_@@_appending_renderer_prototype_bool
4296     }

```

In addition to exact token renderer prototype names, we also support wildcards (*) and enumerations (|) that match multiple token renderer prototype names:

```

\markdownSetup{
  rendererPrototypes = {
    heading* = {{\bf #1}},      % Render headings using the bold face.
    jekyllData(String|Number) = { % Render YAML string and numbers
      {\it #2}%                % using italics.
    },
  }
}

```

Wildcards and enumerations can be combined:

```

\markdownSetup{
  rendererPrototypes = {
    *lItem(|End) = {"},      % Quote ordered/bullet list items.
  }
}

```

To determine the current token renderer prototype, you can use the pseudo-parameter #0:

```

\markdownSetup{
  rendererPrototypes = {
    heading* = {#0: #1}, % Render headings as the renderer prototype
                      % name followed by the heading text.
  }
}

```

```

4297     {
4298       \@@_glob_seq:VnN
4299       \l_keys_key_str
4300       { g_@@_renderers_seq }
4301       \l_@@_renderer_glob_results_seq
4302       \seq_if_empty:NTF
4303       \l_@@_renderer_glob_results_seq
4304       {
4305         \msg_error:nnV
4306         { markdown }
4307         { undefined-renderer-prototype }
4308         \l_keys_key_str
4309       }
4310       {
4311         \tl_set:Nn
4312         \l_@@_renderer_glob_definition_tl
4313         { \exp_not:n { #1 } }
4314         \seq_map_inline:Nn
4315         \l_@@_renderer_glob_results_seq
4316         {
4317           \tl_set:Nn
4318           \l_tmpa_tl
4319           { { ##1 } = }
4320           \tl_put_right:Nx
4321           \l_tmpa_tl
4322           { { \l_@@_renderer_glob_definition_tl } }
4323           \keys_set:nV
4324           { markdown/options/renderer-prototypes }
4325           \l_tmpa_tl
4326         }
4327       }
4328     }
4329   },
4330 }
4331 \msg_new:nnn
4332 { markdown }
4333 { undefined-renderer-prototype }
4334 {
4335   Renderer~prototype~#1~is~undefined.

```

```

4336 }
4337 \@@_with_various_cases:nn
4338 { rendererPrototypes }
4339 {
4340   \keys_define:nn
4341     { markdown/options }
4342     {
4343       #1 .value_required:n = { true },
4344       #1 .code:n = {
4345         \bool_gset_false:N
4346         \g_@@_unprotected_renderer_prototype_bool
4347         \keys_set:nn
4348           { markdown/options/renderer-prototypes }
4349           { ##1 }
4350       },
4351     }
4352 }
4353 \@@_with_various_cases:nn
4354 { unprotectedRendererPrototypes }
4355 {
4356   \keys_define:nn
4357     { markdown/options }
4358     {
4359       #1 .value_required:n = { true },
4360       #1 .code:n = {
4361         \bool_gset_true:N
4362         \g_@@_unprotected_renderer_prototype_bool
4363         \keys_set:nn
4364           { markdown/options/renderer-prototypes }
4365           { ##1 }
4366       },
4367     }
4368 }

```

If plain T_EX is the top layer, we use the `\@@_define_renderer_prototypes:` macro to define plain T_EX token renderer prototype macros and key-values immediately. Otherwise, we postpone the definition until the upper layers have been loaded.

```

4369 \str_if_eq:VVT
4370   \c_@@_top_layer_tl
4371   \c_@@_option_layer_plain_tex_tl
4372   {
4373     \@@_define_renderer_prototypes:
4374   }
4375 \ExplSyntaxOff

```

2.2.7 Logging Facilities

The `\markdownInfo`, `\markdownWarning`, and `\markdownError` macros perform logging for the Markdown package. Their first argument specifies the text of the info, warning, or error message. The `\markdownError` macro receives a second argument that provides a help text. You may redefine these macros to redirect and process the info, warning, and error messages.

The `\markdownInfo`, `\markdownWarning`, and `\markdownError` macros have been deprecated and will be removed in the next major version of the Markdown package.

2.2.8 Miscellanea

The `\markdownMakeOther` macro is used by the package, when a \TeX engine that does not support direct Lua access is starting to buffer a text. The plain \TeX implementation changes the category code of plain \TeX special characters to *other*, but there may be other active characters that may break the output. This macro should temporarily change the category of these to *other*.

```
4376 \let\markdownMakeOther\relax
```

The `\markdownReadAndConvert` macro implements the `\markdownBegin` and `\yamlBegin` macros. The first argument specifies the token sequence that will terminate the markdown input when the plain \TeX special characters have had their category changed to *other*: `\markdownEnd` for the `\markdownBegin` macro and `\yamlEnd` for the `\yamlBegin` macro. The second argument specifies the token sequence that will actually be inserted into the document, when the ending token sequence has been found.

```
4377 \let\markdownReadAndConvert\relax
```

```
4378 \begingroup
```

Locally swap the category code of the backslash symbol (`\`) with the pipe symbol (`|`). This is required in order that all the special symbols in the first argument of the `markdownReadAndConvert` macro have the category code *other*.

```
4379 \catcode`\|=0\catcode`\=12%
```

```
4380 |gdef|markdownBegin{%
```

```
4381   |markdownReadAndConvert{\markdownEnd}%
```

```
4382                               {\|markdownEnd}}%
```

```
4383 |gdef|yamlBegin{%
```

```
4384   |begingroup
```

```
4385   |yamlSetup{jekyllData, expectJekyllData, ensureJekyllData}%
```

```
4386   |markdownReadAndConvert{\yamlEnd}%
```

```
4387                               {\|yamlEnd}}%
```

```
4388 |endgroup
```

The macro is exposed in the interface, so that users can create their own markdown environments. Due to the way the arguments are passed to Lua, the first argument may not contain the string `]]` (regardless of the category code of the bracket symbol).

The `code` key, which can be used to immediately expand and execute code.

```

4389 \ExplSyntaxOn
4390 \keys_define:nn
4391   { markdown/options }
4392   {
4393     code .value_required:n = { true },
4394     code .code:n = { #1 },
4395   }
4396 \ExplSyntaxOff

```

This can be especially useful in snippets.

2.3 L^AT_EX Interface

The L^AT_EX interface provides L^AT_EX environments for the typesetting of markdown input from within L^AT_EX, facilities for setting Lua, plain T_EX, and L^AT_EX options used during the conversion from markdown to plain T_EX, and facilities for changing the way markdown tokens are rendered. The rest of the interface is inherited from the plain T_EX interface (see Section 2.2).

To determine whether L^AT_EX is the top layer or if there are other layers above L^AT_EX, we take a look on whether the `\c_@@_top_layer_tl` token list has already been defined. If not, we will assume that L^AT_EX is the top layer.

```

4397 \ExplSyntaxOn
4398 \tl_const:Nn \c_@@_option_layer_latex_tl { latex }
4399 \cs_generate_variant:Nn
4400   \tl_const:Nn
4401   { NV }
4402 \tl_if_exist:NF
4403   \c_@@_top_layer_tl
4404   {
4405     \tl_const:NV
4406       \c_@@_top_layer_tl
4407       \c_@@_option_layer_latex_tl
4408   }
4409 \ExplSyntaxOff
4410 \input markdown/markdown

```

The L^AT_EX interface is implemented by the `markdown.sty` file, which can be loaded from the L^AT_EX document preamble as follows:

```
\usepackage[⟨options⟩]{markdown}
```

where `⟨options⟩` are the L^AT_EX interface options (see Section 2.3.3). Note that `⟨options⟩` inside the `\usepackage` macro may not set the `markdownRenderers` (see Section 2.2.5.48) and `markdownRendererPrototypes` (see Section 2.2.6.2) keys. Furthermore, although the base variant of the `import` key that loads a single L^AT_EX theme (see Section 2.3.4) can be used, the extended variant that can load multiple

themes and import snippets from them (see Section 2.2.4) cannot. This limitation is due to the way L^AT_EX 2_ε parses package options.

2.3.1 Typesetting Markdown and YAML

The interface exposes the `markdown`, `markdown*`, and `yaml` L^AT_EX environments, and redefines the `\markinline`, `\markdownInput`, and `\yamlInput` commands.

2.3.1.1 Typesetting Markdown and yaml directly

The `markdown` and `markdown*` L^AT_EX environments are aliases for the macros `\markdownBegin` and `\markdownEnd` exposed by the plain T_EX interface.

The `markdown*` environment has been deprecated and will be removed in the next major version of the Markdown package.

```
4411 \newenvironment{markdown}\relax\relax
4412 \newenvironment{markdown*}[1]\relax\relax
```

Furthermore, both environments accept L^AT_EX interface options (see Section 2.3.3) as the only argument. This argument is optional for the `markdown` environment and mandatory for the `markdown*` environment.

The `markdown` and `markdown*` environments are subject to the same limitations as the `\markdownBegin` and `\markdownEnd` macros.

The following example L^AT_EX code showcases the usage of the `markdown` and `markdown*` environments:

<code>\documentclass{article}</code>	<code>\documentclass{article}</code>
<code>\usepackage{markdown}</code>	<code>\usepackage{markdown}</code>
<code>\begin{document}</code>	<code>\begin{document}</code>
<code>\begin{markdown}[smartEllipses]</code>	<code>\begin{markdown*}{smartEllipses}</code>
<code>_Hello_ **world** ...</code>	<code>_Hello_ **world** ...</code>
<code>\end{markdown}</code>	<code>\end{markdown*}</code>
<code>\end{document}</code>	<code>\end{document}</code>

You can't directly extend the `markdown` L^AT_EX environment by using it in other environments as follows:

```
\newenvironment{foo}%
    {code before \begin{markdown}[some, options]}%
    {\end{markdown} code after}
```

This is because the implementation looks for the literal string `\end{markdown}` to stop scanning the markdown text. However, you can work around this limitation by using the `\markdown` and `\markdownEnd` macros directly in the definition as follows:

```
\newenvironment{foo}%
    {code before \markdown[some, options]}%
    {\markdownEnd code after}
```

Specifically, the `\markdown` macro must appear at the end of the replacement before-text and must be followed by text that has not yet been ingested by $\text{T}_{\text{E}}\text{X}$'s input processor.

Furthermore, using the `\markdownEnd` macro in of after the replacement after-text is optional and only makes a difference if you redefined it to produce special effects before and after the `markdown` $\text{L}^{\text{A}}\text{T}_{\text{E}}\text{X}$ environment.

Lastly, you can't nest the other environments. For example, the following definition would be incorrect:

```
\newenvironment{bar}{\begin{foo}}{\end{foo}}
```

In this example, you should use the `\markdown` macro directly in the definition of the environment `bar`:

```
\newenvironment{bar}{\markdown[some, options]}\markdownEnd}
```

The `yaml` $\text{L}^{\text{A}}\text{T}_{\text{E}}\text{X}$ environment is an alias for the macros `\yamlBegin` and `\yamlEnd` exposed by the plain $\text{T}_{\text{E}}\text{X}$ interface.

```
4413 \newenvironment{yaml}\relax\relax
```

Furthermore, the environment accepts $\text{L}^{\text{A}}\text{T}_{\text{E}}\text{X}$ interface options (see Section 2.3.3) as the only optional argument.

The `yaml` environment is subject to the same limitations as the `\markdownBegin` and `\markdownEnd` macros.

The following example $\text{L}^{\text{A}}\text{T}_{\text{E}}\text{X}$ code showcases the usage of the `yaml` environment:

```
\documentclass{article}
\usepackage{markdown}
\begin{document}
\begin{yaml}[smartEllipses]
title: _Hello_ **world** ...
author: John Doe
\end{yaml}
\end{document}
```

The above code has the same effect as the below code:

```

\documentclass{article}
\usepackage{markdown}
\begin{document}
\begin{markdown}[
  jekyllData,
  expectJekyllData,
  ensureJekyllData,
  smartEllipses,
]
title: _Hello_ world ...
author: John Doe
\end{markdown}
\end{document}

```

You can't directly extend the `yaml` L^AT_EX environment by using it in other environments. However, you can work around this limitation by using the `\yaml` and `\yamlEnd` macros directly in the definition, similarly to the `\markdown` and `\markdownEnd` macros described previously. Unlike with the `\markdown` and `\markdownEnd` macros, The `\yamlEnd` macro `_must_` be used in or after the replacement after-text.

The `\markinline` macro accepts a single mandatory parameter containing inline markdown content and expands to the result of the conversion of the input markdown document to plain T_EX. Unlike the `\markinline` macro provided by the plain T_EX interface, this macro also accepts L^AT_EX interface options (see Section 2.3.3) as its optional argument. These options will only influence this markdown content.

2.3.1.2 Typesetting Markdown and yaml from external documents

The `\markdownInput` macro accepts a single mandatory parameter containing the filename of a markdown document and expands to the result of the conversion of the input markdown document to plain T_EX. Unlike the `\markdownInput` macro provided by the plain T_EX interface, this macro also accepts L^AT_EX interface options (see Section 2.3.3) as its optional argument. These options will only influence this markdown document.

The following example L^AT_EX code showcases the usage of the `\markdownInput` macro:

```

\documentclass{article}
\usepackage{markdown}
\begin{document}
\markdownInput[smartEllipses]{hello.md}
\end{document}

```

The `\yamlInput` macro accepts a single mandatory parameter containing the filename of a YAML document and expands to the result of the conversion of the input YAML document to plain TeX. Unlike the `\yamlInput` macro provided by the plain TeX interface, this macro also accepts L^AT_EX interface options (see Section 2.3.3) as its optional argument. These options will only influence this YAML document.

The following example L^AT_EX code showcases the usage of the `\yamlInput` macro:

```
\documentclass{article}
\usepackage{markdown}
\begin{document}
\yamlInput[smartEllipses]{hello.yml}
\end{document}
```

The above code has the same effect as the below code:

```
\documentclass{article}
\usepackage{markdown}
\begin{document}
\markdownInput[
  jekyllData,
  expectJekyllData,
  ensureJekyllData,
  smartEllipses,
]{hello.yml}
\end{document}
```

2.3.2 Using L^AT_EX hooks with the Markdown package

L^AT_EX provides an intricate hook management system that allows users to insert extra material before and after certain TeX macros and L^AT_EX environments, among other things. [15, Section 3.1.2]

The Markdown package is compatible with hooks and allows the use of hooks to insert extra material before TeX commands and before/after L^AT_EX environments without restriction:

```
\documentclass{article}
\usepackage{markdown}
\begin{document}
\AddToHook{cmd/markdownRendererEmphasis/before}{emphasis: }
\AddToHook{env/markdown/before}{<markdown>}
\AddToHook{env/markdown/after}{</markdown>}
\begin{markdown}
```

```
foo _bar_ baz!
\end{markdown}
\end{document}
```

Processing the above example with L^AT_EX will produce the text “foo emphasis: _bar_ baz!”, as expected.

However, using hooks to insert extra material after T_EX commands only works for commands with a fixed number of parameters that don’t use currying.

If, in the above example, you explicitly defined the renderer for emphasis using `\markdownSetup` or another method that does not use currying, then you would be able to insert extra material even after the renderer:

```
\documentclass{article}
\usepackage{markdown}
\markdownSetup{renderers={emphasis={\emph{#1}}}}
\begin{document}
\AddToHook{cmd/markdownRendererEmphasis/before}{<emphasis>}
\AddToHook{cmd/markdownRendererEmphasis/after}{</emphasis>}
\AddToHook{env/markdown/before}{<markdown>}
\AddToHook{env/markdown/after}{</markdown>}
\begin{markdown}
foo _bar_ baz!
\end{markdown}
\end{document}
```

Processing the above example with L^AT_EX will produce the text “foo _bar_ baz!”, as expected.

However, the default renderer for emphasis uses currying and calls the renderer prototype in a way that prevents the use of hooks to insert extra material after the renderer, see Section 2.2.5.17. In such a case, you would need to redefine the renderer in a way that does not use currying before you would be able to use hooks to insert extra material after it.

Hooks also cannot be used to insert extra material after renderers with a variable number of parameters such as the renderer for tables, see Section 2.2.5.42.

2.3.3 Options

The L^AT_EX options are represented by a comma-delimited list of $\langle key \rangle = \langle value \rangle$ pairs. For boolean options, the $= \langle value \rangle$ part is optional, and $\langle key \rangle$ will be interpreted as $\langle key \rangle = \text{true}$ if the $= \langle value \rangle$ part has been omitted.

L^AT_EX options map directly to the options recognized by the plain T_EX interface (see Section 2.2.2) and to the markdown token renderers and their prototypes recognized by the plain T_EX interface (see Sections 2.2.5 and 2.2.6).

The L^AT_EX options may be specified when loading the L^AT_EX package, when using the `markdown*` L^AT_EX environment or the `\markdownInput` macro (see Section 2.3), or via the `\markdownSetup` macro.

2.3.3.1 Finalizing and Freezing the Cache

To ensure compatibility with the `minted` package [16, Section 5.1], which supports the `finalizcache` and `frozenscache` package options with similar semantics to the `finalizeCache` and `frozenCache` plain T_EX options, the Markdown package also recognizes these as aliases and accepts them as document class options. By passing `finalizcache` and `frozenscache` as document class options, you may conveniently control the behavior of both packages at once:

```
\documentclass[frozenscache]{article}
\usepackage{markdown,minted}
\begin{document}
\end{document}
```

We hope that other packages will support the `finalizcache` and `frozenscache` package options in the future, so that they can become a standard interface for preparing L^AT_EX document sources for distribution.

```
4414 \DeclareOption{finalizcache}{\markdownSetup{finalizeCache}}
4415 \DeclareOption{frozenscache}{\markdownSetup{frozenCache}}
```

2.3.3.2 Generating Plain T_EX Option, Token Renderer, and Token Renderer Prototype Macros and Key-Values

If L^AT_EX is the top layer, we use the `\@@_define_option_commands_and_keyvals:`, `\@@_define_renderers:`, and `\@@_define_renderer_prototypes:` macro to define plain T_EX option, token renderer, and token renderer prototype macros and key-values immediately. Otherwise, we postpone the definition until the upper layers have been loaded.

```
4416 \ExplSyntaxOn
4417 \str_if_eq:VVT
4418 \c_@@_top_layer_tl
4419 \c_@@_option_layer_latex_tl
4420 {
4421   \@@_define_option_commands_and_keyvals:
4422   \@@_define_renderers:
4423   \@@_define_renderer_prototypes:
4424 }
4425 \ExplSyntaxOff
```

The following example L^AT_EX code showcases a possible configuration of plain T_EX interface options `hybrid`, `smartEllipses`, and `cacheDir`.

```

\markdownSetup{
  hybrid,
  smartEllipses,
  cacheDir = /tmp,
}

```

2.3.4 Themes

In Section 2.2.3, we described the concept of themes. In L^AT_EX, we expand on the concept of themes by allowing a theme to be a full-blown L^AT_EX package. Specifically, the key-values `theme=<theme name>` and `import=<theme name>` load a L^AT_EX package named `markdowntheme<munged theme name>.sty` if it exists and a T_EX document named `markdowntheme<munged theme name>.tex` otherwise.

Having the Markdown package automatically load either the generic `.tex` theme file or the L^AT_EX-specific `.sty` theme file allows developers to have a single theme file, when the theme is small or the difference between T_EX formats is unimportant, and scale up to separate theme files native to different T_EX formats for large multi-format themes, where different code is needed for different T_EX formats. To enable code reuse, developers can load the `.tex` theme file from the `.sty` theme file using the `\markdownLoadPlainTeXTheme` macro.

If the L^AT_EX option with keys `theme` or `import` is (repeatedly) specified in the `\usepackage` macro, the loading of the theme(s) will be postponed in first-in-first-out order until after the Markdown L^AT_EX package has been loaded. Otherwise, the theme(s) will be loaded immediately. For example, the following code would first load the Markdown package, then the theme `witiko/example/foo`, and finally the theme `witiko/example/bar`:

```

\usepackage[
  import=witiko/example/foo,
  import=witiko/example/bar,
]{markdown}

```

```

4426 \newif\ifmarkdownLaTeXLoaded
4427 \markdownLaTeXLoadedfalse

```

Due to limitations of L^AT_EX, themes may not be loaded after the beginning of a L^AT_EX document.

We also define the prop `\g_@@_latex_built_in_themes_prop` that contains the code of built-in themes. This is a packaging optimization, so that built-in themes does not need to be distributed in many small files.

```

4428 \ExplSyntaxOn
4429 \prop_new:N

```

```

4430 \g_@@_latex_built_in_themes_prop
4431 \ExplSyntaxOff

```

Built-in L^AT_EX themes provided with the Markdown package include:

witiko/markdown/defaults A L^AT_EX theme with the default definitions of token renderer prototypes for plain T_EX. This theme is loaded automatically together with the package and explicitly loading it has no effect.

```

4432 \AtEndOfPackage{\markdownLaTeXLoadedtrue}

```

At the end of the L^AT_EX module, we load the **witiko/markdown/defaults** L^AT_EX theme (see Section 2.2.3) with the default definitions for token renderer prototypes unless the option **noDefaults** has been enabled (see Section 2.2.2.3).

```

4433 \ExplSyntaxOn
4434 \str_if_eq:VVT
4435 \c_@@_top_layer_tl
4436 \c_@@_option_layer_latex_tl
4437 {
4438   \use:c
4439   { ExplSyntaxOff }
4440   \AtEndOfPackage
4441   {
4442     \@@_if_option:nF
4443     { noDefaults }
4444     {
4445       \@@_if_option:nTF
4446       { experimental }
4447       {
4448         \@@_setup:n
4449         { theme = witiko/markdown/defaults@experimental }
4450       }
4451       {
4452         \@@_setup:n
4453         { theme = witiko/markdown/defaults }
4454       }
4455     }
4456   }
4457   \use:c
4458   { ExplSyntaxOn }
4459 }
4460 \ExplSyntaxOff

```

See Section 3.3.2 for implementation details of the built-in L^AT_EX themes.

2.3.5 Snippets

In Section 2.2.4, we described the concept of snippets.

Built-in L^AT_EX snippets provided with the Markdown package include:

witiko/glossaries/import-acronyms Imports all acronyms from the \LaTeX package **glossaries**, appends them to the **acronyms** option and updates the corresponding renderers to recognize these acronyms in running text and link them to the corresponding glossary entries.

This snippet is provided by the theme **witiko/glossaries@v1**.

See Section 3.3.3 for implementation details of the built-in \LaTeX snippets.

2.4 ConT_EXt Interface

To determine whether ConT_EXt is the top layer or if there are other layers above ConT_EXt, we take a look on whether the `\c_@@_top_layer_tl` token list has already been defined. If not, we will assume that ConT_EXt is the top layer.

```

4461 \ExplSyntaxOn
4462 \tl_const:Nn \c_@@_option_layer_context_tl { context }
4463 \cs_generate_variant:Nn
4464   \tl_const:Nn
4465   { NV }
4466 \tl_if_exist:NF
4467   \c_@@_top_layer_tl
4468   {
4469     \tl_const:NV
4470       \c_@@_top_layer_tl
4471       \c_@@_option_layer_context_tl
4472   }
4473 \ExplSyntaxOff

```

The ConT_EXt interface provides a start-stop macro pair for the typesetting of mark-down input from within ConT_EXt and facilities for setting Lua, plain T_EX, and ConT_EXt options used during the conversion from markdown to plain T_EX. The rest of the interface is inherited from the plain T_EX interface (see Section 2.2).

```

4474 \writestatus{loading}{ConTEXt User Module / markdown}%
4475 \startmodule[markdown]
4476 \def\dospecials{\do\ \do\\\do\{\do\}\do\$\do\&%
4477   \do\#\do\^\do\_do\%\do\~}%
4478 \input markdown/markdown

```

The ConT_EXt interface is implemented by the **t-markdown.tex** ConT_EXt module file that can be loaded as follows:

```
\usemodule[t][markdown]
```

It is expected that the special plain T_EX characters have the expected category codes, when **\inputting** the file.

2.4.1 Typesetting Markdown and YAML

The interface exposes the `\startmarkdown`, `\stopmarkdown`, `\startyaml`, `\stopyaml`, `\inputmarkdown`, and `\inputyaml` macros.

2.4.1.1 Typesetting Markdown and yaml directly

The `\startmarkdown` and `\stopmarkdown` macros are aliases for the macros `\markdownBegin` and `\markdownEnd` exposed by the plain TeX interface.

```
4479 \let\startmarkdown\relax
4480 \let\stopmarkdown\relax
```

You may prepend your own code to the `\startmarkdown` macro and redefine the `\stopmarkdown` macro to produce special effects before and after the markdown block.

The macros `\startmarkdown` and `\stopmarkdown` are subject to the same limitations as the `\markdownBegin` and `\markdownEnd` macros.

The following example ConTeXt code showcases the usage of the `\startmarkdown` and `\stopmarkdown` macros:

```
\usemodule[t] [markdown]
\starttext
\startmarkdown
_Hello_ **world** ...
\stopmarkdown
\stoptext
```

The `\startyaml` and `\stopyaml` macros are aliases for the macros `\yamlBegin` and `\yamlEnd` exposed by the plain TeX interface.

```
4481 \let\startyaml\relax
4482 \let\stopyaml\relax
```

You may prepend your own code to the `\startyaml` macro and append your own code to the `\stopyaml` macro to produce special effects before and after the YAML document.

The macros `\startyaml` and `\stopyaml` are subject to the same limitations as the `\markdownBegin` and `\markdownEnd` macros.

The following example ConTeXt code showcases the usage of the `\startyaml` and `\stopyaml` macros:

```
\usemodule[t] [markdown]
\starttext
\startyaml
title: _Hello_ **world** ...
```

```
author: John Doe
\stopyaml
\stoptext
```

The above code has the same effect as the below code:

```
\usemodule[t][markdown]
\starttext
\setupyaml[jekyllData, expectJekyllData, ensureJekyllData]
\startyaml
title: _Hello_ world ...
author: John Doe
\stopyaml
\stoptext
```

2.4.1.2 Typesetting Markdown and yaml from external documents

The `\inputmarkdown` macro aliases the macro `\markdownInput` exposed by the plain T_EX interface.

```
4483 \let\inputmarkdown\relax
```

Furthermore, the `\inputmarkdown` macro also accepts ConT_EXt interface options (see Section 2.4.2) as its optional argument. These options will only influence this markdown document.

The following example ConT_EXt code showcases the usage of the `\inputmarkdown` macro:

```
\usemodule[t][markdown]
\starttext
\inputmarkdown[smartEllipses]{hello.md}
\stoptext
```

The above code has the same effect as the below code:

```
\usemodule[t][markdown]
\starttext
\setupmarkdown[smartEllipses]
\inputmarkdown{hello.md}
\stoptext
```

The `\inputyaml` macro aliases the macro `\yamlInput` exposed by the plain T_EX interface.

```
4484 \let\inputyaml\relax
```

Furthermore, the `\inputyaml` macro also accepts ConTeXt interface options (see Section 2.4.2) as its optional argument. These options will only influence this YAML document.

The following example ConTeXt code showcases the usage of the `\inputyaml` macro:

```
\usemodule[t] [markdown]
\starttext
\inputyaml[smartEllipses]{hello.yaml}
\stoptext
```

The above code has the same effect as the below code:

```
\usemodule[t] [markdown]
\starttext
\setupyaml[smartEllipses]
\inputyaml{hello.yaml}
\stoptext
```

2.4.2 Options

The ConTeXt options are represented by a comma-delimited list of $\langle key \rangle = \langle value \rangle$ pairs. For boolean options, the $= \langle value \rangle$ part is optional, and $\langle key \rangle$ will be interpreted as $\langle key \rangle = \text{true}$ (or, equivalently, $\langle key \rangle = \text{yes}$) if the $= \langle value \rangle$ part has been omitted.

ConTeXt options map directly to the options recognized by the plain TeX interface (see Section 2.2.2).

The ConTeXt options may be specified when using the `\inputmarkdown` macro (see Section 2.4), via the `\markdownSetup` macro, or via the `\setupmarkdown[#1]` macro, which is an alias for `\markdownSetup{#1}`.

```
4485 \ExplSyntaxOn
4486 \cs_new_protected:Npn
4487   \setupmarkdown
4488   [ #1 ]
4489   {
4490     \@@_setup:n
4491     { #1 }
4492   }
```

The command `\setupyaml` is also available as an alias for the command `\setupmarkdown`.

```
4493 \cs_gset_eq:NN
4494   \setupyaml
4495   \setupmarkdown
```

2.4.2.1 Generating Plain TeX Option Macros and Key-Values

Unlike plain TeX, we also accept caseless variants of options in line with the style of ConTeXt.

```
4496 \cs_new_protected:Nn \@@_caseless:N
4497 {
4498   \regex_replace_all:nnN
4499     { ([a-z])([A-Z]) }
4500     { \1 \c { str_lowercase:n } \cB\{ \2 \cE\} }
4501     #1
4502   \tl_set:Nx
4503     #1
4504     { #1 }
4505 }
4506 \seq_gput_right:Nn \g_@@_cases_seq { @@_caseless:N }
```

If ConTeXt is the top layer, we use the `\@@_define_option_commands_and_keyvals:`, `\@@_define_renderers:`, and `\@@_define_renderer_prototypes:` macro to define plain TeX option, token renderer, and token renderer prototype macros and key-values immediately. Otherwise, we postpone the definition until the upper layers have been loaded.

```
4507 \str_if_eq:VVT
4508   \c_@@_top_layer_tl
4509   \c_@@_option_layer_context_tl
4510 {
4511   \@@_define_option_commands_and_keyvals:
4512   \@@_define_renderers:
4513   \@@_define_renderer_prototypes:
4514 }
```

2.4.3 Themes

In Section 2.2.3, we described the concept of themes. In ConTeXt, we expand on the concept of themes by allowing a theme to be a full-blown ConTeXt module. Specifically, the key-values `theme=<theme name>` and `import=<theme name>` load a ConTeXt module named `t-markdowntheme<munged theme name>.tex` if it exists and a TeX document named `markdowntheme<munged theme name>.tex` otherwise.

Having the Markdown package automatically load either the generic `.tex` theme file or the ConTeXt-specific `t-*.tex` theme file allows developers to have a single *theme file*, when the theme is small or the difference between TeX formats is unimportant, and scale up to separate theme files native to different TeX formats for large multi-format themes, where different code is needed for different TeX formats. To enable code reuse, developers can load the `.tex` theme file from the `t-*.tex` theme file using the `\markdownLoadPlainTeXTheme` macro.

For example, to load a theme named `witiko/tilde` in your document:

```
\usemodule[t] [markdown]
\setupmarkdown[import=witiko/tilde]
```

We also define the prop `\g_@@_context_built_in_themes_prop` that contains the code of built-in themes. This is a packaging optimization, so that built-in themes does not need to be distributed in many small files.

```
4515 \prop_new:N
4516   \g_@@_context_built_in_themes_prop
4517 \ExplSyntaxOff
```

Built-in ConT_EXt themes provided with the Markdown package include:

witiko/markdown/defaults A ConT_EXt theme with the default definitions of token renderer prototypes for plain T_EX. This theme is loaded automatically together with the package and explicitly loading it has no effect.

```
4518 \startmodule[markdownthemewitiko_markdown_defaults]
4519 \unprotect
```

See Section 3.4.2 for implementation details of the built-in ConT_EXt themes.

3 Implementation

This part of the documentation describes the implementation of the interfaces exposed by the package (see Section 2) and is aimed at the developers of the package, as well as the curious users.

Figure 1 shows the high-level structure of the Markdown package: The translation from markdown to T_EX *token renderers* is performed by the Lua layer. The plain T_EX layer provides default definitions for the token renderers. The L^AT_EX and ConT_EXt layers correct idiosyncrasies of the respective T_EX formats, and provide format-specific default definitions for the token renderers.

3.1 Lua Implementation

The Lua implementation implements **writer** and **reader** objects, which provide the conversion from markdown to plain T_EX, and **extensions** objects, which provide syntax extensions for the **writer** and **reader** objects.

The Lunamark Lua module implements writers for the conversion to various other formats, such as DocBook, Groff, or HTML. These were stripped from the module and the remaining markdown reader and plain T_EX writer were hidden behind the converter functions exposed by the Lua interface (see Section 2.1).

Furthermore, here are some abbreviations that we inherited from the Lunamark library and which are used throughout the Lua implementation.

```

4520 local upper, format, length =
4521     string.upper, string.format, string.len
4522 local P, R, S, V, C, Cg, Cb, Cmt, Cc, Ct, B, Cs, Cp, any =
4523     lpeg.P, lpeg.R, lpeg.S, lpeg.V, lpeg.C, lpeg.Cg, lpeg.Cb,
4524     lpeg.Cmt, lpeg.Cc, lpeg.Ct, lpeg.B, lpeg.Cs, lpeg.Cp, lpeg.P(1)

```

3.1.1 Unicode Support

To start off, we load a Lua file named `markdown-unicode-data.lua` that contains our implementation of various Unicode algorithms.

```

4525 local early_warnings = {}
4526 local unicode_data = require("markdown-unicode-data")
4527 if metadata.version ~= unicode_data.metadata.version then
4528     table.insert(
4529         early_warnings,
4530         "markdown.lua " .. metadata.version .. " used with " ..
4531         "markdown-unicode-data.lua " .. unicode_data.metadata.version .. "."
4532     )
4533 end

```

In the following subsections, we'll write a second-order file named `markdown-unicode-data-generator.lua`. The code from this file will be executed during the compilation of the Markdown package and the standard output will be stored in a generated file named `markdown-unicode-data.lua`. First, let's define a couple helper functions.

The function `depth_first_search` performs the depth first search algorithm on a tree with nodes being tables with the key `_type` equal to either `intermediate` or `leaf` and with edges labeled with bytes.

Since the algorithm is implemented using recursion, it should only be used for the traversal of shallow trees to prevent exceeding the maximum recursion depth (usually 100).

```

4534 local function depth_first_search(node, path, visit, leave)
4535     assert(node._type == "intermediate")
4536     visit(node, path)
4537     for label, child in pairs(node) do
4538         if label == "_type" then
4539             goto continue
4540         end
4541         if child._type ~= "intermediate" then
4542             goto continue
4543         end
4544         depth_first_search(child, path .. label, visit, leave)
4545         ::continue::
4546     end
4547     for label, child in pairs(node) do
4548         if label == "_type" then
4549             goto continue

```

```

4550     end
4551     if child._type ~= "leaf" then
4552         goto continue
4553     end
4554     visit(child, path)
4555     ::continue::
4556 end
4557 leave(node, path)
4558 end

```

This function is defined in the file [markdown-parser.lua](#) as well, so that it can be used to define the [extensions.acronyms](#) built-in syntax extension. The function [serialize_byte_parser](#) produces the Lua code for a PEG parser that matches a single byte.

```

4559 local function serialize_byte_parser(byte)
4560     if byte == '"' then
4561         return "P('\" .. byte .. \"')"
4562     elseif byte == "\\" then
4563         return "P(\"\\\\\\\")"
4564     else
4565         return "P('\" .. byte .. \"')"
4566     end
4567 end

```

The function [serialize_byte_range_parser](#) produces the Lua code for a PEG parser that matches a contiguous range of bytes.

```

4568 local function serialize_byte_range_parser(start_byte, end_byte)
4569     assert(start_byte <= end_byte)
4570     if start_byte == "\\" then
4571         start_byte = "\\\\"
4572     end
4573     if end_byte == "\\" then
4574         end_byte = "\\\\"
4575     end
4576     if start_byte == '"' or end_byte == '"' then
4577         return "R('\" .. start_byte .. end_byte .. \"')"
4578     else
4579         return "R('\" .. start_byte .. end_byte .. \"')"
4580     end
4581 end

```

The function [serialize_replacement](#) produces the Lua code for a string literal with one or more UTF-8-encoded Unicode characters.

```

4582 local function serialize_replacement(codepoints)
4583     assert(#codepoints > 0)
4584     local buffer = {'"}
4585     for _, codepoint in ipairs(codepoints) do
4586         local code = utf8.char(codepoint)

```



```

4587     for i = 1, #code do
4588         local byte = code:sub(i, i)
4589         if byte == '"' then
4590             table.insert(buffer, '\\\\"')
4591         elseif byte == "\\" then
4592             table.insert(buffer, "\\\\"")
4593         else
4594             table.insert(buffer, byte)
4595         end
4596     end
4597 end
4598 table.insert(buffer, '')
4599 return table.concat(buffer)
4600 end

```

The function `read_decompositions` is an iterator that reads a file `UnicodeData.txt` that has previously been opened for reading and yields all canonical and compatibility decompositions from that file.

```

4601 local function read_decompositions(file)
4602     return function()
4603         local from_codepoint, mapping
4604         for line in file:lines() do
4605             from_codepoint, mapping
4606                 = line:match("^(%x+);[~;]*;%a*;%d+;%a*;( [<%a>%x ]*)")
4607             assert(from_codepoint ~= nil)
4608             if #mapping > 0 then
4609                 break
4610             end
4611         end
4612         if #mapping == 0 then
4613             return nil
4614         end
4615         from_codepoint = tonumber(from_codepoint, 16)
4616         local to_codepoints, decomposition_type = {}, "canonical"
4617         for raw_codepoint in mapping:gmatch("%S+") do
4618             assert(#raw_codepoint > 0)
4619             if raw_codepoint:sub(1, 1) == "<" then
4620                 decomposition_type = "compatibility"
4621             else
4622                 local codepoint = tonumber(raw_codepoint, 16)
4623                 table.insert(to_codepoints, codepoint)
4624             end
4625         end
4626         assert(#to_codepoints > 0)
4627         return decomposition_type, from_codepoint, to_codepoints
4628     end
4629 end

```

Next, let's define some aliases in the generated file.

```
4630 print("local P, R, Cc, C = lpeg.P, lpeg.R, lpeg.Cc, lpeg.C")
4631 print("local fail = P(false)")
4632 print("-- luacheck: push no max line length")
```

3.1.1.1 Canonical and Compatibility Decomposition

Low-level parsers that decompose UTF-8-encoded Unicode characters using either the canonical or the compatibility decomposition [17, Section 3.7] are organized in table `unicode_data.decomposition_mapping` based on the number of bytes they occupy after conversion to UTF-8.

First, let's read the file `UnicodeData.txt`.

```
4633 ;(function()
4634   local file = assert(io.open("UnicodeData.txt", "r"),
4635     [[Could not open file "UnicodeData.txt"]])
4636   local decomposition_types = {"canonical", "compatibility"}
4637   local prefix_trees = {}
4638   for _, decomposition_type in ipairs(decomposition_types) do
4639     prefix_trees[decomposition_type] = {}
4640     for char_length = 1, 4 do
4641       prefix_trees[decomposition_type][char_length]
4642         = {_type = "intermediate"}
4643     end
4644   end
4645   for decomposition_type, from_codepoint, to_codepoints
4646     in read_decompositions(file) do
4647     local from_code = utf8.char(from_codepoint)
4648     local node = prefix_trees[decomposition_type][#from_code]
4649     for i = 1, #from_code do
4650       local from_byte = from_code:sub(i, i)
4651       if i < #from_code then
4652         if node[from_byte] == nil then
4653           node[from_byte] = {_type = "intermediate"}
4654         end
4655         node = node[from_byte]
4656       else
4657         table.insert(node, {from_byte, to_codepoints, _type = "leaf"})
4658       end
4659     end
4660   end
4661   assert(file:close())
```

Next, we will construct parsers out of the prefix trees.

```

4662 print("M.decomposition_mapping = {}")
4663 for _, decomposition_type in ipairs(decomposition_types) do
4664     print("M.decomposition_mapping." .. decomposition_type .. " = {}")
4665     for length, prefix_tree in pairs(prefix_trees[decomposition_type])
4666     do
4667         local subparsers = {}
4668         depth_first_search(prefix_tree, "", function(node, path)
4669             if node._type == "leaf" then
4670                 local from_byte, to_codepoints = table.unpack(node)
4671                 local suffix = serialize_byte_parser(from_byte)
4672                 .. " / " .. serialize_replacement(to_codepoints)
4673                 if subparsers[path] ~= nil then
4674                     subparsers[path] = subparsers[path] .. " + " .. suffix
4675                 else
4676                     subparsers[path] = suffix
4677                 end
4678             end
4679         end, function(_, path)
4680             if #path > 0 then
4681                 local byte = path:sub(#path, #path)
4682                 local parent_path = path:sub(1, #path-1)
4683                 local prefix = serialize_byte_parser(byte)
4684                 local suffix
4685                 if subparsers[path]:find(" %+ ") then
4686                     suffix = prefix .. " * (" .. subparsers[path] .. ")"
4687                 else
4688                     suffix = prefix .. " * " .. subparsers[path]
4689                 end
4690                 if subparsers[parent_path] ~= nil then
4691                     subparsers[parent_path] = subparsers[parent_path]
4692                     .. " + " .. suffix
4693                 else
4694                     subparsers[parent_path] = suffix
4695                 end
4696             else
4697                 print(
4698                     "M.decomposition_mapping." .. decomposition_type
4699                     .. "[" .. length .. "]" = " .. (subparsers[path] or "fail")
4700                 )
4701             end
4702         end)
4703     end
4704 end
4705 end)()

```

3.1.1.2 Hangul Syllable Decomposition

Low-level parsers that decompose UTF-8-encoded Unicode characters using the Hangul syllable decomposition [17, Section 3.12.2] are also organized in table [unicode_data.decomposition_mapping](#), previously defined in Section 3.1.1.1 based on the number of bytes they occupy after conversion to UTF-8.

First, let's read the file [HangulSyllableType.txt](#).

```

4706 ;(function()
4707   local file = assert(io.open("HangulSyllableType.txt", "r"),
4708     [[Could not open file "HangulSyllableType.txt"]])
In order to minimize the size and speed of the parser, we will first construct prefix
trees of UTF-8 encodings for all codepoints of a given syllable type and code length.
4709   local syllable_types = {"LV", "LVT"}
4710   local prefix_trees = {}
4711   for _, syllable_type in ipairs(syllable_types) do
4712     prefix_trees[syllable_type] = {}
4713     for char_length = 1, 4 do
4714       prefix_trees[syllable_type][char_length]
4715         = {_type = "intermediate"}
4716     end
4717   end
4718   for line in file:lines() do
4719     if #line == 0 or line:sub(1, 1) == "#" then
4720       goto continue
4721     end
4722     local codepoint, syllable_type = line:match("^([%x.]+)%s*;%s*(%a*)")
4723     assert(codepoint ~= nil)
4724     if prefix_trees[syllable_type] == nil then
4725       goto continue
4726     end
4727     local codepoint_start, codepoint_end
4728     if codepoint:find("%.%.") then
4729       codepoint_start, codepoint_end
4730         = codepoint:match("^(%x+)%.%.(%x+)$")
4731     else
4732       codepoint_start, codepoint_end = codepoint, codepoint
4733     end
4734     codepoint_start = tonumber(codepoint_start, 16)
4735     codepoint_end = tonumber(codepoint_end, 16)
4736     local prev_code, prev_leaf_node
4737     for codepoint = codepoint_start, codepoint_end do
4738       local code = utf8.char(codepoint)
4739       local node = prefix_trees[syllable_type][#code]
4740       for i = 1, #code do
4741         local byte = code:sub(i, i)
4742         if i < #code then
4743           if node[byte] == nil then
4744             node[byte] = {_type = "intermediate"}

```

```

4745         end
4746         node = node[byte]
4747     else
4748         local leaf_node
4749         if (
4750             prev_code ~= nil
4751             and #prev_code == #code
4752             and code:sub(1, #code - 1)
4753                 == prev_code:sub(1, #code - 1)
4754         ) then
4755             assert(prev_leaf_node ~= nil)
4756             leaf_node = prev_leaf_node
4757             leaf_node[2] = byte
4758         else
4759             leaf_node = {byte, byte, _type = "leaf"}
4760             table.insert(node, leaf_node)
4761         end
4762         prev_code, prev_leaf_node = code, leaf_node
4763     end
4764 end
4765 end
4766 ::continue::
4767 end
4768 assert(file:close())

```

Next, we will define constants and functions with the Hangul syllable (de)composition algorithm.

```

4769 print(string.format("local s_base = %d", tonumber("AC00", 16)))
4770 print(string.format("local l_base = %d", tonumber("1100", 16)))
4771 print(string.format("local v_base = %d", tonumber("1161", 16)))
4772 print(string.format("local t_base = %d", tonumber("11A7", 16)))
4773 print(string.format("local l_count = %d", 19))
4774 print(string.format("local v_count = %d", 21))
4775 print(string.format("local t_count = %d", 28))
4776 print("local n_count = v_count * t_count")
4777 print("local s_count = l_count * n_count")
4778
4779 print("local function hangul_decompose_LV(byte)")
4780 print("  local s = utf8.codepoint(byte)")
4781 print("  local s_index = s - s_base")
4782 print("  local l_index = s_index // n_count")
4783 print("  local v_index = (s_index % n_count) // t_count")
4784 print("  local l_part = l_base + l_index")
4785 print("  local v_part = v_base + v_index")
4786 print("  return utf8.char(l_part) .. utf8.char(v_part)")
4787 print("end")
4788

```

```

4789 print("local function hangul_decompose_LVT(byte)")
4790 print("  local s = utf8.codepoint(byte)")
4791 print("  local s_index = s - s_base")
4792 print("  local lv_index = (s_index // t_count) * t_count")
4793 print("  local t_index = s_index % t_count")
4794 print("  local lv_part = s_base + lv_index")
4795 print("  local t_part = t_base + t_index")
4796 print("  return utf8.char(lv_part) .. utf8.char(t_part)")
4797 print("end")
4798
4799 print("function M.hangul_compose(first_byte, second_byte)")
4800 print("  local last = utf8.codepoint(first_byte)")
4801 print("  local ch = utf8.codepoint(second_byte)")
4802 print("  local l_index = last - l_base")
4803 print("  if 0 <= l_index and l_index < l_count then")
4804 print("    local v_index = ch - v_base")
4805 print("    if 0 <= v_index and v_index < v_count then")
4806 print("      return utf8.char(")
4807 print("        s_base + (l_index * v_count + v_index) * t_count")
4808 print("      ")
4809 print("    end")
4810 print("  end")
4811 print("  local s_index = last - s_base")
4812 print("  if 0 <= s_index and s_index < s_count")
4813 print("    and s_index % t_count == 0 then")
4814 print("    local t_index = ch - t_base")
4815 print("    if 0 < t_index and t_index < t_count then")
4816 print("      return utf8.char(last + t_index)")
4817 print("    end")
4818 print("  end")
4819 print("  return nil")
4820 print("end")

```

Next, we will construct parsers out of the prefix trees.

```

4821 print("M.decomposition_mapping.hangul = {}")
4822 for _, syllable_type in ipairs(syllable_types) do
4823   print("M.decomposition_mapping.hangul." .. syllable_type .. " = {}")
4824   for length, prefix_tree in pairs(prefix_trees[syllable_type]) do
4825     local subparsers = {}
4826     depth_first_search(prefix_tree, "", function(node, path)
4827       if node._type == "leaf" then
4828         local start_byte, end_byte = table.unpack(node)
4829         local suffix
4830         if start_byte == end_byte then
4831           suffix = serialize_byte_parser(start_byte)
4832         else
4833           assert(start_byte < end_byte)
4834           suffix = serialize_byte_range_parser(start_byte, end_byte)

```

```

4835         end
4836         if subparsers[path] ~= nil then
4837             subparsers[path] = subparsers[path] .. " + " .. suffix
4838         else
4839             subparsers[path] = suffix
4840         end
4841     end
4842 end, function(_, path)
4843     if #path > 0 then
4844         local byte = path:sub(#path, #path)
4845         local parent_path = path:sub(1, #path-1)
4846         local prefix = serialize_byte_parser(byte)
4847         local suffix
4848         if subparsers[path]:find(" %+ ") then
4849             suffix = prefix .. " * (" .. subparsers[path] .. ")"
4850         else
4851             suffix = prefix .. " * " .. subparsers[path]
4852         end
4853         if subparsers[parent_path] ~= nil then
4854             subparsers[parent_path] = subparsers[parent_path]
4855                 .. " + " .. suffix
4856         else
4857             subparsers[parent_path] = suffix
4858         end
4859     else
4860         if subparsers[path] then
4861             print(
4862                 "M.decomposition_mapping.hangul." .. syllable_type
4863                 .. "[" .. length .. "] = C(" .. subparsers[path] .. ")"
4864                 .. " / hangul_decompose_" .. syllable_type
4865             )
4866         else
4867             print(
4868                 "M.decomposition_mapping.hangul." .. syllable_type
4869                 .. "[" .. length .. "] = fail"
4870             )
4871         end
4872     end
4873 end)
4874 end
4875 end
4876 end)()

```

3.1.1.3 Canonical Composition

Low-level parsers that map pairs of UTF-8-encoded Unicode characters from a canonical or compatibility decomposition into their primary composites [17, Sec-

tion 3.11.6] are organized in table [unicode_data.composition_mapping](#) based on the number of bytes the characters occupy after conversion to UTF-8.

First, let's read the file [DerivedNormalizationProps.txt](#) and record all canonical decomposable characters that are not full composition exclusions.

```

4877 ;(function()
4878   local file = assert(io.open("DerivedNormalizationProps.txt", "r"),
4879     [[Could not open file "DerivedNormalizationProps.txt"]])
4880   local full_composition_exclusions = {}
4881   for line in file:lines() do
4882     if #line == 0 or line:sub(1, 1) == "#" then
4883       goto continue
4884     end
4885     local codepoint, property = line:match("^([%x.]+)%s*;%s*([%a_]+)")
4886     assert(codepoint ~= nil)
4887     if property ~= "Full_Composition_Exclusion" then
4888       goto continue
4889     end
4890     local codepoint_start, codepoint_end
4891     if codepoint:find("%.%.") then
4892       codepoint_start, codepoint_end
4893       = codepoint:match("^(%x+)%%.%.(%x+)$")
4894     else
4895       codepoint_start, codepoint_end = codepoint, codepoint
4896     end
4897     codepoint_start = tonumber(codepoint_start, 16)
4898     codepoint_end = tonumber(codepoint_end, 16)
4899     for codepoint = codepoint_start, codepoint_end do
4900       full_composition_exclusions[codepoint] = true
4901     end
4902     ::continue::
4903   end
4904   assert(file:close())

```

Next, let's also read the file [UnicodeData.txt](#).

```

4905   file = assert(io.open("UnicodeData.txt", "r"),
4906     [[Could not open file "UnicodeData.txt"]])

```

In order to minimize the size and speed of the parser, we will first construct prefix trees of UTF-8 encodings for all pairs of codepoints of given code lengths.

```

4907   local prefix_trees = {starters = {}, both = {}}
4908   for first_char_length = 1, 4 do
4909     prefix_trees.starters[first_char_length]
4910     = {_type = "intermediate"}
4911     prefix_trees.both[first_char_length] = {}
4912     for second_char_length = 1, 4 do
4913       prefix_trees.both[first_char_length][second_char_length]
4914       = {_type = "intermediate"}

```



```

4915     end
4916 end
4917 local seen_starter_codes = {}
4918 for decomposition_type, to_codepoint, from_codepoints
4919     in read_decompositions(file) do
4920     if (
4921         decomposition_type ~= "canonical"
4922         or #from_codepoints ~= 2
4923         or full_composition_exclusions[to_codepoint]
4924     ) then
4925         goto continue
4926     end
4927     local starter_code = utf8.char(from_codepoints[1])
4928     local combining_character_code = utf8.char(from_codepoints[2])
4929     local starter_node = prefix_trees.starters[#starter_code]
4930     local both_node
4931         = prefix_trees.both[#starter_code][#combining_character_code]
4932     for i = 1, #starter_code do
4933         local from_byte = starter_code:sub(i, i)
4934         if both_node[from_byte] == nil then
4935             both_node[from_byte] = {_type = "intermediate"}
4936         end
4937         both_node = both_node[from_byte]
4938         if i < #starter_code then
4939             if starter_node[from_byte] == nil then
4940                 starter_node[from_byte] = {_type = "intermediate"}
4941             end
4942             starter_node = starter_node[from_byte]
4943         elseif seen_starter_codes[starter_code] == nil then
4944             seen_starter_codes[starter_code] = true
4945             table.insert(starter_node, {from_byte, _type = "leaf"})
4946         end
4947     end
4948     for i = 1, #combining_character_code do
4949         local from_byte = combining_character_code:sub(i, i)
4950         if i < #combining_character_code then
4951             if both_node[from_byte] == nil then
4952                 both_node[from_byte] = {_type = "intermediate"}
4953             end
4954             both_node = both_node[from_byte]
4955         else
4956             table.insert(
4957                 both_node,
4958                 {from_byte, to_codepoint, _type = "leaf"}
4959             )
4960         end
4961     end

```

```

4962     ::continue::
4963 end
4964 assert(file:close())

```

Next, we will construct parsers out of the prefix trees.

```

4965 print("M.composition_mapping = {starters = {}, both = {}}")
4966 for first_char_length = 1, 4 do
4967     local prefix_tree = prefix_trees.starters[first_char_length]
4968     local subparsers = {}
4969     depth_first_search(prefix_tree, "", function(node, path)
4970         if node._type == "leaf" then
4971             local from_byte = table.unpack(node)
4972             local suffix = serialize_byte_parser(from_byte)
4973             if subparsers[path] ~= nil then
4974                 subparsers[path] = subparsers[path] .. " + " .. suffix
4975             else
4976                 subparsers[path] = suffix
4977             end
4978         end
4979     end, function(_, path)
4980         if #path > 0 then
4981             local byte = path:sub(#path, #path)
4982             local parent_path = path:sub(1, #path-1)
4983             local prefix = serialize_byte_parser(byte)
4984             local suffix
4985             if subparsers[path]:find(" %+ ") then
4986                 suffix = prefix .. " * (" .. subparsers[path] .. ")"
4987             else
4988                 suffix = prefix .. " * " .. subparsers[path]
4989             end
4990             if subparsers[parent_path] ~= nil then
4991                 subparsers[parent_path] = subparsers[parent_path]
4992                     .. " + " .. suffix
4993             else
4994                 subparsers[parent_path] = suffix
4995             end
4996         else
4997             print(
4998                 "M.composition_mapping.starters["
4999                 .. first_char_length .. "] = " .. (subparsers[path] or "fail")
5000             )
5001         end
5002     end)
5003 print(
5004     string.format(
5005         "M.composition_mapping.both[%d] = {}",
5006         first_char_length
5007     )

```

```

5008     )
5009     for second_char_length = 1, 4 do
5010         prefix_tree
5011         = prefix_trees.both[first_char_length][second_char_length]
5012         subparsers = {}
5013         depth_first_search(prefix_tree, "", function(node, path)
5014             if node._type == "leaf" then
5015                 local from_byte, to_codepoint = table.unpack(node)
5016                 local suffix = serialize_byte_parser(from_byte)
5017                 .. " / " .. serialize_replacement({to_codepoint})
5018                 if subparsers[path] ~= nil then
5019                     subparsers[path] = subparsers[path] .. " + " .. suffix
5020                 else
5021                     subparsers[path] = suffix
5022                 end
5023             end
5024         end, function(_, path)
5025             if #path > 0 then
5026                 local byte = path:sub(#path, #path)
5027                 local parent_path = path:sub(1, #path-1)
5028                 local prefix = serialize_byte_parser(byte)
5029                 local suffix
5030                 if subparsers[path]:find(" %+ ") then
5031                     suffix = prefix .. " * (" .. subparsers[path] .. ")"
5032                 else
5033                     suffix = prefix .. " * " .. subparsers[path]
5034                 end
5035                 if subparsers[parent_path] ~= nil then
5036                     subparsers[parent_path] = subparsers[parent_path]
5037                         .. " + " .. suffix
5038                 else
5039                     subparsers[parent_path] = suffix
5040                 end
5041             else
5042                 print(
5043                     "M.composition_mapping.both[" .. first_char_length .. "]["
5044                         .. second_char_length .. "] = "
5045                         .. (subparsers[path] or "fail")
5046                 )
5047             end
5048         end)
5049     end
5050 end
5051 end)()

```

3.1.1.4 Case Folding

Low-level parsers that case-fold UTF-8-encoded Unicode characters using the full mapping (C and F) [17, Section 3.13.3] are organized in table `unicode_data.casefold_mapping` based on the number of bytes they occupy after conversion to UTF-8.

First, let's read the file `CaseFolding.txt`.

```

5052 ;(function()
5053   local file = assert(io.open("CaseFolding.txt", "r"),
5054     [[Could not open file "CaseFolding.txt"]])
In order to minimize the size and speed of the parser, we will first construct prefix
trees of UTF-8 encodings for all codepoints of a given code length.
5055   local prefix_trees = {}
5056   for char_length = 1, 4 do
5057     prefix_trees[char_length] = {_type = "intermediate"}
5058   end
5059   for line in file:lines() do
5060     if #line == 0 or line:sub(1, 1) == "#" then
5061       goto continue
5062     end
5063     local raw_from_codepoint, status, raw_to_codepoints
5064       = line:match("^(%x+); ([CFST]); ([%x ]+);")
5065     assert(raw_from_codepoint ~= nil)
5066     assert(status ~= nil)
5067     assert(raw_to_codepoints ~= nil)
5068     if status ~= "C" and status ~= "F" then
5069       goto continue
5070     end
5071     local from_codepoint = tonumber(raw_from_codepoint, 16)
5072     local to_codepoints = {}
5073     for raw_codepoint in raw_to_codepoints:gmatch('%x+') do
5074       local codepoint = tonumber(raw_codepoint, 16)
5075       table.insert(to_codepoints, codepoint)
5076     end
5077     local from_code = utf8.char(from_codepoint)
5078     local node = prefix_trees[#from_code]
5079     for i = 1, #from_code do
5080       local from_byte = from_code:sub(i, i)
5081       if i < #from_code then
5082         if node[from_byte] == nil then
5083           node[from_byte] = {_type = "intermediate"}
5084         end
5085         node = node[from_byte]
5086       else
5087         table.insert(node, {from_byte, to_codepoints, _type = "leaf"})
5088       end
5089     end
5090     ::continue::

```

```

5091 end
5092 assert(file:close())

```

Next, we will construct parsers out of the prefix trees.

```

5093 print("M.casefold_mapping = {}")
5094 for length, prefix_tree in pairs(prefix_trees) do
5095     local subparsers = {}
5096     depth_first_search(prefix_tree, "", function(node, path)
5097         if node._type == "leaf" then
5098             local from_byte, to_codepoints = table.unpack(node)
5099             local suffix = serialize_byte_parser(from_byte)
5100             .. " / " .. serialize_replacement(to_codepoints)
5101             if subparsers[path] ~= nil then
5102                 subparsers[path] = subparsers[path] .. " + " .. suffix
5103             else
5104                 subparsers[path] = suffix
5105             end
5106         end
5107     end, function(_, path)
5108         if #path > 0 then
5109             local byte = path:sub(#path, #path)
5110             local parent_path = path:sub(1, #path-1)
5111             local prefix = serialize_byte_parser(byte)
5112             local suffix
5113             if subparsers[path]:find(" %+ ") then
5114                 suffix = prefix .. " * (" .. subparsers[path] .. ")"
5115             else
5116                 suffix = prefix .. " * " .. subparsers[path]
5117             end
5118             if subparsers[parent_path] ~= nil then
5119                 subparsers[parent_path] = subparsers[parent_path]
5120                 .. " + " .. suffix
5121             else
5122                 subparsers[parent_path] = suffix
5123             end
5124         else
5125             print(
5126                 "M.casefold_mapping[" .. length .. "] = "
5127                 .. (subparsers[path] or "fail")
5128             )
5129         end
5130     end)
5131 end
5132 end)()

```

3.1.1.5 Character Categories

Low-level parsers of UTF-8-encoded Unicode characters from different general categories [17, Section 4.5] are organized in table `unicode_data.categories` based on the number of bytes they occupy after conversion to UTF-8.

First, let's read the file `UnicodeData.txt`.

```
5133 ;(function()
5134   local file = assert(io.open("UnicodeData.txt", "r"),
5135     [[Could not open file "UnicodeData.txt"]])
```

In order to minimize the size and speed of the parser, we will first construct prefix trees of UTF-8 encodings for all codepoints of a given Unicode category and code length.

```
5136   local categories = {"L", "N", "P", "Pc", "S", "Z"}
5137   local prefix_trees = {}
5138   for _, category in ipairs(categories) do
5139     prefix_trees[category] = {}
5140     for char_length = 1, 4 do
5141       prefix_trees[category][char_length] = {_type = "intermediate"}
5142     end
5143   end
5144   for line in file:lines() do
5145     local codepoint, full_category = line:match("^(%x+);[~;]*;(%a*)")
5146     assert(#full_category >= 1)
5147     local major_category = full_category:sub(1, 1)
5148     for _, category in ipairs({full_category, major_category}) do
5149       if prefix_trees[category] == nil then
5150         goto continue
5151       end
5152       local code = utf8.char(tonumber(codepoint, 16))
5153       local node = prefix_trees[category][#code]
5154       for i = 1, #code do
5155         local byte = code:sub(i, i)
5156         if i < #code then
5157           if node[byte] == nil then
5158             node[byte] = {_type = "intermediate"}
5159           end
5160           node = node[byte]
5161         else
5162           table.insert(node, {byte, _type = "leaf"})
5163         end
5164       end
5165       ::continue::
5166     end
5167   end
5168   assert(file:close())
```

Next, we will construct parsers out of the prefix trees.

```
5169   print("M.categories = {}")
```

```

5170 for _, category in ipairs(categories) do
5171     print("M.categories." .. category .. " = {}".format({}))
5172     for length, prefix_tree in pairs(prefix_trees[category]) do
5173         local subparsers = {}
5174         depth_first_search(prefix_tree, "", function(node, path)
5175             if node._type == "leaf" then
5176                 local byte = node[1]
5177                 local suffix = serialize_byte_parser(byte)
5178                 if subparsers[path] ~= nil then
5179                     subparsers[path] = subparsers[path] .. " + " .. suffix
5180                 else
5181                     subparsers[path] = suffix
5182                 end
5183             end
5184         end, function(_, path)
5185             if #path > 0 then
5186                 local byte = path:sub(#path, #path)
5187                 local parent_path = path:sub(1, #path-1)
5188                 local prefix = serialize_byte_parser(byte)
5189                 local suffix
5190                 if subparsers[path]:find(" %+ ") then
5191                     suffix = prefix .. " * (" .. subparsers[path] .. ")"
5192                 else
5193                     suffix = prefix .. " * " .. subparsers[path]
5194                 end
5195                 if subparsers[parent_path] ~= nil then
5196                     subparsers[parent_path] = subparsers[parent_path]
5197                         .. " + " .. suffix
5198                 else
5199                     subparsers[parent_path] = suffix
5200                 end
5201             else
5202                 print(
5203                     "M.categories." .. category .. "[" .. length .. "] = "
5204                     .. (subparsers[path] or "fail")
5205                 )
5206             end
5207         end)
5208     end
5209 end
5210 end()

```

3.1.1.6 Canonical Ordering Classes

Low-level parsers of UTF-8-encoded Unicode characters from different character classes [17, Section 3.11] are organized in table `unicode_data.ccc` based on the number of bytes they occupy after conversion to UTF-8.

First, let's read the file `UnicodeData.txt`.

```
5211 ;(function()
5212   local file = assert(io.open("UnicodeData.txt", "r"),
5213     [[Could not open file "UnicodeData.txt"]])
```

In order to minimize the size and speed of the parser, we will first construct prefix trees of UTF-8 encodings for all codepoints of a given Unicode combining class and code length.

```
5214   local prefix_trees = {}
5215   for char_length = 1, 4 do
5216     prefix_trees[char_length] = {_type = "intermediate"}
5217   end
5218   for line in file:lines() do
5219     local codepoint, combining_class
5220     = line:match("^(%x+);[~;]*;%a*;%d+")
5221     combining_class = tonumber(combining_class)
5222     if combining_class == 0 then
5223       goto continue
5224     end
5225     local code = utf8.char(tonumber(codepoint, 16))
5226     local node = prefix_trees[#code]
5227     for i = 1, #code do
5228       local byte = code:sub(i, i)
5229       if i < #code then
5230         if node[byte] == nil then
5231           node[byte] = {_type = "intermediate"}
5232         end
5233         node = node[byte]
5234       else
5235         table.insert(node, {byte, combining_class, _type = "leaf"})
5236       end
5237     end
5238     ::continue::
5239   end
5240   assert(file:close())
```

Next, we will construct parsers out of the prefix trees.

```
5241   print("M.ccc = {}")
5242   for length, prefix_tree in pairs(prefix_trees) do
5243     local subparsers = {}
5244     depth_first_search(prefix_tree, "", function(node, path)
5245       if node._type == "leaf" then
5246         local byte, combining_class = table.unpack(node)
5247         local suffix = serialize_byte_parser(byte)
5248         .. " * Cc(" .. tostring(combining_class) .. ")"
5249         if subparsers[path] ~= nil then
5250           subparsers[path] = subparsers[path] .. " + " .. suffix
```



```

5251         else
5252             subparsers[path] = suffix
5253         end
5254     end
5255 end, function(_, path)
5256     if #path > 0 then
5257         local byte = path:sub(#path, #path)
5258         local parent_path = path:sub(1, #path-1)
5259         local prefix = serialize_byte_parser(byte)
5260         local suffix
5261         if subparsers[path]:find(" %+ ") then
5262             suffix = prefix .. " * (" .. subparsers[path] .. ")"
5263         else
5264             suffix = prefix .. " * " .. subparsers[path]
5265         end
5266         if subparsers[parent_path] ~= nil then
5267             subparsers[parent_path] = subparsers[parent_path]
5268                 .. " + " .. suffix
5269         else
5270             subparsers[parent_path] = suffix
5271         end
5272     else
5273         print(
5274             "M.ccc[" .. length .. "] = " .. (subparsers[path] or "fail")
5275         )
5276     end
5277 end)
5278 end
5279 end)()
5280 print("-- luacheck: pop")
5281 print("return M")

```

3.1.2 Utility Functions

This section documents the utility functions back in the file [markdown-parser.lua](#) used by the plain TeX writer and the markdown reader. These functions are encapsulated in the [util](#) object. The functions were originally located in the [lunamark/util.lua](#) file in the Lunamark Lua module.

```

5282 local util = {}

```

The [util.err](#) method prints an error message [msg](#) and exits. If [exit_code](#) is provided, it specifies the exit code. Otherwise, the exit code will be 1.

```

5283 function util.err(msg, exit_code)
5284     io.stderr:write("markdown.lua: " .. msg .. "\n")
5285     os.exit(exit_code or 1)
5286 end

```

The `util.cache` method used `dir`, `string`, `salt`, and `suffix` to determine a pathname. If a file with such a pathname does not exist, it gets created with `transform(string)` as its content and the result of `transform(string)` is returned as the second return value in case it's useful to the caller. Regardless, the pathname is always returned as the first return value.

```

5287 function util.cache(dir, string, salt, transform, suffix)
5288   local digest = md5.sumhexa(string .. (salt or ""))
5289   local name = util.pathname(dir, digest .. suffix)
5290   local file = io.open(name, "r")
5291   local result = nil
5292   if file == nil then -- If no cache entry exists, create a new one.
5293     file = assert(io.open(name, "w"),
5294       [[Could not open file ]] .. name .. [[ for writing]])
5295     result = string
5296     if transform ~= nil then
5297       result = transform(result)
5298     end
5299     assert(file:write(result))
5300     assert(file:close())
5301   end
5302   return name, result
5303 end

```

The `util.cache_verbatim` method strips whitespaces from the end of `string` and calls `util.cache` with `dir`, `string`, no salt or transformations, and the `.verbatim` suffix.

```

5304 function util.cache_verbatim(dir, string)
5305   local name = util.cache(dir, string, nil, nil, ".verbatim")
5306   return name
5307 end

```

The `util.table_copy` method creates a shallow copy of a table `t` and its metatable.

```

5308 function util.table_copy(t)
5309   local u = { }
5310   for k, v in pairs(t) do u[k] = v end
5311   return setmetatable(u, getmetatable(t))
5312 end

```

The `util.encode_json_string` method encodes a string `s` in JSON.

```

5313 function util.encode_json_string(s)
5314   s = s:gsub([[\\]], [[\\]])
5315   s = s:gsub([[\"]], [[\"]])
5316   return [["]] .. s .. [["]]
5317 end

```

The `util.expand_tabs_in_line` expands tabs in string `s`. If `tabstop` is specified, it is used as the tab stop width. Otherwise, the tab stop width of 4 characters is

used. The method is a copy of the tab expansion algorithm from Ierusalimschy [18, Chapter 21].

```
5318 function util.expand_tabs_in_line(s, tabstop)
5319   local tab = tabstop or 4
5320   local corr = 0
5321   return (s:gsub("()\t", function(p)
5322     local sp = tab - (p - 1 + corr) % tab
5323     corr = corr - 1 + sp
5324     return string.rep(" ", sp)
5325   end))
5326 end
```

The `util.walk` method walks a rope `t`, applying a function `f` to each leaf element in order. A rope is an array whose elements may be ropes, strings, numbers, or functions. If a leaf element is a function, call it and get the return value before proceeding.

```
5327 function util.walk(t, f)
5328   local typ = type(t)
5329   if typ == "string" then
5330     f(t)
5331   elseif typ == "table" then
5332     local i = 1
5333     local n
5334     n = t[i]
5335     while n do
5336       util.walk(n, f)
5337       i = i + 1
5338       n = t[i]
5339     end
5340   elseif typ == "function" then
5341     local ok, val = pcall(t)
5342     if ok then
5343       util.walk(val, f)
5344     end
5345   else
5346     f(tostring(t))
5347   end
5348 end
```

The `util.flatten` method flattens an array `ary` that does not contain cycles and returns the result.

```
5349 function util.flatten(ary)
5350   local new = {}
5351   for _,v in ipairs(ary) do
5352     if type(v) == "table" then
5353       for _,w in ipairs(util.flatten(v)) do
5354         new[#new + 1] = w
5355       end
5356     end
5357   end
5358   return new
5359 end
```

```

5355     end
5356   else
5357     new[#new + 1] = v
5358   end
5359 end
5360 return new
5361 end

```

The `util.rope_to_string` method converts a rope `rope` to a string and returns it. For the definition of a rope, see the definition of the `util.walk` method.

```

5362 function util.rope_to_string(rope)
5363   local buffer = {}
5364   util.walk(rope, function(x) buffer[#buffer + 1] = x end)
5365   return table.concat(buffer)
5366 end

```

The `util.rope_last` method retrieves the last item in a rope. For the definition of a rope, see the definition of the `util.walk` method.

```

5367 function util.rope_last(rope)
5368   if #rope == 0 then
5369     return nil
5370   else
5371     local l = rope[#rope]
5372     if type(l) == "table" then
5373       return util.rope_last(l)
5374     else
5375       return l
5376     end
5377   end
5378 end

```

Given an array `ary` and a string `x`, the `util.intersperse` method returns an array `new`, such that `ary[i] == new[2*(i-1)+1]` and `new[2*i] == x` for all $1 \leq i \leq \#ary$.

```

5379 function util.intersperse(ary, x)
5380   local new = {}
5381   local l = #ary
5382   for i,v in ipairs(ary) do
5383     local n = #new
5384     new[n + 1] = v
5385     if i ~= l then
5386       new[n + 2] = x
5387     end
5388   end
5389   return new
5390 end

```

Given an array `ary` and a function `f`, the `util.map` method returns an array `new`, such that `new[i] == f(ary[i])` for all $1 \leq i \leq \#ary$.

```
5391 function util.map(ary, f)
5392   local new = {}
5393   for i,v in ipairs(ary) do
5394     new[i] = f(v)
5395   end
5396   return new
5397 end
```

Given a table `char_escapes` mapping escapable characters to escaped strings and optionally a table `string_escapes` mapping escapable strings to escaped strings, the `util.escaper` method returns an escaper function that escapes all occurrences of escapable strings and characters (in this order).

The method uses LPeg, which is faster than the Lua `string.gsub` built-in method.

```
5398 function util.escaper(char_escapes, string_escapes)
```

Build a string of escapable characters.

```
5399   local char_escapes_list = ""
5400   for i,_ in pairs(char_escapes) do
5401     char_escapes_list = char_escapes_list .. i
5402   end
```

Create an LPeg capture `escapable` that produces the escaped string corresponding to the matched escapable character.

```
5403   local escapable = S(char_escapes_list) / char_escapes
```

If `string_escapes` is provided, turn `escapable` into the

$$\sum_{(k,v) \in \text{string_escapes}} P(k) / v + \text{escapable}$$

capture that replaces any occurrence of the string `k` with the string `v` for each $(k,v) \in \text{string_escapes}$. Note that the pattern summation is not commutative and its operands are inspected in the summation order during the matching. As a corollary, the strings always take precedence over the characters.

```
5404   if string_escapes then
5405     for k,v in pairs(string_escapes) do
5406       escapable = P(k) / v + escapable
5407     end
5408   end
```

Create an LPeg capture `escape_string` that captures anything `escapable` does and matches any other unmatched characters.

```
5409   local escape_string = Cs((escapable + any)^0)
```

Return a function that matches the input string `s` against the `escape_string` capture.

```

5410 return function(s)
5411     return lpeg.match(escape_string, s)
5412 end
5413 end

```

The `util.pathname` method produces a pathname out of a directory name `dir` and a filename `file` and returns it.

```

5414 function util.pathname(dir, file)
5415     if #dir == 0 then
5416         return file
5417     else
5418         return dir .. "/" .. file
5419     end
5420 end

```

The `util.salt` method produces cryptographic salt out of a table of options `options`.

```

5421 function util.salt(options)
5422     local opt_string = {}
5423     for k, _ in pairs(defaultOptions) do
5424         local v = options[k]
5425         if type(v) == "table" then
5426             for _, i in ipairs(v) do
5427                 opt_string[#opt_string+1] = k .. "=" .. tostring(i)
5428             end
5429         end
5430     end
5431     table.sort(opt_string)
5432     local salt = table.concat(opt_string, ",")
5433     .. "," .. metadata.version
5434     return salt
5435 end

```

The `cacheDir` option is disregarded.

```

5429     elseif k ~= "cacheDir" then
5430         opt_string[#opt_string+1] = k .. "=" .. tostring(v)
5431     end
5432 end
5433 table.sort(opt_string)
5434 local salt = table.concat(opt_string, ",")
5435     .. "," .. metadata.version
5436 return salt
5437 end

```

The `util.warning` method produces a warning `s` that is unrelated to any specific markdown text being processed. For warnings that are specific to a markdown text, use `writer->warning` function.

```

5438 util.warning = (function()
5439     local function warning(s)
5440         io.stderr:write("Warning: " .. s .. "\n")
5441     end
5442     for _, message in ipairs(early_warnings) do
5443         warning(message)
5444     end
5445     return warning
5446 end)()

```

The `util.casefold` method performs a full case-folding of a UTF-8-encoded Unicode string `s` based on the low-level parsers in `unicode_data.casefold_mapping`, defined in Section 3.1.1.4. Unlike the low-level parsers, the high-level function is invariant to the number of bytes the Unicode characters occupy after conversion to UTF-8.

```
5447 util.casefold = (function()
5448   local fail, any = P(false), P(1)
5449   local eof = -any
```

First, define a parser that will case-fold a character.

```
5450   local fold_character = fail
5451   for n = 1, 4 do
5452     fold_character
5453     = fold_character
5454     + unicode_data.casefold_mapping[n]
5455   end
5456   fold_character
5457   = fold_character
5458   + C(any)
```

Next, define a parser that will case-fold a string.

```
5459   local fold_string = Ct(fold_character^0) * eof
5460   return function(s, form)
5461     local result = table.concat(lpeg.match(fold_string, s))
5462     assert(result ~= nil)
```

For NFD and NFKD normalization forms, normalize the case-folded string and then repeat the fold-and-normalize operation.

```
5463     if form == "nfd" or form == "nfkd" then
5464       result = util.normalize(result, form)
5465       result = table.concat(lpeg.match(fold_string, result))
5466       assert(result ~= nil)
5467       result = util.normalize(result, form)
5468     end
5469     return result
5470   end
5471 end)()
```

The `util.canonically_order` method performs a Unicode canonical ordering of a string UTF-8-encoded Unicode `s` based on the low-level parsers in `unicode_data.ccc`, defined in Section 3.1.1.6. Unlike the low-level parsers, the high-level function is invariant to the number of bytes the Unicode characters occupy after conversion to UTF-8.

```
5472 util.canonically_order = (function()
5473   local fail, any = P(false), P(1)
5474   local eof = -any
5475   local cont = R("\128\191")
5476   local utf8_character
```

```

5477     = R("\0\127")
5478     + R("\194\223") * cont
5479     + R("\224\239") * cont * cont
5480     + R("\240\244") * cont * cont * cont

```

First, define a parser that will determine the combining class of a character.

```

5481     local classify_character = fail
5482     for n = 1, 4 do
5483         classify_character
5484         = classify_character
5485         + unicode_data.ccc[n]
5486     end
5487     classify_character
5488     = classify_character
5489     + utf8_character * Cc(0)

```

Next, define a parser that will determine the combining classes of all characters in a string.

```

5490     local classify_string = Ct(classify_character^0) * eof

```

When the function is called, first check whether the string is trivially ordered. If it is, return it without any changes.

```

5491     return function(s)
5492         local s_len = utf8.len(s)
5493         if s == false or s_len <= 1 then
5494             return s
5495         end

```

Otherwise, determine the combining classes of all characters in the string. If the string cannot be decoded with UTF-8, return it unchanged.

```

5496         local classes = lpeg.match(classify_string, s)
5497         if classes == nil then
5498             return s
5499         end
5500         assert(#classes == s_len)

```

Again, check whether the string is trivially ordered. If it is, return it without any changes. Otherwise, construct a list of ranges of non-starter characters that must be ordered.

```

5501         local non_starter_ranges = {}
5502         local first_non_starter, last_non_starter = nil, nil
5503         for i = 1, #classes do
5504             if first_non_starter == nil then
5505                 if classes[i] ~= 0 then
5506                     first_non_starter, last_non_starter = i, i
5507                 end
5508             else
5509                 if classes[i] == 0 then

```



```

5510         table.insert(
5511             non_starter_ranges,
5512             {first_non_starter, last_non_starter}
5513         )
5514         first_non_starter, last_non_starter = nil, nil
5515     else
5516         last_non_starter = i
5517     end
5518 end
5519 end
5520 if first_non_starter ~= nil then
5521     table.insert(
5522         non_starter_ranges,
5523         {first_non_starter, last_non_starter}
5524     )
5525 end
5526 if #non_starter_ranges == 0 then
5527     return s
5528 end
5529 local max_range_length = 0
5530 for _, range in ipairs(non_starter_ranges) do
5531     local range_start, range_end = table.unpack(range)
5532     local range_length = range_end - range_start + 1
5533     if range_length > max_range_length then
5534         max_range_length = range_length
5535     end
5536 end
5537 if max_range_length <= 1 then
5538     return s
5539 end

```

Then, construct a buffer of all characters in the string.

```

5540     local buffer = {}
5541     for _, code in utf8.codes(s) do
5542         local char = utf8.char(code)
5543         table.insert(buffer, char)
5544     end
5545     assert(#buffer == s_len)

```

Next, perform a local bubble sort over the ranges of non-starter characters.

```

5546     for _, range in ipairs(non_starter_ranges) do
5547         local range_start, range_end = table.unpack(range)
5548         local range_length = range_end - range_start + 1
5549         for _ = 1, range_length - 1 do
5550             local swapped = false
5551             for i = range_start, range_end - 1 do
5552                 local j = i + 1
5553                 if classes[i] > classes[j] then

```

```

5554         classes[i], classes[j] = classes[j], classes[i]
5555         buffer[i], buffer[j] = buffer[j], buffer[i]
5556         swapped = true
5557     end
5558 end
5559 if not swapped then
5560     break
5561 end
5562 end
5563 end

```

Finally, concatenate the buffer and return an ordered string.

```

5564     return table.concat(buffer, "")
5565 end
5566 end)()

```

The `util.decompose` method performs either the canonical or the compatibility decomposition of a UTF-8-encoded Unicode string `s` based on the low-level parsers in `unicode_data.decomposition_mapping`, defined in sections 3.1.1.1 and 3.1.1.2. Unlike the low-level parsers, the high-level function is invariant to the number of bytes the Unicode characters occupy after conversion to UTF-8.

```

5567 util.decompose = (function()
5568     local fail, any = P(false), P(1)
5569     local eof = -any
5570     local decomposition_types = {"canonical", "compatibility"}

```

First, define parsers that will decompose a character.

```

5571     local decompose_character = {}
5572     for _, decomposition_type in ipairs(decomposition_types) do
5573         decompose_character[decomposition_type] = fail
5574         for n = 1, 4 do
5575             decompose_character[decomposition_type]
5576                 = decompose_character[decomposition_type]
5577                 + unicode_data.decomposition_mapping[decomposition_type][n]
5578         end
5579         decompose_character[decomposition_type]
5580             = decompose_character[decomposition_type]
5581             + C(any)
5582     end
5583     local hangul = unicode_data.decomposition_mapping.hangul
5584     decompose_character.hangul = {}
5585     for syllable_type, _ in pairs(hangul) do
5586         decompose_character.hangul[syllable_type] = fail
5587         for n = 1, 4 do
5588             decompose_character.hangul[syllable_type]
5589                 = decompose_character.hangul[syllable_type]
5590                 + hangul[syllable_type][n]
5591         end

```

```

5592     decompose_character.hangul[syllable_type]
5593     = decompose_character.hangul[syllable_type]
5594     + C(any)
5595 end

```

Next, define a parser that will decompose a string.

```

5596 local decompose_string = {}
5597 for _, decomposition_type in ipairs(decomposition_types) do
5598     decompose_string[decomposition_type]
5599     = Ct(decompose_character[decomposition_type]^0) * eof
5600 end
5601 decompose_string.hangul = {}
5602 for syllable_type, _ in pairs(hangul) do
5603     decompose_string.hangul[syllable_type]
5604     = Ct(decompose_character.hangul[syllable_type]^0) * eof
5605 end
5606 local function _decompose(s, parser)
5607     assert(s ~= nil)
5608     local result = table.concat(lpeg.match(parser, s), "")
5609     assert(result ~= nil)
5610     return result
5611 end
5612 return function(s, decomposition_type)
5613     assert(
5614         decomposition_type == "canonical"
5615         or decomposition_type == "compatibility"
5616     )
5617     local prev_s
5618     local next_s = s
5619     repeat
5620         prev_s = next_s
5621         local function decompose(...) next_s = _decompose(next_s, ...) end
5622         decompose(decompose_string.canonical)
5623         if decomposition_type == "compatibility" then
5624             decompose(decompose_string.compatibility)
5625         end
5626         decompose(decompose_string.hangul.LVT)
5627         decompose(decompose_string.hangul.LV)
5628     until prev_s == next_s
5629     return util.canonically_order(next_s)
5630 end
5631 end)()

```

The `util.compose` method performs the canonical composition of a UTF-8-encoded canonically ordered Unicode string `s` based on the low-level parsers in `unicode_data.composition_mapping`, defined in Section 3.1.1.3, and definitions from the Hangul syllable (de)composition algorithm, defined in Section 3.1.1.2. Un-

like the low-level parsers, this high-level function is invariant to the number of bytes the Unicode characters occupy after conversion to UTF-8.

```
5632 util.compose = (function()
5633   local fail, any = P(false), P(1)
5634   local eof = -any
5635   local cont = R("\128\191")
5636   local utf8_character
5637     = R("\0\127")
5638     + R("\194\223") * cont
5639     + R("\224\239") * cont * cont
5640     + R("\240\244") * cont * cont * cont
```

First, define a parser that will determine the combining class of a character.

```
5641   local classify_character = fail
5642   for n = 1, 4 do
5643     classify_character
5644       = classify_character
5645       + unicode_data.ccc[n]
5646   end
5647   classify_character
5648     = classify_character
5649     + utf8_character * Cc(0)
```

Next, define a parser that will determine the combining classes of all characters in a string.

```
5650   local classify_string = Ct(classify_character^0) * eof
```

First, define parsers that will compose a pair of UTF-8-encoded Unicode characters into their primary composite.

```
5651   local compose_characters = fail
5652   for m = 1, 4 do
5653     local starter = #unicode_data.composition_mapping.starters[m]
5654     local both = fail
5655     for n = 1, 4 do
5656       both = (
5657         both
5658         + #unicode_data.composition_mapping.both[m][n]
5659         * unicode_data.composition_mapping.both[m][n]
5660       )
5661     end
5662     compose_characters = compose_characters + starter * both
5663   end
```

When the function is called, first check whether the string is trivially ordered. If it is, return it without any changes.

```
5664   return function(s)
5665     local s_len = utf8.len(s)
5666     if s == false or s_len <= 1 then
```

```

5667     return s
5668 end

```

Otherwise, determine the combining classes of all characters in the string. If the string cannot be decoded with UTF-8, return it unchanged.

```

5669     local classes = lpeg.match(classify_string, s)
5670     if classes == nil then
5671         return s
5672     end
5673     assert(#classes == s_len)

```

Otherwise, construct a buffer of all characters in the string.

```

5674     local buffer = {}
5675     for _, code in utf8.codes(s) do
5676         local char = utf8.char(code)
5677         table.insert(buffer, char)
5678     end
5679     assert(#buffer == s_len)

```

Finally, implement the composition algorithm.

First, find the first starter character in the string.

```

5680     local starter = 1
5681     while starter <= s_len and classes[starter] ~= 0 do
5682         starter = starter + 1
5683     end
5684     local candidate_combining_mark = starter + 1

```

Next, apply the composition rules until we reach the end of the string.

```

5685     while candidate_combining_mark <= s_len do
5686         local L = buffer[starter]
5687         local C = buffer[candidate_combining_mark]
5688         local P = lpeg.match(compose_characters, L .. C)
5689         if P ~= nil then
5690             buffer[starter] = P
5691             buffer[candidate_combining_mark] = ""
5692         else
5693             if classes[candidate_combining_mark] == 0 then
5694                 starter = candidate_combining_mark
5695             end
5696             candidate_combining_mark = candidate_combining_mark + 1
5697         end
5698         assert(starter <= s_len)
5699     end

```

Next, iterate over the string once more and compose Hangul syllables.

```

5700     for i = 1, s_len - 1 do
5701         local last, ch = buffer[i], buffer[i + 1]
5702         if last ~= "" and ch ~= "" then
5703             local composite = unicode_data.hangul_compose(last, ch)

```

```

5704         if composite ~= nil then
5705             buffer[i] = ""
5706             buffer[i + 1] = composite
5707         end
5708     end
5709 end

```

Finally, concatenate the buffer and return an ordered string.

```

5710     return table.concat(buffer, "")
5711 end
5712 end)()

```

The `util.normalize` method normalizes a UTF-8-encoded canonically ordered Unicode string `s` using the normalization form `form`.

```

5713 function util.normalize(s, form)
5714     if form == "nfd" then
5715         return util.decompose(s, "canonical")
5716     elseif form == "nfkd" then
5717         return util.decompose(s, "compatibility")
5718     elseif form == "nfc" then
5719         return util.compose(util.decompose(s, "canonical"))
5720     elseif form == "nfkc" then
5721         return util.compose(util.decompose(s, "compatibility"))
5722     else
5723         error(string.format('Unexpected normal form "%s"', form))
5724     end
5725 end

```

The `util.find_file` and `util.find_files` method find the first or all locations of a file, respectively, according to either the resolvers API [1, Section 11.5] from the ConTeXt format or the Kpathsea library.

```

5726 function util.find_file(filename)
5727     if resolvers ~= nil then
5728         return resolvers.findfile(filename)
5729     else
5730         return kpse.find_file(filename)
5731     end
5732 end
5733 function util.find_files(filename)
5734     if resolvers ~= nil then
5735         return resolvers.findfiles(filename)
5736     else
5737         return {kpse.lookup(filename, {all=true})}
5738     end
5739 end

```

3.1.3 HTML Entities

This section documents the HTML entities recognized by the markdown reader. These functions are encapsulated in the `entities` object. The functions were originally located in the `lunamark/entities.lua` file in the Lunamark Lua module.

```
5740 local entities = {}
5741
5742 local character_entities = {
5743     ["Tab"] = 9,
5744     ["NewLine"] = 10,
5745     ["excl"] = 33,
5746     ["QUOT"] = 34,
5747     ["quot"] = 34,
5748     ["num"] = 35,
5749     ["dollar"] = 36,
5750     ["percent"] = 37,
5751     ["AMP"] = 38,
5752     ["amp"] = 38,
5753     ["apos"] = 39,
5754     ["lpar"] = 40,
5755     ["rpar"] = 41,
5756     ["ast"] = 42,
5757     ["midast"] = 42,
5758     ["plus"] = 43,
5759     ["comma"] = 44,
5760     ["period"] = 46,
5761     ["sol"] = 47,
5762     ["colon"] = 58,
5763     ["semi"] = 59,
5764     ["LT"] = 60,
5765     ["lt"] = 60,
5766     ["nvlt"] = {60, 8402},
5767     ["bne"] = {61, 8421},
5768     ["equals"] = 61,
5769     ["GT"] = 62,
5770     ["gt"] = 62,
5771     ["nvgt"] = {62, 8402},
5772     ["quest"] = 63,
5773     ["commat"] = 64,
5774     ["lbrack"] = 91,
5775     ["lsqb"] = 91,
5776     ["bsol"] = 92,
5777     ["rbrack"] = 93,
5778     ["rsqb"] = 93,
5779     ["Hat"] = 94,
5780     ["UnderBar"] = 95,
5781     ["lowbar"] = 95,
```

```

5782 ["DiacriticalGrave"] = 96,
5783 ["grave"] = 96,
5784 ["fjlig"] = {102, 106},
5785 ["lbrace"] = 123,
5786 ["lcub"] = 123,
5787 ["VerticalLine"] = 124,
5788 ["verbar"] = 124,
5789 ["vert"] = 124,
5790 ["rbrace"] = 125,
5791 ["rcub"] = 125,
5792 ["NonBreakingSpace"] = 160,
5793 ["nbsp"] = 160,
5794 ["iexcl"] = 161,
5795 ["cent"] = 162,
5796 ["pound"] = 163,
5797 ["curren"] = 164,
5798 ["yen"] = 165,
5799 ["brvbar"] = 166,
5800 ["sect"] = 167,
5801 ["Dot"] = 168,
5802 ["DoubleDot"] = 168,
5803 ["die"] = 168,
5804 ["uml"] = 168,
5805 ["COPY"] = 169,
5806 ["copy"] = 169,
5807 ["ordf"] = 170,
5808 ["laquo"] = 171,
5809 ["not"] = 172,
5810 ["shy"] = 173,
5811 ["REG"] = 174,
5812 ["circledR"] = 174,
5813 ["reg"] = 174,
5814 ["macr"] = 175,
5815 ["strns"] = 175,
5816 ["deg"] = 176,
5817 ["PlusMinus"] = 177,
5818 ["plusmn"] = 177,
5819 ["pm"] = 177,
5820 ["sup2"] = 178,
5821 ["sup3"] = 179,
5822 ["DiacriticalAcute"] = 180,
5823 ["acute"] = 180,
5824 ["micro"] = 181,
5825 ["para"] = 182,
5826 ["CenterDot"] = 183,
5827 ["centerdot"] = 183,
5828 ["middot"] = 183,

```


5829 ["Cedilla"] = 184,
 5830 ["cedil"] = 184,
 5831 ["sup1"] = 185,
 5832 ["ordm"] = 186,
 5833 ["raquo"] = 187,
 5834 ["frac14"] = 188,
 5835 ["frac12"] = 189,
 5836 ["half"] = 189,
 5837 ["frac34"] = 190,
 5838 ["iquest"] = 191,
 5839 ["Agrave"] = 192,
 5840 ["Aacute"] = 193,
 5841 ["Acirc"] = 194,
 5842 ["Atilde"] = 195,
 5843 ["Auml"] = 196,
 5844 ["Aring"] = 197,
 5845 ["angst"] = 197,
 5846 ["AElig"] = 198,
 5847 ["Ccedil"] = 199,
 5848 ["Egrave"] = 200,
 5849 ["Eacute"] = 201,
 5850 ["Ecirc"] = 202,
 5851 ["Euml"] = 203,
 5852 ["Igrave"] = 204,
 5853 ["Iacute"] = 205,
 5854 ["Icirc"] = 206,
 5855 ["Iuml"] = 207,
 5856 ["ETH"] = 208,
 5857 ["Ntilde"] = 209,
 5858 ["Ograve"] = 210,
 5859 ["Oacute"] = 211,
 5860 ["Ocirc"] = 212,
 5861 ["Otilde"] = 213,
 5862 ["Ouml"] = 214,
 5863 ["times"] = 215,
 5864 ["Oslash"] = 216,
 5865 ["Ugrave"] = 217,
 5866 ["Uacute"] = 218,
 5867 ["Ucirc"] = 219,
 5868 ["Uuml"] = 220,
 5869 ["Yacute"] = 221,
 5870 ["THORN"] = 222,
 5871 ["szlig"] = 223,
 5872 ["agrave"] = 224,
 5873 ["aacute"] = 225,
 5874 ["acirc"] = 226,
 5875 ["atilde"] = 227,

```

5876 ["auml"] = 228,
5877 ["aring"] = 229,
5878 ["aelig"] = 230,
5879 ["ccedil"] = 231,
5880 ["egrave"] = 232,
5881 ["eacute"] = 233,
5882 ["ecirc"] = 234,
5883 ["euml"] = 235,
5884 ["igrave"] = 236,
5885 ["iacute"] = 237,
5886 ["icirc"] = 238,
5887 ["iuml"] = 239,
5888 ["eth"] = 240,
5889 ["ntilde"] = 241,
5890 ["ograve"] = 242,
5891 ["oacute"] = 243,
5892 ["ocirc"] = 244,
5893 ["otilde"] = 245,
5894 ["ouml"] = 246,
5895 ["div"] = 247,
5896 ["divide"] = 247,
5897 ["oslash"] = 248,
5898 ["ugrave"] = 249,
5899 ["uacute"] = 250,
5900 ["ucirc"] = 251,
5901 ["uuml"] = 252,
5902 ["yacute"] = 253,
5903 ["thorn"] = 254,
5904 ["yuml"] = 255,
5905 ["Amacr"] = 256,
5906 ["amacr"] = 257,
5907 ["Abreve"] = 258,
5908 ["abreve"] = 259,
5909 ["Aogon"] = 260,
5910 ["aogon"] = 261,
5911 ["Cacute"] = 262,
5912 ["cacute"] = 263,
5913 ["Ccirc"] = 264,
5914 ["ccirc"] = 265,
5915 ["Cdot"] = 266,
5916 ["cdot"] = 267,
5917 ["Ccaron"] = 268,
5918 ["ccaron"] = 269,
5919 ["Dcaron"] = 270,
5920 ["dcaron"] = 271,
5921 ["Dstrok"] = 272,
5922 ["dstrok"] = 273,

```

```

5923 ["Emacr"] = 274,
5924 ["emacr"] = 275,
5925 ["Edot"] = 278,
5926 ["edot"] = 279,
5927 ["Eogon"] = 280,
5928 ["eogon"] = 281,
5929 ["Ecaron"] = 282,
5930 ["ecaron"] = 283,
5931 ["Gcirc"] = 284,
5932 ["gcirc"] = 285,
5933 ["Gbreve"] = 286,
5934 ["gbreve"] = 287,
5935 ["Gdot"] = 288,
5936 ["gdot"] = 289,
5937 ["Gcedil"] = 290,
5938 ["Hcirc"] = 292,
5939 ["hcirc"] = 293,
5940 ["Hstrokr"] = 294,
5941 ["hstrokr"] = 295,
5942 ["Itilde"] = 296,
5943 ["itilde"] = 297,
5944 ["Imacr"] = 298,
5945 ["imacr"] = 299,
5946 ["Iogon"] = 302,
5947 ["iogon"] = 303,
5948 ["Idot"] = 304,
5949 ["imath"] = 305,
5950 ["inodot"] = 305,
5951 ["IJlig"] = 306,
5952 ["ijlig"] = 307,
5953 ["Jcirc"] = 308,
5954 ["jcirc"] = 309,
5955 ["Kcedil"] = 310,
5956 ["kcedil"] = 311,
5957 ["kgreen"] = 312,
5958 ["Lacute"] = 313,
5959 ["lacute"] = 314,
5960 ["Lcedil"] = 315,
5961 ["lcedil"] = 316,
5962 ["Lcaron"] = 317,
5963 ["lcaron"] = 318,
5964 ["Lmidot"] = 319,
5965 ["lmidot"] = 320,
5966 ["Lstrokr"] = 321,
5967 ["lstrokr"] = 322,
5968 ["Nacute"] = 323,
5969 ["nacute"] = 324,

```

5970 ["Ncedil"] = 325,
 5971 ["ncedil"] = 326,
 5972 ["Ncaron"] = 327,
 5973 ["ncaron"] = 328,
 5974 ["napos"] = 329,
 5975 ["ENG"] = 330,
 5976 ["eng"] = 331,
 5977 ["Omacr"] = 332,
 5978 ["omacr"] = 333,
 5979 ["Odblac"] = 336,
 5980 ["odblac"] = 337,
 5981 ["OElig"] = 338,
 5982 ["oelig"] = 339,
 5983 ["Racute"] = 340,
 5984 ["racute"] = 341,
 5985 ["Rcedil"] = 342,
 5986 ["rcedil"] = 343,
 5987 ["Rcaron"] = 344,
 5988 ["rcaron"] = 345,
 5989 ["Sacute"] = 346,
 5990 ["sacute"] = 347,
 5991 ["Scirc"] = 348,
 5992 ["scirc"] = 349,
 5993 ["Scedil"] = 350,
 5994 ["scedil"] = 351,
 5995 ["Scaron"] = 352,
 5996 ["scaron"] = 353,
 5997 ["Tcedil"] = 354,
 5998 ["tcedil"] = 355,
 5999 ["Tcaron"] = 356,
 6000 ["tcaron"] = 357,
 6001 ["Tstrok"] = 358,
 6002 ["tstrok"] = 359,
 6003 ["Utilde"] = 360,
 6004 ["utilde"] = 361,
 6005 ["Umacr"] = 362,
 6006 ["umacr"] = 363,
 6007 ["Ubreve"] = 364,
 6008 ["ubreve"] = 365,
 6009 ["Uring"] = 366,
 6010 ["uring"] = 367,
 6011 ["Udblac"] = 368,
 6012 ["udblac"] = 369,
 6013 ["Uogon"] = 370,
 6014 ["uogon"] = 371,
 6015 ["Wcirc"] = 372,
 6016 ["wcirc"] = 373,

6017 ["Ycirc"] = 374,
 6018 ["ycirc"] = 375,
 6019 ["Yuml"] = 376,
 6020 ["Zacute"] = 377,
 6021 ["zacute"] = 378,
 6022 ["Zdot"] = 379,
 6023 ["zdot"] = 380,
 6024 ["Zcaron"] = 381,
 6025 ["zcaron"] = 382,
 6026 ["fnof"] = 402,
 6027 ["imped"] = 437,
 6028 ["gacute"] = 501,
 6029 ["jmath"] = 567,
 6030 ["circ"] = 710,
 6031 ["Hacek"] = 711,
 6032 ["caron"] = 711,
 6033 ["Breve"] = 728,
 6034 ["breve"] = 728,
 6035 ["DiacriticalDot"] = 729,
 6036 ["dot"] = 729,
 6037 ["ring"] = 730,
 6038 ["ogon"] = 731,
 6039 ["DiacriticalTilde"] = 732,
 6040 ["tilde"] = 732,
 6041 ["DiacriticalDoubleAcute"] = 733,
 6042 ["dblac"] = 733,
 6043 ["DownBreve"] = 785,
 6044 ["Alpha"] = 913,
 6045 ["Beta"] = 914,
 6046 ["Gamma"] = 915,
 6047 ["Delta"] = 916,
 6048 ["Epsilon"] = 917,
 6049 ["Zeta"] = 918,
 6050 ["Eta"] = 919,
 6051 ["Theta"] = 920,
 6052 ["Iota"] = 921,
 6053 ["Kappa"] = 922,
 6054 ["Lambda"] = 923,
 6055 ["Mu"] = 924,
 6056 ["Nu"] = 925,
 6057 ["Xi"] = 926,
 6058 ["Omicron"] = 927,
 6059 ["Pi"] = 928,
 6060 ["Rho"] = 929,
 6061 ["Sigma"] = 931,
 6062 ["Tau"] = 932,
 6063 ["Upsilon"] = 933,

```

6064 ["Phi"] = 934,
6065 ["Chi"] = 935,
6066 ["Psi"] = 936,
6067 ["Omega"] = 937,
6068 ["ohm"] = 937,
6069 ["alpha"] = 945,
6070 ["beta"] = 946,
6071 ["gamma"] = 947,
6072 ["delta"] = 948,
6073 ["epsi"] = 949,
6074 ["epsilon"] = 949,
6075 ["zeta"] = 950,
6076 ["eta"] = 951,
6077 ["theta"] = 952,
6078 ["iota"] = 953,
6079 ["kappa"] = 954,
6080 ["lambda"] = 955,
6081 ["mu"] = 956,
6082 ["nu"] = 957,
6083 ["xi"] = 958,
6084 ["omicron"] = 959,
6085 ["pi"] = 960,
6086 ["rho"] = 961,
6087 ["sigmaf"] = 962,
6088 ["sigmav"] = 962,
6089 ["varsigma"] = 962,
6090 ["sigma"] = 963,
6091 ["tau"] = 964,
6092 ["upsi"] = 965,
6093 ["upsilon"] = 965,
6094 ["phi"] = 966,
6095 ["chi"] = 967,
6096 ["psi"] = 968,
6097 ["omega"] = 969,
6098 ["thetasym"] = 977,
6099 ["thetav"] = 977,
6100 ["vartheta"] = 977,
6101 ["Upsi"] = 978,
6102 ["upsih"] = 978,
6103 ["phiv"] = 981,
6104 ["straightphi"] = 981,
6105 ["varphi"] = 981,
6106 ["piv"] = 982,
6107 ["varpi"] = 982,
6108 ["Gammad"] = 988,
6109 ["digamma"] = 989,
6110 ["gammad"] = 989,

```

```

6111 ["kappav"] = 1008,
6112 ["varkappa"] = 1008,
6113 ["rhov"] = 1009,
6114 ["varrho"] = 1009,
6115 ["epsiv"] = 1013,
6116 ["straightepsilon"] = 1013,
6117 ["varepsilon"] = 1013,
6118 ["backepsilon"] = 1014,
6119 ["bepsi"] = 1014,
6120 ["IOcy"] = 1025,
6121 ["DJcy"] = 1026,
6122 ["GJcy"] = 1027,
6123 ["Jukcy"] = 1028,
6124 ["DScy"] = 1029,
6125 ["Iukcy"] = 1030,
6126 ["YIcy"] = 1031,
6127 ["Jsercy"] = 1032,
6128 ["LJcy"] = 1033,
6129 ["NJcy"] = 1034,
6130 ["TSHcy"] = 1035,
6131 ["KJcy"] = 1036,
6132 ["Ubrcy"] = 1038,
6133 ["DZcy"] = 1039,
6134 ["Acy"] = 1040,
6135 ["Bcy"] = 1041,
6136 ["Vcy"] = 1042,
6137 ["Gcy"] = 1043,
6138 ["Dcy"] = 1044,
6139 ["IEcy"] = 1045,
6140 ["ZHcy"] = 1046,
6141 ["Zcy"] = 1047,
6142 ["Icy"] = 1048,
6143 ["Jcy"] = 1049,
6144 ["Kcy"] = 1050,
6145 ["Lcy"] = 1051,
6146 ["Mcy"] = 1052,
6147 ["Ncy"] = 1053,
6148 ["Ocy"] = 1054,
6149 ["Pcy"] = 1055,
6150 ["Rcy"] = 1056,
6151 ["Scy"] = 1057,
6152 ["Tcy"] = 1058,
6153 ["Ucy"] = 1059,
6154 ["Fcy"] = 1060,
6155 ["KHcy"] = 1061,
6156 ["TScy"] = 1062,
6157 ["CHcy"] = 1063,

```

```

6158 ["SHcy"] = 1064,
6159 ["SHCHcy"] = 1065,
6160 ["HARDcy"] = 1066,
6161 ["Ycy"] = 1067,
6162 ["SOFTcy"] = 1068,
6163 ["Ecy"] = 1069,
6164 ["YUcy"] = 1070,
6165 ["YAcy"] = 1071,
6166 ["acy"] = 1072,
6167 ["bcy"] = 1073,
6168 ["vcy"] = 1074,
6169 ["gcy"] = 1075,
6170 ["dcy"] = 1076,
6171 ["iecy"] = 1077,
6172 ["zhcy"] = 1078,
6173 ["zcy"] = 1079,
6174 ["icy"] = 1080,
6175 ["jcy"] = 1081,
6176 ["kcy"] = 1082,
6177 ["lcy"] = 1083,
6178 ["mcy"] = 1084,
6179 ["ncy"] = 1085,
6180 ["ocy"] = 1086,
6181 ["pcy"] = 1087,
6182 ["rcy"] = 1088,
6183 ["scy"] = 1089,
6184 ["tcy"] = 1090,
6185 ["ucy"] = 1091,
6186 ["fcy"] = 1092,
6187 ["khcy"] = 1093,
6188 ["tscy"] = 1094,
6189 ["chcy"] = 1095,
6190 ["shcy"] = 1096,
6191 ["shchcy"] = 1097,
6192 ["hardcy"] = 1098,
6193 ["ycy"] = 1099,
6194 ["softcy"] = 1100,
6195 ["ecy"] = 1101,
6196 ["yucy"] = 1102,
6197 ["yacy"] = 1103,
6198 ["iocy"] = 1105,
6199 ["djcy"] = 1106,
6200 ["gjcy"] = 1107,
6201 ["jukcy"] = 1108,
6202 ["dscy"] = 1109,
6203 ["iukcy"] = 1110,
6204 ["yicy"] = 1111,

```



```

6205 ["jsercy"] = 1112,
6206 ["ljcy"] = 1113,
6207 ["njcy"] = 1114,
6208 ["tshcy"] = 1115,
6209 ["kjcy"] = 1116,
6210 ["ubrcy"] = 1118,
6211 ["dzcyc"] = 1119,
6212 ["ensp"] = 8194,
6213 ["emsp"] = 8195,
6214 ["emsp13"] = 8196,
6215 ["emsp14"] = 8197,
6216 ["numsp"] = 8199,
6217 ["puncsp"] = 8200,
6218 ["ThinSpace"] = 8201,
6219 ["thinsp"] = 8201,
6220 ["VeryThinSpace"] = 8202,
6221 ["hairsp"] = 8202,
6222 ["NegativeMediumSpace"] = 8203,
6223 ["NegativeThickSpace"] = 8203,
6224 ["NegativeThinSpace"] = 8203,
6225 ["NegativeVeryThinSpace"] = 8203,
6226 ["ZeroWidthSpace"] = 8203,
6227 ["zwnj"] = 8204,
6228 ["zwj"] = 8205,
6229 ["lrm"] = 8206,
6230 ["rlm"] = 8207,
6231 ["dash"] = 8208,
6232 ["hyphen"] = 8208,
6233 ["ndash"] = 8211,
6234 ["mdash"] = 8212,
6235 ["horbar"] = 8213,
6236 ["Verbar"] = 8214,
6237 ["Vert"] = 8214,
6238 ["OpenCurlyQuote"] = 8216,
6239 ["lsquo"] = 8216,
6240 ["CloseCurlyQuote"] = 8217,
6241 ["rsquo"] = 8217,
6242 ["rsquor"] = 8217,
6243 ["lsquor"] = 8218,
6244 ["sbquo"] = 8218,
6245 ["OpenCurlyDoubleQuote"] = 8220,
6246 ["ldquo"] = 8220,
6247 ["CloseCurlyDoubleQuote"] = 8221,
6248 ["rdquo"] = 8221,
6249 ["rdquor"] = 8221,
6250 ["bdquo"] = 8222,
6251 ["ldquor"] = 8222,

```

```

6252 ["dagger"] = 8224,
6253 ["Dagger"] = 8225,
6254 ["ddagger"] = 8225,
6255 ["bull"] = 8226,
6256 ["bullet"] = 8226,
6257 ["nldr"] = 8229,
6258 ["hellip"] = 8230,
6259 ["mldr"] = 8230,
6260 ["permil"] = 8240,
6261 ["pertenk"] = 8241,
6262 ["prime"] = 8242,
6263 ["Prime"] = 8243,
6264 ["tprime"] = 8244,
6265 ["backprime"] = 8245,
6266 ["bprime"] = 8245,
6267 ["lsaquo"] = 8249,
6268 ["rsaquo"] = 8250,
6269 ["OverBar"] = 8254,
6270 ["oline"] = 8254,
6271 ["caret"] = 8257,
6272 ["hybull"] = 8259,
6273 ["frasl"] = 8260,
6274 ["bsemi"] = 8271,
6275 ["qprime"] = 8279,
6276 ["MediumSpace"] = 8287,
6277 ["ThickSpace"] = {8287, 8202},
6278 ["NoBreak"] = 8288,
6279 ["ApplyFunction"] = 8289,
6280 ["af"] = 8289,
6281 ["InvisibleTimes"] = 8290,
6282 ["it"] = 8290,
6283 ["InvisibleComma"] = 8291,
6284 ["ic"] = 8291,
6285 ["euro"] = 8364,
6286 ["TripleDot"] = 8411,
6287 ["tdot"] = 8411,
6288 ["DotDot"] = 8412,
6289 ["Copf"] = 8450,
6290 ["complexes"] = 8450,
6291 ["incare"] = 8453,
6292 ["gscr"] = 8458,
6293 ["HilbertSpace"] = 8459,
6294 ["Hscr"] = 8459,
6295 ["hamilt"] = 8459,
6296 ["Hfr"] = 8460,
6297 ["Poincareplane"] = 8460,
6298 ["Hopf"] = 8461,

```

```

6299 ["quaternions"] = 8461,
6300 ["planckh"] = 8462,
6301 ["hbar"] = 8463,
6302 ["hslash"] = 8463,
6303 ["planck"] = 8463,
6304 ["plankv"] = 8463,
6305 ["Iscr"] = 8464,
6306 ["imagline"] = 8464,
6307 ["Ifr"] = 8465,
6308 ["Im"] = 8465,
6309 ["image"] = 8465,
6310 ["imagpart"] = 8465,
6311 ["Laplacetrfr"] = 8466,
6312 ["Lscr"] = 8466,
6313 ["lagran"] = 8466,
6314 ["ell"] = 8467,
6315 ["Nopf"] = 8469,
6316 ["naturals"] = 8469,
6317 ["numero"] = 8470,
6318 ["copysr"] = 8471,
6319 ["weierp"] = 8472,
6320 ["wp"] = 8472,
6321 ["Popf"] = 8473,
6322 ["primes"] = 8473,
6323 ["Qopf"] = 8474,
6324 ["rationals"] = 8474,
6325 ["Rscr"] = 8475,
6326 ["realine"] = 8475,
6327 ["Re"] = 8476,
6328 ["Rfr"] = 8476,
6329 ["real"] = 8476,
6330 ["realpart"] = 8476,
6331 ["Ropf"] = 8477,
6332 ["reals"] = 8477,
6333 ["rx"] = 8478,
6334 ["TRADE"] = 8482,
6335 ["trade"] = 8482,
6336 ["Zopf"] = 8484,
6337 ["integers"] = 8484,
6338 ["mho"] = 8487,
6339 ["Zfr"] = 8488,
6340 ["zeetrfr"] = 8488,
6341 ["iiota"] = 8489,
6342 ["Bernoullis"] = 8492,
6343 ["Bscr"] = 8492,
6344 ["bernou"] = 8492,
6345 ["Cayleys"] = 8493,

```

```

6346 ["Cfr"] = 8493,
6347 ["escr"] = 8495,
6348 ["Escr"] = 8496,
6349 ["expectation"] = 8496,
6350 ["Fouriertrf"] = 8497,
6351 ["Fscr"] = 8497,
6352 ["Mellintrf"] = 8499,
6353 ["Mscr"] = 8499,
6354 ["phmmat"] = 8499,
6355 ["order"] = 8500,
6356 ["orderof"] = 8500,
6357 ["oscr"] = 8500,
6358 ["alefsym"] = 8501,
6359 ["aleph"] = 8501,
6360 ["beth"] = 8502,
6361 ["gimel"] = 8503,
6362 ["daleth"] = 8504,
6363 ["CapitalDifferentialD"] = 8517,
6364 ["DD"] = 8517,
6365 ["DifferentialD"] = 8518,
6366 ["dd"] = 8518,
6367 ["ExponentialE"] = 8519,
6368 ["ee"] = 8519,
6369 ["exponentiale"] = 8519,
6370 ["ImaginaryI"] = 8520,
6371 ["ii"] = 8520,
6372 ["frac13"] = 8531,
6373 ["frac23"] = 8532,
6374 ["frac15"] = 8533,
6375 ["frac25"] = 8534,
6376 ["frac35"] = 8535,
6377 ["frac45"] = 8536,
6378 ["frac16"] = 8537,
6379 ["frac56"] = 8538,
6380 ["frac18"] = 8539,
6381 ["frac38"] = 8540,
6382 ["frac58"] = 8541,
6383 ["frac78"] = 8542,
6384 ["LeftArrow"] = 8592,
6385 ["ShortLeftArrow"] = 8592,
6386 ["larr"] = 8592,
6387 ["leftarrow"] = 8592,
6388 ["slarr"] = 8592,
6389 ["ShortUpArrow"] = 8593,
6390 ["UpArrow"] = 8593,
6391 ["uarr"] = 8593,
6392 ["uparrow"] = 8593,

```

```

6393 ["RightArrow"] = 8594,
6394 ["ShortRightArrow"] = 8594,
6395 ["rarr"] = 8594,
6396 ["rightarrow"] = 8594,
6397 ["srarr"] = 8594,
6398 ["DownArrow"] = 8595,
6399 ["ShortDownArrow"] = 8595,
6400 ["darr"] = 8595,
6401 ["downarrow"] = 8595,
6402 ["LeftRightArrow"] = 8596,
6403 ["harr"] = 8596,
6404 ["leftrightarrow"] = 8596,
6405 ["UpDownArrow"] = 8597,
6406 ["updownarrow"] = 8597,
6407 ["varr"] = 8597,
6408 ["UpperLeftArrow"] = 8598,
6409 ["nwarr"] = 8598,
6410 ["nwarrow"] = 8598,
6411 ["UpperRightArrow"] = 8599,
6412 ["nearr"] = 8599,
6413 ["nearrow"] = 8599,
6414 ["LowerRightArrow"] = 8600,
6415 ["searr"] = 8600,
6416 ["searrow"] = 8600,
6417 ["LowerLeftArrow"] = 8601,
6418 ["swarr"] = 8601,
6419 ["swarrow"] = 8601,
6420 ["nlarr"] = 8602,
6421 ["nleftarrow"] = 8602,
6422 ["nrarr"] = 8603,
6423 ["nrightarrow"] = 8603,
6424 ["nrarrw"] = {8605, 824},
6425 ["rarrw"] = 8605,
6426 ["rightsquigarrow"] = 8605,
6427 ["Larr"] = 8606,
6428 ["twoheadleftarrow"] = 8606,
6429 ["Uarr"] = 8607,
6430 ["Rarr"] = 8608,
6431 ["twoheadrightarrow"] = 8608,
6432 ["Darr"] = 8609,
6433 ["larrtl"] = 8610,
6434 ["leftarrowtail"] = 8610,
6435 ["rarrtl"] = 8611,
6436 ["rightarrowtail"] = 8611,
6437 ["LeftTeeArrow"] = 8612,
6438 ["mapstoleft"] = 8612,
6439 ["UpTeeArrow"] = 8613,

```

```

6440 ["mapstoup"] = 8613,
6441 ["RightTeeArrow"] = 8614,
6442 ["map"] = 8614,
6443 ["mapsto"] = 8614,
6444 ["DownTeeArrow"] = 8615,
6445 ["mapstodown"] = 8615,
6446 ["hookleftarrow"] = 8617,
6447 ["larrhk"] = 8617,
6448 ["hookrightarrow"] = 8618,
6449 ["rarrhk"] = 8618,
6450 ["larrlp"] = 8619,
6451 ["looparrowleft"] = 8619,
6452 ["looparrowright"] = 8620,
6453 ["rarrlp"] = 8620,
6454 ["harrw"] = 8621,
6455 ["leftrightsquigarrow"] = 8621,
6456 ["nharr"] = 8622,
6457 ["nletrightarrow"] = 8622,
6458 ["Lsh"] = 8624,
6459 ["lsh"] = 8624,
6460 ["Rsh"] = 8625,
6461 ["rsh"] = 8625,
6462 ["ldsh"] = 8626,
6463 ["rdsh"] = 8627,
6464 ["crarr"] = 8629,
6465 ["cularr"] = 8630,
6466 ["curvearrowleft"] = 8630,
6467 ["curarr"] = 8631,
6468 ["curvearrowright"] = 8631,
6469 ["circlearrowleft"] = 8634,
6470 ["olarr"] = 8634,
6471 ["circlearrowright"] = 8635,
6472 ["orarr"] = 8635,
6473 ["LeftVector"] = 8636,
6474 ["leftharpoonup"] = 8636,
6475 ["lharu"] = 8636,
6476 ["DownLeftVector"] = 8637,
6477 ["leftharpoondown"] = 8637,
6478 ["lhard"] = 8637,
6479 ["RightUpVector"] = 8638,
6480 ["uharr"] = 8638,
6481 ["upharpoonright"] = 8638,
6482 ["LeftUpVector"] = 8639,
6483 ["uharl"] = 8639,
6484 ["upharpoonleft"] = 8639,
6485 ["RightVector"] = 8640,
6486 ["rharu"] = 8640,

```

```

6487 ["rightharpoonup"] = 8640,
6488 ["DownRightVector"] = 8641,
6489 ["rhard"] = 8641,
6490 ["rightharpoondown"] = 8641,
6491 ["RightDownVector"] = 8642,
6492 ["dharr"] = 8642,
6493 ["downharpoonright"] = 8642,
6494 ["LeftDownVector"] = 8643,
6495 ["dharl"] = 8643,
6496 ["downharpoonleft"] = 8643,
6497 ["RightArrowLeftArrow"] = 8644,
6498 ["rightleftarrows"] = 8644,
6499 ["rlarr"] = 8644,
6500 ["UpArrowDownArrow"] = 8645,
6501 ["udarr"] = 8645,
6502 ["LeftArrowRightArrow"] = 8646,
6503 ["leftrightarrows"] = 8646,
6504 ["lrarr"] = 8646,
6505 ["leftleftarrows"] = 8647,
6506 ["llarr"] = 8647,
6507 ["upuparrows"] = 8648,
6508 ["uuarr"] = 8648,
6509 ["rightrightarrows"] = 8649,
6510 ["rrarr"] = 8649,
6511 ["ddarr"] = 8650,
6512 ["downdownarrows"] = 8650,
6513 ["ReverseEquilibrium"] = 8651,
6514 ["leftrightharpoons"] = 8651,
6515 ["lrhar"] = 8651,
6516 ["Equilibrium"] = 8652,
6517 ["rightleftharpoons"] = 8652,
6518 ["rlhar"] = 8652,
6519 ["nLeftarrow"] = 8653,
6520 ["nlArr"] = 8653,
6521 ["nLeftrightarrow"] = 8654,
6522 ["nhArr"] = 8654,
6523 ["nRightarrow"] = 8655,
6524 ["nrArr"] = 8655,
6525 ["DoubleLeftArrow"] = 8656,
6526 ["Leftarrow"] = 8656,
6527 ["lArr"] = 8656,
6528 ["DoubleUpArrow"] = 8657,
6529 ["Uparrow"] = 8657,
6530 ["uArr"] = 8657,
6531 ["DoubleRightArrow"] = 8658,
6532 ["Implies"] = 8658,
6533 ["Rightarrow"] = 8658,

```

```

6534 ["rArr"] = 8658,
6535 ["DoubleDownArrow"] = 8659,
6536 ["Downarrow"] = 8659,
6537 ["dArr"] = 8659,
6538 ["DoubleLeftRightArrow"] = 8660,
6539 ["Leftrightarrow"] = 8660,
6540 ["hArr"] = 8660,
6541 ["iff"] = 8660,
6542 ["DoubleUpDownArrow"] = 8661,
6543 ["Updownarrow"] = 8661,
6544 ["vArr"] = 8661,
6545 ["nwArr"] = 8662,
6546 ["neArr"] = 8663,
6547 ["seArr"] = 8664,
6548 ["swArr"] = 8665,
6549 ["Lleftarrow"] = 8666,
6550 ["lAarr"] = 8666,
6551 ["Rrightarrow"] = 8667,
6552 ["rAarr"] = 8667,
6553 ["zigrarr"] = 8669,
6554 ["LeftArrowBar"] = 8676,
6555 ["larrb"] = 8676,
6556 ["RightArrowBar"] = 8677,
6557 ["rarrb"] = 8677,
6558 ["DownArrowUpArrow"] = 8693,
6559 ["duarr"] = 8693,
6560 ["loarr"] = 8701,
6561 ["roarr"] = 8702,
6562 ["hoarr"] = 8703,
6563 ["ForAll"] = 8704,
6564 ["forall"] = 8704,
6565 ["comp"] = 8705,
6566 ["complement"] = 8705,
6567 ["PartialD"] = 8706,
6568 ["npart"] = {8706, 824},
6569 ["part"] = 8706,
6570 ["Exists"] = 8707,
6571 ["exist"] = 8707,
6572 ["NotExists"] = 8708,
6573 ["nexist"] = 8708,
6574 ["nexists"] = 8708,
6575 ["empty"] = 8709,
6576 ["emptyset"] = 8709,
6577 ["emptyv"] = 8709,
6578 ["varnothing"] = 8709,
6579 ["Del"] = 8711,
6580 ["nabla"] = 8711,

```



```

6581 ["Element"] = 8712,
6582 ["in"] = 8712,
6583 ["isin"] = 8712,
6584 ["isinv"] = 8712,
6585 ["NotElement"] = 8713,
6586 ["notin"] = 8713,
6587 ["notinva"] = 8713,
6588 ["ReverseElement"] = 8715,
6589 ["SuchThat"] = 8715,
6590 ["ni"] = 8715,
6591 ["niv"] = 8715,
6592 ["NotReverseElement"] = 8716,
6593 ["notni"] = 8716,
6594 ["notniva"] = 8716,
6595 ["Product"] = 8719,
6596 ["prod"] = 8719,
6597 ["Coproduct"] = 8720,
6598 ["coprod"] = 8720,
6599 ["Sum"] = 8721,
6600 ["sum"] = 8721,
6601 ["minus"] = 8722,
6602 ["MinusPlus"] = 8723,
6603 ["mnplus"] = 8723,
6604 ["mp"] = 8723,
6605 ["dotplus"] = 8724,
6606 ["plusdo"] = 8724,
6607 ["Backslash"] = 8726,
6608 ["setminus"] = 8726,
6609 ["setmn"] = 8726,
6610 ["smallsetminus"] = 8726,
6611 ["ssetmn"] = 8726,
6612 ["lowast"] = 8727,
6613 ["SmallCircle"] = 8728,
6614 ["compfn"] = 8728,
6615 ["Sqrt"] = 8730,
6616 ["radic"] = 8730,
6617 ["Proportional"] = 8733,
6618 ["prop"] = 8733,
6619 ["propto"] = 8733,
6620 ["varpropto"] = 8733,
6621 ["vprop"] = 8733,
6622 ["infin"] = 8734,
6623 ["angrt"] = 8735,
6624 ["ang"] = 8736,
6625 ["angle"] = 8736,
6626 ["nang"] = {8736, 8402},
6627 ["angmsd"] = 8737,

```

```

6628 ["measuredangle"] = 8737,
6629 ["angsph"] = 8738,
6630 ["VerticalBar"] = 8739,
6631 ["mid"] = 8739,
6632 ["shortmid"] = 8739,
6633 ["smid"] = 8739,
6634 ["NotVerticalBar"] = 8740,
6635 ["nmid"] = 8740,
6636 ["nshortmid"] = 8740,
6637 ["nsmid"] = 8740,
6638 ["DoubleVerticalBar"] = 8741,
6639 ["par"] = 8741,
6640 ["parallel"] = 8741,
6641 ["shortparallel"] = 8741,
6642 ["spar"] = 8741,
6643 ["NotDoubleVerticalBar"] = 8742,
6644 ["npar"] = 8742,
6645 ["nparallel"] = 8742,
6646 ["nshortparallel"] = 8742,
6647 ["nspar"] = 8742,
6648 ["and"] = 8743,
6649 ["wedge"] = 8743,
6650 ["or"] = 8744,
6651 ["vee"] = 8744,
6652 ["cap"] = 8745,
6653 ["caps"] = {8745, 65024},
6654 ["cup"] = 8746,
6655 ["cups"] = {8746, 65024},
6656 ["Integral"] = 8747,
6657 ["int"] = 8747,
6658 ["Int"] = 8748,
6659 ["iiint"] = 8749,
6660 ["tint"] = 8749,
6661 ["ContourIntegral"] = 8750,
6662 ["conint"] = 8750,
6663 ["oint"] = 8750,
6664 ["Conint"] = 8751,
6665 ["DoubleContourIntegral"] = 8751,
6666 ["Cconint"] = 8752,
6667 ["cwint"] = 8753,
6668 ["ClockwiseContourIntegral"] = 8754,
6669 ["cwconint"] = 8754,
6670 ["CounterClockwiseContourIntegral"] = 8755,
6671 ["awconint"] = 8755,
6672 ["Therefore"] = 8756,
6673 ["there4"] = 8756,
6674 ["therefore"] = 8756,

```

```

6675 ["Because"] = 8757,
6676 ["becaus"] = 8757,
6677 ["because"] = 8757,
6678 ["ratio"] = 8758,
6679 ["Colon"] = 8759,
6680 ["Proportion"] = 8759,
6681 ["dotminus"] = 8760,
6682 ["minusd"] = 8760,
6683 ["mDDot"] = 8762,
6684 ["homtht"] = 8763,
6685 ["Tilde"] = 8764,
6686 ["nvsim"] = {8764, 8402},
6687 ["sim"] = 8764,
6688 ["thicksim"] = 8764,
6689 ["thksim"] = 8764,
6690 ["backsim"] = 8765,
6691 ["bsim"] = 8765,
6692 ["race"] = {8765, 817},
6693 ["ac"] = 8766,
6694 ["acE"] = {8766, 819},
6695 ["mstpos"] = 8766,
6696 ["acd"] = 8767,
6697 ["VerticalTilde"] = 8768,
6698 ["wr"] = 8768,
6699 ["wreath"] = 8768,
6700 ["NotTilde"] = 8769,
6701 ["nsim"] = 8769,
6702 ["EqualTilde"] = 8770,
6703 ["NotEqualTilde"] = {8770, 824},
6704 ["eqsim"] = 8770,
6705 ["esim"] = 8770,
6706 ["nesim"] = {8770, 824},
6707 ["TildeEqual"] = 8771,
6708 ["sime"] = 8771,
6709 ["simeq"] = 8771,
6710 ["NotTildeEqual"] = 8772,
6711 ["nsime"] = 8772,
6712 ["nsimeq"] = 8772,
6713 ["TildeFullEqual"] = 8773,
6714 ["cong"] = 8773,
6715 ["simne"] = 8774,
6716 ["NotTildeFullEqual"] = 8775,
6717 ["ncong"] = 8775,
6718 ["TildeTilde"] = 8776,
6719 ["ap"] = 8776,
6720 ["approx"] = 8776,
6721 ["asymp"] = 8776,

```

```

6722 ["thickapprox"] = 8776,
6723 ["thkap"] = 8776,
6724 ["NotTildeTilde"] = 8777,
6725 ["nap"] = 8777,
6726 ["napprox"] = 8777,
6727 ["ape"] = 8778,
6728 ["approxeq"] = 8778,
6729 ["apid"] = 8779,
6730 ["napid"] = {8779, 824},
6731 ["backcong"] = 8780,
6732 ["bcong"] = 8780,
6733 ["CupCap"] = 8781,
6734 ["asympeq"] = 8781,
6735 ["nvap"] = {8781, 8402},
6736 ["Bumpeq"] = 8782,
6737 ["HumpDownHump"] = 8782,
6738 ["NotHumpDownHump"] = {8782, 824},
6739 ["bump"] = 8782,
6740 ["nbump"] = {8782, 824},
6741 ["HumpEqual"] = 8783,
6742 ["NotHumpEqual"] = {8783, 824},
6743 ["bumpe"] = 8783,
6744 ["bumpeq"] = 8783,
6745 ["nbumpe"] = {8783, 824},
6746 ["DotEqual"] = 8784,
6747 ["doteq"] = 8784,
6748 ["esdot"] = 8784,
6749 ["nedot"] = {8784, 824},
6750 ["doteqdot"] = 8785,
6751 ["eDot"] = 8785,
6752 ["efDot"] = 8786,
6753 ["fallingdotseq"] = 8786,
6754 ["erDot"] = 8787,
6755 ["risingdotseq"] = 8787,
6756 ["Assign"] = 8788,
6757 ["colone"] = 8788,
6758 ["coloneq"] = 8788,
6759 ["ecolon"] = 8789,
6760 ["eqcolon"] = 8789,
6761 ["ecir"] = 8790,
6762 ["eqcirc"] = 8790,
6763 ["circeq"] = 8791,
6764 ["cire"] = 8791,
6765 ["wedgeq"] = 8793,
6766 ["veeeq"] = 8794,
6767 ["triangleq"] = 8796,
6768 ["trie"] = 8796,

```

```

6769 ["equest"] = 8799,
6770 ["questeq"] = 8799,
6771 ["NotEqual"] = 8800,
6772 ["ne"] = 8800,
6773 ["Congruent"] = 8801,
6774 ["bnequiv"] = {8801, 8421},
6775 ["equiv"] = 8801,
6776 ["NotCongruent"] = 8802,
6777 ["nequiv"] = 8802,
6778 ["le"] = 8804,
6779 ["leq"] = 8804,
6780 ["nvle"] = {8804, 8402},
6781 ["GreaterEqual"] = 8805,
6782 ["ge"] = 8805,
6783 ["geq"] = 8805,
6784 ["nvge"] = {8805, 8402},
6785 ["LessFullEqual"] = 8806,
6786 ["lE"] = 8806,
6787 ["leqq"] = 8806,
6788 ["nLE"] = {8806, 824},
6789 ["nleqq"] = {8806, 824},
6790 ["GreaterFullEqual"] = 8807,
6791 ["NotGreaterFullEqual"] = {8807, 824},
6792 ["gE"] = 8807,
6793 ["geqq"] = 8807,
6794 ["ngE"] = {8807, 824},
6795 ["ngeqq"] = {8807, 824},
6796 ["lnE"] = 8808,
6797 ["lneqq"] = 8808,
6798 ["lvertneqq"] = {8808, 65024},
6799 ["lvnE"] = {8808, 65024},
6800 ["gnE"] = 8809,
6801 ["gneqq"] = 8809,
6802 ["gvertneqq"] = {8809, 65024},
6803 ["gvnE"] = {8809, 65024},
6804 ["Lt"] = 8810,
6805 ["NestedLessLess"] = 8810,
6806 ["NotLessLess"] = {8810, 824},
6807 ["ll"] = 8810,
6808 ["nLt"] = {8810, 8402},
6809 ["nLtv"] = {8810, 824},
6810 ["Gt"] = 8811,
6811 ["NestedGreaterGreater"] = 8811,
6812 ["NotGreaterGreater"] = {8811, 824},
6813 ["gg"] = 8811,
6814 ["nGt"] = {8811, 8402},
6815 ["nGtv"] = {8811, 824},

```

```

6816 ["between"] = 8812,
6817 ["twixt"] = 8812,
6818 ["NotCupCap"] = 8813,
6819 ["NotLess"] = 8814,
6820 ["nless"] = 8814,
6821 ["nlt"] = 8814,
6822 ["NotGreater"] = 8815,
6823 ["ngt"] = 8815,
6824 ["ngtr"] = 8815,
6825 ["NotLessEqual"] = 8816,
6826 ["nle"] = 8816,
6827 ["nleq"] = 8816,
6828 ["NotGreaterEqual"] = 8817,
6829 ["nge"] = 8817,
6830 ["ngeq"] = 8817,
6831 ["LessTilde"] = 8818,
6832 ["lesssim"] = 8818,
6833 ["lsim"] = 8818,
6834 ["GreaterTilde"] = 8819,
6835 ["gsim"] = 8819,
6836 ["gtrsim"] = 8819,
6837 ["NotLessTilde"] = 8820,
6838 ["nlsim"] = 8820,
6839 ["NotGreaterTilde"] = 8821,
6840 ["ngsim"] = 8821,
6841 ["LessGreater"] = 8822,
6842 ["lessgtr"] = 8822,
6843 ["lg"] = 8822,
6844 ["GreaterLess"] = 8823,
6845 ["gl"] = 8823,
6846 ["gtrless"] = 8823,
6847 ["NotLessGreater"] = 8824,
6848 ["ntlg"] = 8824,
6849 ["NotGreaterLess"] = 8825,
6850 ["ntgl"] = 8825,
6851 ["Precedes"] = 8826,
6852 ["pr"] = 8826,
6853 ["prec"] = 8826,
6854 ["Succeeds"] = 8827,
6855 ["sc"] = 8827,
6856 ["succ"] = 8827,
6857 ["PrecedesSlantEqual"] = 8828,
6858 ["prcue"] = 8828,
6859 ["preccurlyeq"] = 8828,
6860 ["SucceedsSlantEqual"] = 8829,
6861 ["sccue"] = 8829,
6862 ["succcurlyeq"] = 8829,

```

```

6863 ["PrecedesTilde"] = 8830,
6864 ["precsim"] = 8830,
6865 ["prsim"] = 8830,
6866 ["NotSucceedsTilde"] = {8831, 824},
6867 ["SucceedsTilde"] = 8831,
6868 ["scsim"] = 8831,
6869 ["succsim"] = 8831,
6870 ["NotPrecedes"] = 8832,
6871 ["npr"] = 8832,
6872 ["nprec"] = 8832,
6873 ["NotSucceeds"] = 8833,
6874 ["nsc"] = 8833,
6875 ["nsucc"] = 8833,
6876 ["NotSubset"] = {8834, 8402},
6877 ["nsubset"] = {8834, 8402},
6878 ["sub"] = 8834,
6879 ["subset"] = 8834,
6880 ["vnsup"] = {8834, 8402},
6881 ["NotSuperset"] = {8835, 8402},
6882 ["Superset"] = 8835,
6883 ["nsupset"] = {8835, 8402},
6884 ["sup"] = 8835,
6885 ["supset"] = 8835,
6886 ["vnsup"] = {8835, 8402},
6887 ["nsub"] = 8836,
6888 ["nsup"] = 8837,
6889 ["SubsetEqual"] = 8838,
6890 ["sube"] = 8838,
6891 ["subseteq"] = 8838,
6892 ["SupersetEqual"] = 8839,
6893 ["supe"] = 8839,
6894 ["supseteq"] = 8839,
6895 ["NotSubsetEqual"] = 8840,
6896 ["nsube"] = 8840,
6897 ["nsubseteq"] = 8840,
6898 ["NotSupersetEqual"] = 8841,
6899 ["nsupe"] = 8841,
6900 ["nsupseteq"] = 8841,
6901 ["subne"] = 8842,
6902 ["subsetneq"] = 8842,
6903 ["varsubsetneq"] = {8842, 65024},
6904 ["vsubne"] = {8842, 65024},
6905 ["supne"] = 8843,
6906 ["supsetneq"] = 8843,
6907 ["varsupsetneq"] = {8843, 65024},
6908 ["vsupne"] = {8843, 65024},
6909 ["cupdot"] = 8845,

```

```

6910 ["UnionPlus"] = 8846,
6911 ["uplus"] = 8846,
6912 ["NotSquareSubset"] = {8847, 824},
6913 ["SquareSubset"] = 8847,
6914 ["sqsub"] = 8847,
6915 ["sqsubset"] = 8847,
6916 ["NotSquareSuperset"] = {8848, 824},
6917 ["SquareSuperset"] = 8848,
6918 ["sqsup"] = 8848,
6919 ["sqsupset"] = 8848,
6920 ["SquareSubsetEqual"] = 8849,
6921 ["sqsube"] = 8849,
6922 ["sqsubseteq"] = 8849,
6923 ["SquareSupersetEqual"] = 8850,
6924 ["sqsupe"] = 8850,
6925 ["sqsupseteq"] = 8850,
6926 ["SquareIntersection"] = 8851,
6927 ["sqcap"] = 8851,
6928 ["sqcaps"] = {8851, 65024},
6929 ["SquareUnion"] = 8852,
6930 ["sqcup"] = 8852,
6931 ["sqcups"] = {8852, 65024},
6932 ["CirclePlus"] = 8853,
6933 ["oplus"] = 8853,
6934 ["CircleMinus"] = 8854,
6935 ["ominus"] = 8854,
6936 ["CircleTimes"] = 8855,
6937 ["otimes"] = 8855,
6938 ["osol"] = 8856,
6939 ["CircleDot"] = 8857,
6940 ["odot"] = 8857,
6941 ["circledcirc"] = 8858,
6942 ["ocir"] = 8858,
6943 ["circledast"] = 8859,
6944 ["oast"] = 8859,
6945 ["circleddash"] = 8861,
6946 ["odash"] = 8861,
6947 ["boxplus"] = 8862,
6948 ["plusb"] = 8862,
6949 ["boxminus"] = 8863,
6950 ["minusb"] = 8863,
6951 ["boxtimes"] = 8864,
6952 ["timesb"] = 8864,
6953 ["dotssquare"] = 8865,
6954 ["sdotb"] = 8865,
6955 ["RightTee"] = 8866,
6956 ["vdash"] = 8866,

```



```

6957 ["LeftTee"] = 8867,
6958 ["dashv"] = 8867,
6959 ["DownTee"] = 8868,
6960 ["top"] = 8868,
6961 ["UpTee"] = 8869,
6962 ["bot"] = 8869,
6963 ["bottom"] = 8869,
6964 ["perp"] = 8869,
6965 ["models"] = 8871,
6966 ["DoubleRightTee"] = 8872,
6967 ["vDash"] = 8872,
6968 ["Vdash"] = 8873,
6969 ["Vvdash"] = 8874,
6970 ["VDash"] = 8875,
6971 ["nvdash"] = 8876,
6972 ["nvDash"] = 8877,
6973 ["nVdash"] = 8878,
6974 ["nVDash"] = 8879,
6975 ["prurel"] = 8880,
6976 ["LeftTriangle"] = 8882,
6977 ["vartriangleleft"] = 8882,
6978 ["vltri"] = 8882,
6979 ["RightTriangle"] = 8883,
6980 ["vartriangleright"] = 8883,
6981 ["vrtri"] = 8883,
6982 ["LeftTriangleEqual"] = 8884,
6983 ["ltrie"] = 8884,
6984 ["nvltrie"] = {8884, 8402},
6985 ["trianglelefteq"] = 8884,
6986 ["RightTriangleEqual"] = 8885,
6987 ["nvrtrie"] = {8885, 8402},
6988 ["rtrie"] = 8885,
6989 ["trianglerighteq"] = 8885,
6990 ["origof"] = 8886,
6991 ["imof"] = 8887,
6992 ["multimap"] = 8888,
6993 ["mumap"] = 8888,
6994 ["hercon"] = 8889,
6995 ["intcal"] = 8890,
6996 ["intercal"] = 8890,
6997 ["veebar"] = 8891,
6998 ["barvee"] = 8893,
6999 ["angrtvb"] = 8894,
7000 ["lrtri"] = 8895,
7001 ["Wedge"] = 8896,
7002 ["bigwedge"] = 8896,
7003 ["xwedge"] = 8896,

```

```

7004 ["Vee"] = 8897,
7005 ["bigvee"] = 8897,
7006 ["xvee"] = 8897,
7007 ["Intersection"] = 8898,
7008 ["bigcap"] = 8898,
7009 ["xcap"] = 8898,
7010 ["Union"] = 8899,
7011 ["bigcup"] = 8899,
7012 ["xcup"] = 8899,
7013 ["Diamond"] = 8900,
7014 ["diam"] = 8900,
7015 ["diamond"] = 8900,
7016 ["sdot"] = 8901,
7017 ["Star"] = 8902,
7018 ["sstarf"] = 8902,
7019 ["divideontimes"] = 8903,
7020 ["divonx"] = 8903,
7021 ["bowtie"] = 8904,
7022 ["ltimes"] = 8905,
7023 ["rtimes"] = 8906,
7024 ["leftthreetimes"] = 8907,
7025 ["lthree"] = 8907,
7026 ["rightthreetimes"] = 8908,
7027 ["rthree"] = 8908,
7028 ["backsimeq"] = 8909,
7029 ["bsime"] = 8909,
7030 ["curlyvee"] = 8910,
7031 ["cuvee"] = 8910,
7032 ["curlywedge"] = 8911,
7033 ["cuwed"] = 8911,
7034 ["Sub"] = 8912,
7035 ["Subset"] = 8912,
7036 ["Sup"] = 8913,
7037 ["Supset"] = 8913,
7038 ["Cap"] = 8914,
7039 ["Cup"] = 8915,
7040 ["fork"] = 8916,
7041 ["pitchfork"] = 8916,
7042 ["epar"] = 8917,
7043 ["lessdot"] = 8918,
7044 ["ltdot"] = 8918,
7045 ["gtdot"] = 8919,
7046 ["gtrdot"] = 8919,
7047 ["Ll"] = 8920,
7048 ["nLl"] = {8920, 824},
7049 ["Gg"] = 8921,
7050 ["ggg"] = 8921,

```

```

7051 ["nGg"] = {8921, 824},
7052 ["LessEqualGreater"] = 8922,
7053 ["leg"] = 8922,
7054 ["lesg"] = {8922, 65024},
7055 ["lesseqgtr"] = 8922,
7056 ["GreaterEqualLess"] = 8923,
7057 ["gel"] = 8923,
7058 ["gesl"] = {8923, 65024},
7059 ["gtreqless"] = 8923,
7060 ["cuepr"] = 8926,
7061 ["curlyeqprec"] = 8926,
7062 ["cuesc"] = 8927,
7063 ["curlyeqsucc"] = 8927,
7064 ["NotPrecedesSlantEqual"] = 8928,
7065 ["nprcue"] = 8928,
7066 ["NotSucceedsSlantEqual"] = 8929,
7067 ["nsccue"] = 8929,
7068 ["NotSquareSubsetEqual"] = 8930,
7069 ["nsqsube"] = 8930,
7070 ["NotSquareSupersetEqual"] = 8931,
7071 ["nsqsupe"] = 8931,
7072 ["lnsim"] = 8934,
7073 ["gnsim"] = 8935,
7074 ["precnsim"] = 8936,
7075 ["prnsim"] = 8936,
7076 ["scnsim"] = 8937,
7077 ["succnsim"] = 8937,
7078 ["NotLeftTriangle"] = 8938,
7079 ["nltri"] = 8938,
7080 ["ntriangleleft"] = 8938,
7081 ["NotRightTriangle"] = 8939,
7082 ["nrtri"] = 8939,
7083 ["ntriangleright"] = 8939,
7084 ["NotLeftTriangleEqual"] = 8940,
7085 ["nltrie"] = 8940,
7086 ["ntrianglelefteq"] = 8940,
7087 ["NotRightTriangleEqual"] = 8941,
7088 ["nrtrie"] = 8941,
7089 ["ntrianglerighteq"] = 8941,
7090 ["vellip"] = 8942,
7091 ["ctdot"] = 8943,
7092 ["utdot"] = 8944,
7093 ["dtdot"] = 8945,
7094 ["disin"] = 8946,
7095 ["isinsv"] = 8947,
7096 ["isins"] = 8948,
7097 ["isindot"] = 8949,

```

```

7098 ["notindot"] = {8949, 824},
7099 ["notinvc"] = 8950,
7100 ["notinvb"] = 8951,
7101 ["isinE"] = 8953,
7102 ["notinE"] = {8953, 824},
7103 ["nisd"] = 8954,
7104 ["xnis"] = 8955,
7105 ["nis"] = 8956,
7106 ["notnivc"] = 8957,
7107 ["notnivb"] = 8958,
7108 ["barwed"] = 8965,
7109 ["barwedge"] = 8965,
7110 ["Barwed"] = 8966,
7111 ["doublebarwedge"] = 8966,
7112 ["LeftCeiling"] = 8968,
7113 ["lceil"] = 8968,
7114 ["RightCeiling"] = 8969,
7115 ["rceil"] = 8969,
7116 ["LeftFloor"] = 8970,
7117 ["lfloor"] = 8970,
7118 ["RightFloor"] = 8971,
7119 ["rfloor"] = 8971,
7120 ["drcrop"] = 8972,
7121 ["dlcrop"] = 8973,
7122 ["urcrop"] = 8974,
7123 ["ulcrop"] = 8975,
7124 ["bnot"] = 8976,
7125 ["proflin"] = 8978,
7126 ["profsurf"] = 8979,
7127 ["telrec"] = 8981,
7128 ["target"] = 8982,
7129 ["ulcorn"] = 8988,
7130 ["ulcorner"] = 8988,
7131 ["urcorn"] = 8989,
7132 ["urcorner"] = 8989,
7133 ["dlcorn"] = 8990,
7134 ["llcorner"] = 8990,
7135 ["drcorn"] = 8991,
7136 ["lrcorn"] = 8991,
7137 ["frown"] = 8994,
7138 ["sfrown"] = 8994,
7139 ["smile"] = 8995,
7140 ["ssmile"] = 8995,
7141 ["cylcty"] = 9005,
7142 ["profalar"] = 9006,
7143 ["topbot"] = 9014,
7144 ["ovbar"] = 9021,

```

```

7145 ["solbar"] = 9023,
7146 ["angzarr"] = 9084,
7147 ["lmoust"] = 9136,
7148 ["lmoustache"] = 9136,
7149 ["rmoust"] = 9137,
7150 ["rmoustache"] = 9137,
7151 ["OverBracket"] = 9140,
7152 ["tbrk"] = 9140,
7153 ["UnderBracket"] = 9141,
7154 ["bbrk"] = 9141,
7155 ["bbrktbrk"] = 9142,
7156 ["OverParenthesis"] = 9180,
7157 ["UnderParenthesis"] = 9181,
7158 ["OverBrace"] = 9182,
7159 ["UnderBrace"] = 9183,
7160 ["trpezium"] = 9186,
7161 ["elinters"] = 9191,
7162 ["blank"] = 9251,
7163 ["circledS"] = 9416,
7164 ["oS"] = 9416,
7165 ["HorizontalLine"] = 9472,
7166 ["boxh"] = 9472,
7167 ["boxv"] = 9474,
7168 ["boxdr"] = 9484,
7169 ["boxdl"] = 9488,
7170 ["boxur"] = 9492,
7171 ["boxul"] = 9496,
7172 ["boxvr"] = 9500,
7173 ["boxvl"] = 9508,
7174 ["boxhd"] = 9516,
7175 ["boxhu"] = 9524,
7176 ["boxvh"] = 9532,
7177 ["boxH"] = 9552,
7178 ["boxV"] = 9553,
7179 ["boxdR"] = 9554,
7180 ["boxDr"] = 9555,
7181 ["boxDR"] = 9556,
7182 ["boxdL"] = 9557,
7183 ["boxDL"] = 9558,
7184 ["boxDL"] = 9559,
7185 ["boxuR"] = 9560,
7186 ["boxUr"] = 9561,
7187 ["boxUR"] = 9562,
7188 ["boxuL"] = 9563,
7189 ["boxUL"] = 9564,
7190 ["boxUL"] = 9565,
7191 ["boxvR"] = 9566,

```

```

7192 ["boxVr"] = 9567,
7193 ["boxVR"] = 9568,
7194 ["boxvL"] = 9569,
7195 ["boxVl"] = 9570,
7196 ["boxVL"] = 9571,
7197 ["boxHd"] = 9572,
7198 ["boxhD"] = 9573,
7199 ["boxHD"] = 9574,
7200 ["boxHu"] = 9575,
7201 ["boxhU"] = 9576,
7202 ["boxHU"] = 9577,
7203 ["boxvH"] = 9578,
7204 ["boxVh"] = 9579,
7205 ["boxVH"] = 9580,
7206 ["uhblk"] = 9600,
7207 ["lhblk"] = 9604,
7208 ["block"] = 9608,
7209 ["blk14"] = 9617,
7210 ["blk12"] = 9618,
7211 ["blk34"] = 9619,
7212 ["Square"] = 9633,
7213 ["squ"] = 9633,
7214 ["square"] = 9633,
7215 ["FilledVerySmallSquare"] = 9642,
7216 ["blacksquare"] = 9642,
7217 ["squarf"] = 9642,
7218 ["squf"] = 9642,
7219 ["EmptyVerySmallSquare"] = 9643,
7220 ["rect"] = 9645,
7221 ["marker"] = 9646,
7222 ["fltns"] = 9649,
7223 ["bigtriangleup"] = 9651,
7224 ["xutri"] = 9651,
7225 ["blacktriangle"] = 9652,
7226 ["utrif"] = 9652,
7227 ["triangle"] = 9653,
7228 ["utri"] = 9653,
7229 ["blacktriangleright"] = 9656,
7230 ["rtrif"] = 9656,
7231 ["rtri"] = 9657,
7232 ["triangleright"] = 9657,
7233 ["bigtriangledown"] = 9661,
7234 ["xdtri"] = 9661,
7235 ["blacktriangledown"] = 9662,
7236 ["dtrif"] = 9662,
7237 ["dtri"] = 9663,
7238 ["triangledown"] = 9663,

```

7239 ["blacktriangleleft"] = 9666,
 7240 ["ltrif"] = 9666,
 7241 ["ltri"] = 9667,
 7242 ["triangleleft"] = 9667,
 7243 ["loz"] = 9674,
 7244 ["lozenge"] = 9674,
 7245 ["cir"] = 9675,
 7246 ["tridot"] = 9708,
 7247 ["bigcirc"] = 9711,
 7248 ["xcirc"] = 9711,
 7249 ["ultri"] = 9720,
 7250 ["urtri"] = 9721,
 7251 ["lltri"] = 9722,
 7252 ["EmptySmallSquare"] = 9723,
 7253 ["FilledSmallSquare"] = 9724,
 7254 ["bigstar"] = 9733,
 7255 ["starf"] = 9733,
 7256 ["star"] = 9734,
 7257 ["phone"] = 9742,
 7258 ["female"] = 9792,
 7259 ["male"] = 9794,
 7260 ["spades"] = 9824,
 7261 ["spadesuit"] = 9824,
 7262 ["clubs"] = 9827,
 7263 ["clubsuit"] = 9827,
 7264 ["hearts"] = 9829,
 7265 ["heartsuit"] = 9829,
 7266 ["diamondsuit"] = 9830,
 7267 ["diams"] = 9830,
 7268 ["sung"] = 9834,
 7269 ["flat"] = 9837,
 7270 ["natur"] = 9838,
 7271 ["natural"] = 9838,
 7272 ["sharp"] = 9839,
 7273 ["check"] = 10003,
 7274 ["checkmark"] = 10003,
 7275 ["cross"] = 10007,
 7276 ["malt"] = 10016,
 7277 ["maltese"] = 10016,
 7278 ["sext"] = 10038,
 7279 ["VerticalSeparator"] = 10072,
 7280 ["lbbbrk"] = 10098,
 7281 ["rbbbrk"] = 10099,
 7282 ["bsolhsub"] = 10184,
 7283 ["suphsol"] = 10185,
 7284 ["LeftDoubleBracket"] = 10214,
 7285 ["lobrk"] = 10214,

7286 ["RightDoubleBracket"] = 10215,
 7287 ["robrk"] = 10215,
 7288 ["LeftAngleBracket"] = 10216,
 7289 ["lang"] = 10216,
 7290 ["langle"] = 10216,
 7291 ["RightAngleBracket"] = 10217,
 7292 ["rang"] = 10217,
 7293 ["rangle"] = 10217,
 7294 ["Lang"] = 10218,
 7295 ["Rang"] = 10219,
 7296 ["loang"] = 10220,
 7297 ["roang"] = 10221,
 7298 ["LongLeftArrow"] = 10229,
 7299 ["longleftarrow"] = 10229,
 7300 ["xlarr"] = 10229,
 7301 ["LongRightArrow"] = 10230,
 7302 ["longrightarrow"] = 10230,
 7303 ["xrarr"] = 10230,
 7304 ["LongLeftRightArrow"] = 10231,
 7305 ["longleftrightarrow"] = 10231,
 7306 ["xharr"] = 10231,
 7307 ["DoubleLongLeftArrow"] = 10232,
 7308 ["Longleftarrow"] = 10232,
 7309 ["xlArr"] = 10232,
 7310 ["DoubleLongRightArrow"] = 10233,
 7311 ["Longrightarrow"] = 10233,
 7312 ["xrArr"] = 10233,
 7313 ["DoubleLongLeftRightArrow"] = 10234,
 7314 ["Longleftrightarrow"] = 10234,
 7315 ["xhArr"] = 10234,
 7316 ["longmapsto"] = 10236,
 7317 ["xmap"] = 10236,
 7318 ["dzigrarr"] = 10239,
 7319 ["nvlArr"] = 10498,
 7320 ["nvrArr"] = 10499,
 7321 ["nvHarr"] = 10500,
 7322 ["Map"] = 10501,
 7323 ["lbarr"] = 10508,
 7324 ["bkarow"] = 10509,
 7325 ["rbarr"] = 10509,
 7326 ["lBarr"] = 10510,
 7327 ["dbkarow"] = 10511,
 7328 ["rBarr"] = 10511,
 7329 ["RBarr"] = 10512,
 7330 ["drbkarow"] = 10512,
 7331 ["DDottrahd"] = 10513,
 7332 ["UpArrowBar"] = 10514,


```

7333 ["DownArrowBar"] = 10515,
7334 ["Rarrtl"] = 10518,
7335 ["latail"] = 10521,
7336 ["ratail"] = 10522,
7337 ["lAtail"] = 10523,
7338 ["rAtail"] = 10524,
7339 ["larrfs"] = 10525,
7340 ["rarrfs"] = 10526,
7341 ["larrbfs"] = 10527,
7342 ["rarrbfs"] = 10528,
7343 ["nwarhk"] = 10531,
7344 ["nearhk"] = 10532,
7345 ["hksearow"] = 10533,
7346 ["searhk"] = 10533,
7347 ["hkswarow"] = 10534,
7348 ["swarhk"] = 10534,
7349 ["nwnear"] = 10535,
7350 ["nesear"] = 10536,
7351 ["toea"] = 10536,
7352 ["seswar"] = 10537,
7353 ["tosa"] = 10537,
7354 ["swnwar"] = 10538,
7355 ["nrarrc"] = {10547, 824},
7356 ["rarrc"] = 10547,
7357 ["cudarrr"] = 10549,
7358 ["ldca"] = 10550,
7359 ["rdca"] = 10551,
7360 ["cudarrrl"] = 10552,
7361 ["larrpl"] = 10553,
7362 ["curarrm"] = 10556,
7363 ["cularrp"] = 10557,
7364 ["rarrpl"] = 10565,
7365 ["harrcir"] = 10568,
7366 ["Uarrocir"] = 10569,
7367 ["lurdshar"] = 10570,
7368 ["ldrushar"] = 10571,
7369 ["LeftRightVector"] = 10574,
7370 ["RightUpDownVector"] = 10575,
7371 ["DownLeftRightVector"] = 10576,
7372 ["LeftUpDownVector"] = 10577,
7373 ["LeftVectorBar"] = 10578,
7374 ["RightVectorBar"] = 10579,
7375 ["RightUpVectorBar"] = 10580,
7376 ["RightDownVectorBar"] = 10581,
7377 ["DownLeftVectorBar"] = 10582,
7378 ["DownRightVectorBar"] = 10583,
7379 ["LeftUpVectorBar"] = 10584,

```

```

7380 ["LeftDownVectorBar"] = 10585,
7381 ["LeftTeeVector"] = 10586,
7382 ["RightTeeVector"] = 10587,
7383 ["RightUpTeeVector"] = 10588,
7384 ["RightDownTeeVector"] = 10589,
7385 ["DownLeftTeeVector"] = 10590,
7386 ["DownRightTeeVector"] = 10591,
7387 ["LeftUpTeeVector"] = 10592,
7388 ["LeftDownTeeVector"] = 10593,
7389 ["lHar"] = 10594,
7390 ["uHar"] = 10595,
7391 ["rHar"] = 10596,
7392 ["dHar"] = 10597,
7393 ["luruhar"] = 10598,
7394 ["ldrdhar"] = 10599,
7395 ["ruluhar"] = 10600,
7396 ["rdldhar"] = 10601,
7397 ["lharul"] = 10602,
7398 ["llhard"] = 10603,
7399 ["rharul"] = 10604,
7400 ["lrhard"] = 10605,
7401 ["UpEquilibrium"] = 10606,
7402 ["udhar"] = 10606,
7403 ["ReverseUpEquilibrium"] = 10607,
7404 ["duhar"] = 10607,
7405 ["RoundImplies"] = 10608,
7406 ["erarr"] = 10609,
7407 ["simrarr"] = 10610,
7408 ["larrsim"] = 10611,
7409 ["rarrsim"] = 10612,
7410 ["rarrap"] = 10613,
7411 ["ltlarr"] = 10614,
7412 ["gtrarr"] = 10616,
7413 ["subrarr"] = 10617,
7414 ["suplarr"] = 10619,
7415 ["lfisht"] = 10620,
7416 ["rfisht"] = 10621,
7417 ["ufisht"] = 10622,
7418 ["dfisht"] = 10623,
7419 ["lopar"] = 10629,
7420 ["ropar"] = 10630,
7421 ["lbrke"] = 10635,
7422 ["rbrke"] = 10636,
7423 ["lbrkslu"] = 10637,
7424 ["rbrksld"] = 10638,
7425 ["lbrksld"] = 10639,
7426 ["rbrkslu"] = 10640,

```

```

7427 ["langd"] = 10641,
7428 ["rangd"] = 10642,
7429 ["lparlt"] = 10643,
7430 ["rpargt"] = 10644,
7431 ["gtlPar"] = 10645,
7432 ["ltrPar"] = 10646,
7433 ["vzigzag"] = 10650,
7434 ["vangrt"] = 10652,
7435 ["angrtvbd"] = 10653,
7436 ["ange"] = 10660,
7437 ["range"] = 10661,
7438 ["dwangle"] = 10662,
7439 ["uwangle"] = 10663,
7440 ["angmsdaa"] = 10664,
7441 ["angmsdab"] = 10665,
7442 ["angmsdac"] = 10666,
7443 ["angmsdad"] = 10667,
7444 ["angmsdae"] = 10668,
7445 ["angmsdaf"] = 10669,
7446 ["angmsdag"] = 10670,
7447 ["angmsdah"] = 10671,
7448 ["bemptyv"] = 10672,
7449 ["demptyv"] = 10673,
7450 ["cemptyv"] = 10674,
7451 ["raemptyv"] = 10675,
7452 ["laemptyv"] = 10676,
7453 ["ohbar"] = 10677,
7454 ["omid"] = 10678,
7455 ["opar"] = 10679,
7456 ["operp"] = 10681,
7457 ["olcross"] = 10683,
7458 ["odsold"] = 10684,
7459 ["olcir"] = 10686,
7460 ["ofcir"] = 10687,
7461 ["olt"] = 10688,
7462 ["ogt"] = 10689,
7463 ["cirscir"] = 10690,
7464 ["cirE"] = 10691,
7465 ["solb"] = 10692,
7466 ["bsolb"] = 10693,
7467 ["boxbox"] = 10697,
7468 ["trish"] = 10701,
7469 ["rtriltri"] = 10702,
7470 ["LeftTriangleBar"] = 10703,
7471 ["NotLeftTriangleBar"] = {10703, 824},
7472 ["NotRightTriangleBar"] = {10704, 824},
7473 ["RightTriangleBar"] = 10704,

```

```

7474 ["i infin"] = 10716,
7475 ["infintie"] = 10717,
7476 ["nvinfin"] = 10718,
7477 ["eparsl"] = 10723,
7478 ["smeparsl"] = 10724,
7479 ["eqvparsl"] = 10725,
7480 ["blacklozenge"] = 10731,
7481 ["lozf"] = 10731,
7482 ["RuleDelayed"] = 10740,
7483 ["dsol"] = 10742,
7484 ["bigodot"] = 10752,
7485 ["xodot"] = 10752,
7486 ["bigoplus"] = 10753,
7487 ["xoplus"] = 10753,
7488 ["bigotimes"] = 10754,
7489 ["xotime"] = 10754,
7490 ["biguplus"] = 10756,
7491 ["xuplus"] = 10756,
7492 ["bigsqcup"] = 10758,
7493 ["xsqcup"] = 10758,
7494 ["iiiint"] = 10764,
7495 ["qint"] = 10764,
7496 ["fpartint"] = 10765,
7497 ["cirfnint"] = 10768,
7498 ["awint"] = 10769,
7499 ["rppolint"] = 10770,
7500 ["scpolint"] = 10771,
7501 ["npolint"] = 10772,
7502 ["pointint"] = 10773,
7503 ["quatint"] = 10774,
7504 ["intlarhk"] = 10775,
7505 ["pluscir"] = 10786,
7506 ["plusacir"] = 10787,
7507 ["simplus"] = 10788,
7508 ["plusdu"] = 10789,
7509 ["plussim"] = 10790,
7510 ["plustwo"] = 10791,
7511 ["mcomma"] = 10793,
7512 ["minusdu"] = 10794,
7513 ["loplus"] = 10797,
7514 ["roplus"] = 10798,
7515 ["Cross"] = 10799,
7516 ["timesd"] = 10800,
7517 ["timesbar"] = 10801,
7518 ["smashp"] = 10803,
7519 ["lotimes"] = 10804,
7520 ["rotimes"] = 10805,

```

7521 ["otimesas"] = 10806,
7522 ["Otimes"] = 10807,
7523 ["odiv"] = 10808,
7524 ["triplus"] = 10809,
7525 ["triminus"] = 10810,
7526 ["tritime"] = 10811,
7527 ["intprod"] = 10812,
7528 ["iprod"] = 10812,
7529 ["amalg"] = 10815,
7530 ["capdot"] = 10816,
7531 ["ncup"] = 10818,
7532 ["ncap"] = 10819,
7533 ["capand"] = 10820,
7534 ["cupor"] = 10821,
7535 ["cupcap"] = 10822,
7536 ["capcup"] = 10823,
7537 ["cupbrcap"] = 10824,
7538 ["capbrcup"] = 10825,
7539 ["cupcup"] = 10826,
7540 ["capcap"] = 10827,
7541 ["ccups"] = 10828,
7542 ["ccaps"] = 10829,
7543 ["ccupssm"] = 10832,
7544 ["And"] = 10835,
7545 ["Or"] = 10836,
7546 ["andand"] = 10837,
7547 ["oror"] = 10838,
7548 ["orslope"] = 10839,
7549 ["andslope"] = 10840,
7550 ["andv"] = 10842,
7551 ["orv"] = 10843,
7552 ["andd"] = 10844,
7553 ["ord"] = 10845,
7554 ["wedbar"] = 10847,
7555 ["sdote"] = 10854,
7556 ["simdot"] = 10858,
7557 ["congdots"] = 10861,
7558 ["ncongdots"] = {10861, 824},
7559 ["easter"] = 10862,
7560 ["apacir"] = 10863,
7561 ["apE"] = 10864,
7562 ["napE"] = {10864, 824},
7563 ["eplus"] = 10865,
7564 ["pluse"] = 10866,
7565 ["Esim"] = 10867,
7566 ["Colone"] = 10868,
7567 ["Equal"] = 10869,

```

7568 ["ddotseq"] = 10871,
7569 ["eDDot"] = 10871,
7570 ["equivDD"] = 10872,
7571 ["ltcir"] = 10873,
7572 ["gtcir"] = 10874,
7573 ["ltquest"] = 10875,
7574 ["gtquest"] = 10876,
7575 ["LessSlantEqual"] = 10877,
7576 ["NotLessSlantEqual"] = {10877, 824},
7577 ["leqslant"] = 10877,
7578 ["les"] = 10877,
7579 ["nleqslant"] = {10877, 824},
7580 ["nles"] = {10877, 824},
7581 ["GreaterSlantEqual"] = 10878,
7582 ["NotGreaterSlantEqual"] = {10878, 824},
7583 ["geqslant"] = 10878,
7584 ["ges"] = 10878,
7585 ["ngeqslant"] = {10878, 824},
7586 ["nges"] = {10878, 824},
7587 ["lesdot"] = 10879,
7588 ["gesdot"] = 10880,
7589 ["lesdoto"] = 10881,
7590 ["gesdoto"] = 10882,
7591 ["lesdotor"] = 10883,
7592 ["gesdoto1"] = 10884,
7593 ["lap"] = 10885,
7594 ["lessapprox"] = 10885,
7595 ["gap"] = 10886,
7596 ["gtrapprox"] = 10886,
7597 ["lne"] = 10887,
7598 ["lneq"] = 10887,
7599 ["gne"] = 10888,
7600 ["gneq"] = 10888,
7601 ["lnap"] = 10889,
7602 ["lnapprox"] = 10889,
7603 ["gnap"] = 10890,
7604 ["gnapprox"] = 10890,
7605 ["lEg"] = 10891,
7606 ["lesseqqgtr"] = 10891,
7607 ["gEl"] = 10892,
7608 ["gtreqqless"] = 10892,
7609 ["lsime"] = 10893,
7610 ["gsime"] = 10894,
7611 ["lsimg"] = 10895,
7612 ["gsiml"] = 10896,
7613 ["lgE"] = 10897,
7614 ["glE"] = 10898,

```

```

7615 ["lesges"] = 10899,
7616 ["gesles"] = 10900,
7617 ["els"] = 10901,
7618 ["eqslantless"] = 10901,
7619 ["egs"] = 10902,
7620 ["eqslantgtr"] = 10902,
7621 ["elsdot"] = 10903,
7622 ["egsdot"] = 10904,
7623 ["el"] = 10905,
7624 ["eg"] = 10906,
7625 ["siml"] = 10909,
7626 ["simg"] = 10910,
7627 ["simlE"] = 10911,
7628 ["simgE"] = 10912,
7629 ["LessLess"] = 10913,
7630 ["NotNestedLessLess"] = {10913, 824},
7631 ["GreaterGreater"] = 10914,
7632 ["NotNestedGreaterGreater"] = {10914, 824},
7633 ["glj"] = 10916,
7634 ["gla"] = 10917,
7635 ["ltcc"] = 10918,
7636 ["gtcc"] = 10919,
7637 ["lescc"] = 10920,
7638 ["gescc"] = 10921,
7639 ["smt"] = 10922,
7640 ["lat"] = 10923,
7641 ["smte"] = 10924,
7642 ["smtes"] = {10924, 65024},
7643 ["late"] = 10925,
7644 ["lates"] = {10925, 65024},
7645 ["bumpE"] = 10926,
7646 ["NotPrecedesEqual"] = {10927, 824},
7647 ["PrecedesEqual"] = 10927,
7648 ["npre"] = {10927, 824},
7649 ["npreceq"] = {10927, 824},
7650 ["pre"] = 10927,
7651 ["preceq"] = 10927,
7652 ["NotSucceedsEqual"] = {10928, 824},
7653 ["SucceedsEqual"] = 10928,
7654 ["nsce"] = {10928, 824},
7655 ["nsucceq"] = {10928, 824},
7656 ["sce"] = 10928,
7657 ["succeq"] = 10928,
7658 ["prE"] = 10931,
7659 ["scE"] = 10932,
7660 ["precneqq"] = 10933,
7661 ["prnE"] = 10933,

```

```

7662 ["scnE"] = 10934,
7663 ["succneqq"] = 10934,
7664 ["prap"] = 10935,
7665 ["precapprox"] = 10935,
7666 ["scap"] = 10936,
7667 ["succapprox"] = 10936,
7668 ["precnapprox"] = 10937,
7669 ["prnap"] = 10937,
7670 ["scnap"] = 10938,
7671 ["succnapprox"] = 10938,
7672 ["Pr"] = 10939,
7673 ["Sc"] = 10940,
7674 ["subdot"] = 10941,
7675 ["supdot"] = 10942,
7676 ["subplus"] = 10943,
7677 ["supplus"] = 10944,
7678 ["submult"] = 10945,
7679 ["supmult"] = 10946,
7680 ["subedot"] = 10947,
7681 ["supedot"] = 10948,
7682 ["nsubE"] = {10949, 824},
7683 ["nsubseteqq"] = {10949, 824},
7684 ["subE"] = 10949,
7685 ["subseteqq"] = 10949,
7686 ["nsupE"] = {10950, 824},
7687 ["nsupseteqq"] = {10950, 824},
7688 ["supE"] = 10950,
7689 ["supseteqq"] = 10950,
7690 ["subsim"] = 10951,
7691 ["supsim"] = 10952,
7692 ["subnE"] = 10955,
7693 ["subsetneqq"] = 10955,
7694 ["varsubsetneqq"] = {10955, 65024},
7695 ["vsubnE"] = {10955, 65024},
7696 ["supnE"] = 10956,
7697 ["supsetneqq"] = 10956,
7698 ["varsupsetneqq"] = {10956, 65024},
7699 ["vsupnE"] = {10956, 65024},
7700 ["csub"] = 10959,
7701 ["csup"] = 10960,
7702 ["csube"] = 10961,
7703 ["csupe"] = 10962,
7704 ["subsup"] = 10963,
7705 ["supsub"] = 10964,
7706 ["subsub"] = 10965,
7707 ["supsup"] = 10966,
7708 ["suphsub"] = 10967,

```



```

7709 ["supdsub"] = 10968,
7710 ["forkv"] = 10969,
7711 ["topfork"] = 10970,
7712 ["mlcp"] = 10971,
7713 ["Dashv"] = 10980,
7714 ["DoubleLeftTee"] = 10980,
7715 ["Vdashl"] = 10982,
7716 ["Barv"] = 10983,
7717 ["vBar"] = 10984,
7718 ["vBarv"] = 10985,
7719 ["Vbar"] = 10987,
7720 ["Not"] = 10988,
7721 ["bNot"] = 10989,
7722 ["rnmid"] = 10990,
7723 ["cirmid"] = 10991,
7724 ["midcir"] = 10992,
7725 ["topcir"] = 10993,
7726 ["nhpar"] = 10994,
7727 ["parsim"] = 10995,
7728 ["nparsl"] = {11005, 8421},
7729 ["parsl"] = 11005,
7730 ["fflig"] = 64256,
7731 ["filig"] = 64257,
7732 ["fllig"] = 64258,
7733 ["ffilig"] = 64259,
7734 ["ffllig"] = 64260,
7735 ["Ascr"] = 119964,
7736 ["Cscr"] = 119966,
7737 ["Dscr"] = 119967,
7738 ["Gscr"] = 119970,
7739 ["Jscr"] = 119973,
7740 ["Kscr"] = 119974,
7741 ["Nscr"] = 119977,
7742 ["Oscr"] = 119978,
7743 ["Pscr"] = 119979,
7744 ["Qscr"] = 119980,
7745 ["Sscr"] = 119982,
7746 ["Tscr"] = 119983,
7747 ["Uscr"] = 119984,
7748 ["Vscr"] = 119985,
7749 ["Wscr"] = 119986,
7750 ["Xscr"] = 119987,
7751 ["Yscr"] = 119988,
7752 ["Zscr"] = 119989,
7753 ["ascr"] = 119990,
7754 ["bscr"] = 119991,
7755 ["cscr"] = 119992,

```

7756 ["dscr"] = 119993,
7757 ["fscr"] = 119995,
7758 ["hscr"] = 119997,
7759 ["iscr"] = 119998,
7760 ["jscr"] = 119999,
7761 ["kscr"] = 120000,
7762 ["lscr"] = 120001,
7763 ["mscr"] = 120002,
7764 ["nscr"] = 120003,
7765 ["pscr"] = 120005,
7766 ["qscr"] = 120006,
7767 ["rscr"] = 120007,
7768 ["sscr"] = 120008,
7769 ["tscr"] = 120009,
7770 ["uscr"] = 120010,
7771 ["vscr"] = 120011,
7772 ["wscr"] = 120012,
7773 ["xscr"] = 120013,
7774 ["yscr"] = 120014,
7775 ["zscr"] = 120015,
7776 ["Afr"] = 120068,
7777 ["Bfr"] = 120069,
7778 ["Dfr"] = 120071,
7779 ["Efr"] = 120072,
7780 ["Ffr"] = 120073,
7781 ["Gfr"] = 120074,
7782 ["Jfr"] = 120077,
7783 ["Kfr"] = 120078,
7784 ["Lfr"] = 120079,
7785 ["Mfr"] = 120080,
7786 ["Nfr"] = 120081,
7787 ["Ofr"] = 120082,
7788 ["Pfr"] = 120083,
7789 ["Qfr"] = 120084,
7790 ["Sfr"] = 120086,
7791 ["Tfr"] = 120087,
7792 ["Ufr"] = 120088,
7793 ["Vfr"] = 120089,
7794 ["Wfr"] = 120090,
7795 ["Xfr"] = 120091,
7796 ["Yfr"] = 120092,
7797 ["afr"] = 120094,
7798 ["bfr"] = 120095,
7799 ["cfr"] = 120096,
7800 ["dfr"] = 120097,
7801 ["efr"] = 120098,
7802 ["ffr"] = 120099,

```

7803 ["gfr"] = 120100,
7804 ["hfr"] = 120101,
7805 ["ifr"] = 120102,
7806 ["jfr"] = 120103,
7807 ["kfr"] = 120104,
7808 ["lfr"] = 120105,
7809 ["mfr"] = 120106,
7810 ["nfr"] = 120107,
7811 ["ofr"] = 120108,
7812 ["pfr"] = 120109,
7813 ["qfr"] = 120110,
7814 ["rfr"] = 120111,
7815 ["sfr"] = 120112,
7816 ["tfr"] = 120113,
7817 ["ufr"] = 120114,
7818 ["vfr"] = 120115,
7819 ["wfr"] = 120116,
7820 ["xfr"] = 120117,
7821 ["yfr"] = 120118,
7822 ["zfr"] = 120119,
7823 ["Aopf"] = 120120,
7824 ["Bopf"] = 120121,
7825 ["Dopf"] = 120123,
7826 ["Eopf"] = 120124,
7827 ["Fopf"] = 120125,
7828 ["Gopf"] = 120126,
7829 ["Iopf"] = 120128,
7830 ["Jopf"] = 120129,
7831 ["Kopf"] = 120130,
7832 ["Lopf"] = 120131,
7833 ["Mopf"] = 120132,
7834 ["Oopf"] = 120134,
7835 ["Sopf"] = 120138,
7836 ["Topf"] = 120139,
7837 ["Uopf"] = 120140,
7838 ["Vopf"] = 120141,
7839 ["Wopf"] = 120142,
7840 ["Xopf"] = 120143,
7841 ["Yopf"] = 120144,
7842 ["aopf"] = 120146,
7843 ["bopf"] = 120147,
7844 ["copf"] = 120148,
7845 ["dopf"] = 120149,
7846 ["eopf"] = 120150,
7847 ["fopf"] = 120151,
7848 ["gopf"] = 120152,
7849 ["hopf"] = 120153,

```

```

7850 ["iopf"] = 120154,
7851 ["jopf"] = 120155,
7852 ["kopf"] = 120156,
7853 ["lopf"] = 120157,
7854 ["mopf"] = 120158,
7855 ["nopf"] = 120159,
7856 ["oopf"] = 120160,
7857 ["popf"] = 120161,
7858 ["qopf"] = 120162,
7859 ["ropf"] = 120163,
7860 ["sopf"] = 120164,
7861 ["topf"] = 120165,
7862 ["uopf"] = 120166,
7863 ["vopf"] = 120167,
7864 ["wopf"] = 120168,
7865 ["xopf"] = 120169,
7866 ["yopf"] = 120170,
7867 ["zopf"] = 120171,
7868 }

```

Given a string `s` of decimal digits, the `entities.dec_entity` returns the corresponding UTF8-encoded Unicode codepoint.

```

7869 function entities.dec_entity(s)
7870   local n = tonumber(s)
7871   if n == nil then
7872     return "&#" .. s .. ";" -- fallback for unknown entities
7873   end
7874   return utf8.char(n)
7875 end

```

Given a string `s` of hexadecimal digits, the `entities.hex_entity` returns the corresponding UTF8-encoded Unicode codepoint.

```

7876 function entities.hex_entity(s)
7877   local n = tonumber("0x"..s)
7878   if n == nil then
7879     return "&#x" .. s .. ";" -- fallback for unknown entities
7880   end
7881   return utf8.char(n)
7882 end

```

Given a captured character `x` and a string `s` of hexadecimal digits, the `entities.hex_entity_with_x_char` returns the corresponding UTF8-encoded Unicode codepoint or fallback with the `x` character.

```

7883 function entities.hex_entity_with_x_char(x, s)
7884   local n = tonumber("0x"..s)
7885   if n == nil then
7886     return "&#" .. x .. s .. ";" -- fallback for unknown entities
7887   end

```

```

7888   return utf8.char(n)
7889 end

```

Given a character entity name `s` (like `ouml`), the `entities.char_entity` returns the corresponding UTF8-encoded Unicode codepoint.

```

7890 function entities.char_entity(s)
7891   local code_points = character_entities[s]
7892   if code_points == nil then
7893     return "&" .. s .. ";"
7894   end
7895   if type(code_points) ~= 'table' then
7896     code_points = {code_points}
7897   end
7898   local char_table = {}
7899   for _, code_point in ipairs(code_points) do
7900     table.insert(char_table, utf8.char(code_point))
7901   end
7902   return table.concat(char_table)
7903 end

```

3.1.4 Plain T_EX Writer

This section documents the `writer` object, which implements the routines for producing the T_EX output. The object is an amalgamate of the generic, T_EX, L^AT_EX writer objects that were located in the `lunamark/writer/generic.lua`, `lunamark/writer/tex.lua`, and `lunamark/writer/latex.lua` files in the Luna-mark Lua module.

Although not specified in the Lua interface (see Section 2.1), the `writer` object is exported, so that the curious user could easily tinker with the methods of the objects produced by the `writer.new` method described below. The user should be aware, however, that the implementation may change in a future revision.

```

7904 M.writer = {}

```

The `writer.new` method creates and returns a new T_EX writer object associated with the Lua interface options (see Section 2.1.3) `options`. When `options` are unspecified, it is assumed that an empty table was passed to the method.

The objects produced by the `writer.new` method expose instance methods and variables of their own. As a convention, I will refer to these *member*s as `writer->member`. All member variables are immutable unless explicitly stated otherwise.

```

7905 local parsers
7906 function M.writer.new(options)
7907   local self = {}

```

Make `options` available as `writer->options`, so that it is accessible from extensions.

```

7908   self.options = options

```

Define `writer->flatten_inlines`, which indicates whether or not the writer should produce raw text rather than text in the output format for inline elements. The `writer->flatten_inlines` member variable is mutable.

```
7909 self.flatten_inlines = false
```

3.1.4.1 Slicing

Parse the `slice` option and define `writer->slice_begin`, `writer->slice_end`, and `writer->is_writing`. The `writer->is_writing` member variable is mutable.

```
7910 local slice_specifiers = {}
7911 for specifier in options.slice:gmatch("[~%s]+") do
7912     table.insert(slice_specifiers, specifier)
7913 end
7914
7915 if #slice_specifiers == 2 then
7916     self.slice_begin, self.slice_end = table.unpack(slice_specifiers)
7917     local slice_begin_type = self.slice_begin:sub(1, 1)
7918     if slice_begin_type ~= "^" and slice_begin_type ~= "$" then
7919         self.slice_begin = "^" .. self.slice_begin
7920     end
7921     local slice_end_type = self.slice_end:sub(1, 1)
7922     if slice_end_type ~= "^" and slice_end_type ~= "$" then
7923         self.slice_end = "$" .. self.slice_end
7924     end
7925 elseif #slice_specifiers == 1 then
7926     self.slice_begin = "^" .. slice_specifiers[1]
7927     self.slice_end = "$" .. slice_specifiers[1]
7928 end
7929
7930 self.slice_begin_type = self.slice_begin:sub(1, 1)
7931 self.slice_begin_identifier = self.slice_begin:sub(2) or ""
7932 self.slice_end_type = self.slice_end:sub(1, 1)
7933 self.slice_end_identifier = self.slice_end:sub(2) or ""
7934
7935 if self.slice_begin == "^" and self.slice_end ~= "^" then
7936     self.is_writing = true
7937 else
7938     self.is_writing = false
7939 end
```

3.1.4.2 Basic Formatter Variables and Functions

Define `writer->space` as the output format of a space character.

```
7940 self.space = " "
```

Define `writer->nbsp` as the output format of a non-breaking space character.

```
7941 self.nbsp = "\\markdownRendererNbsp{}"
```

Define `writer->plain` as a function that will transform an input plain text block `s` to the output format.

```
7942 function self.plain(s)
7943   return s
7944 end
```

Define `writer->paragraph` as a function that will transform an input paragraph `s` to the output format.

```
7945 function self.paragraph(s)
7946   if not self.is_writing then return "" end
7947   return s
7948 end
```

Define `writer->interblocksep` as the output format of a block element separator.

```
7949 self.interblocksep_text = "\\markdownRendererInterblockSeparator\\n{"
7950 function self.interblocksep()
7951   if not self.is_writing then return "" end
7952   return self.interblocksep_text
7953 end
```

Define `writer->paragraphsep` as the output format of a paragraph separator. Users can use more than one blank line to delimit two blocks to indicate the end of a series of blocks that make up a paragraph. This produces a paragraph separator instead of an interblock separator.

```
7954 self.paragraphsep_text = "\\markdownRendererParagraphSeparator\\n{"
7955 function self.paragraphsep()
7956   if not self.is_writing then return "" end
7957   return self.paragraphsep_text
7958 end
```

Define `writer->undosep` as a function that will remove the output produced by an immediately preceding block element / paragraph separator.

```
7959 self.undosep_text = "\\markdownRendererUndoSeparator\\n{"
7960 function self.undosep()
7961   if not self.is_writing then return "" end
7962   return self.undosep_text
7963 end
```

Define `writer->soft_line_break` as the output format of a soft line break.

```
7964 self.soft_line_break = function()
7965   if self.flatten_inlines then return "\\n" end
7966   return "\\markdownRendererSoftLineBreak\\n{"
7967 end
```

Define `writer->hard_line_break` as the output format of a hard line break.

```
7968 self.hard_line_break = function()
7969   if self.flatten_inlines then return "\\n" end
7970   return "\\markdownRendererHardLineBreak\\n{"
7971 end
```

Define `writer->ellipsis` as the output format of an ellipsis.

```
7972 self.ellipsis = "\\markdownRendererEllipsis{}
```

Define `writer->thematic_break` as the output format of a thematic break.

```
7973 function self.thematic_break()
7974   if not self.is_writing then return "" end
7975   return "\\markdownRendererThematicBreak{"
7976 end
```

3.1.4.3 Escaping Special Characters

Define tables `writer->escaped_uri_chars` and `writer->escaped_minimal_strings` containing the mapping from special plain characters and character strings that always need to be escaped.

```
7977 self.escaped_uri_chars = {
7978   ["{"] = "\\markdownRendererLeftBrace{",
7979   ["}"] = "\\markdownRendererRightBrace{",
7980   ["\\"] = "\\markdownRendererBackslash{",
7981   ["\r"] = " ",
7982   ["\n"] = " ",
7983 }
7984 self.escaped_minimal_strings = {
7985   ["^"] = "\\markdownRendererCircumflex",
7986   .. "\\markdownRendererCircumflex ",
7987   ["☑"] = "\\markdownRendererTickedBox{",
7988   ["◻"] = "\\markdownRendererHalfTickedBox{",
7989   ["□"] = "\\markdownRendererUntickedBox{",
7990   [entities.hex_entity('FFFD')]
7991     = "\\markdownRendererReplacementCharacter{",
7992 }
```

Define table `writer->escaped_strings` containing the mapping from character strings that need to be escaped in typeset content.

```
7993 self.escaped_strings = util.table_copy(self.escaped_minimal_strings)
7994 self.escaped_strings[entities.hex_entity('00A0')] = self.nbsp
```

Define a table `writer->escaped_chars` containing the mapping from special plain TeX characters (including the active pipe character (`|`) of ConTeXt) that need to be escaped in typeset content.

```
7995 self.escaped_chars = {
7996   ["{"] = "\\markdownRendererLeftBrace{",
7997   ["}"] = "\\markdownRendererRightBrace{",
7998   ["%"] = "\\markdownRendererPercentSign{",
7999   ["\\"] = "\\markdownRendererBackslash{",
8000   ["#"] = "\\markdownRendererHash{",
8001   ["$"] = "\\markdownRendererDollarSign{",
8002   ["&"] = "\\markdownRendererAmpersand{",
8003   ["_"] = "\\markdownRendererUnderscore{",
```



```

8004     ["^"] = "\\markdownRendererCircumflex{}",
8005     ["~"] = "\\markdownRendererTilde{}",
8006     ["|"] = "\\markdownRendererPipe{}",
8007     [entities.hex_entity('0000')]
8008     = "\\markdownRendererReplacementCharacter{}",
8009 }

```

Use the `writer->escaped_chars`, `writer->escaped_uri_chars`, and `writer->escaped_minimal_` tables to create the `escape_typographic_text`, `escape_programmatic_text`, and `escape_minimal` local escaper functions.

```

8010 local function create_escaper(char_escapes, string_escapes)
8011     local escape = util.escaper(char_escapes, string_escapes)
8012     return function(s)
8013         if self.flatten_inlines then return s end
8014         return escape(s)
8015     end
8016 end
8017 local escape_typographic_text = create_escaper(
8018     self.escaped_chars, self.escaped_strings)
8019 local escape_programmatic_text = create_escaper(
8020     self.escaped_uri_chars, self.escaped_minimal_strings)
8021 local escape_minimal = create_escaper(
8022     {}, self.escaped_minimal_strings)

```

Define the following semantic aliases for the escaper functions:

- `writer->escape` transforms a text string that should always be made printable.
- `writer->string` transforms a text string that should be made printable only when the `hybrid` Lua option is disabled. When `hybrid` is enabled, the text string should be kept as-is.
- `writer->math` transforms a math span.
- `writer->identifier` transforms an input programmatic identifier.
- `writer->uri` transforms an input URI.
- `writer->infostring` transforms a fence code infostring.

```

8023 self.escape = escape_typographic_text
8024 self.math = escape_minimal
8025 if options.hybrid then
8026     self.identifier = escape_minimal
8027     self.string = escape_minimal
8028     self.uri = escape_minimal
8029     self.infostring = escape_minimal
8030 else
8031     self.identifier = escape_programmatic_text
8032     self.string = escape_typographic_text
8033     self.uri = escape_programmatic_text
8034     self.infostring = escape_programmatic_text
8035 end

```

3.1.4.4 Formatters of Warnings and Errors

Define `writer->warning` as a function that will transform an input warning `t` with optional more warning text `m` to the output format.

```
8036 function self.warning(t, m)
8037   return {"\\markdownRendererWarning{" , self.escape(t), "}{" ,
8038           escape_minimal(t), "}{" , self.escape(m or ""), "}{" ,
8039           escape_minimal(m or ""), "}"}
8040 end
```

Define `writer->error` as a function that will transform an input error text `t` with optional more error text `m` to the output format.

```
8041 function self.error(t, m)
8042   return {"\\markdownRendererError{" , self.escape(t), "}{" ,
8043           escape_minimal(t), "}{" , self.escape(m or ""), "}{" ,
8044           escape_minimal(m or ""), "}"}
8045 end
```

3.1.4.5 Formatter of Code Spans

Define `writer->code` as a function that will transform an input inline code span `s` with optional attributes `attributes` to the output format.

```
8046 function self.code(s, attributes)
8047   if self.flatten_inlines then return s end
8048   local buf = {}
8049   if attributes ~= nil then
8050     table.insert(buf,
8051                 "\\markdownRendererCodeSpanAttributeContextBegin\\n")
8052     table.insert(buf, self.attributes(attributes))
8053   end
8054   table.insert(buf,
8055               {"\\markdownRendererCodeSpan{" , self.escape(s), "}"}))
8056   if attributes ~= nil then
8057     table.insert(buf,
8058                 "\\markdownRendererCodeSpanAttributeContextEnd{")
8059   end
8060   return buf
8061 end
```

3.1.4.6 Formatter of Hyperlinks

Define `writer->link` as a function that will transform an input hyperlink to the output format, where `lab` corresponds to the label, `src` to URI, `tit` to the title of the link, and `attributes` to optional attributes.

```
8062 function self.link(lab, src, tit, attributes)
8063   if self.flatten_inlines then return lab end
8064   local buf = {}
8065   if attributes ~= nil then
```

```

8066     table.insert(buf,
8067         "\\markdownRendererLinkAttributeContextBegin\n")
8068     table.insert(buf, self.attributes(attributes))
8069 end
8070 table.insert(buf, {"\\markdownRendererLink{",lab,"}",
8071     "{",self.escape(src),"}",
8072     "{",self.uri(src),"}",
8073     "{",self.string(tit or ""),"}}"})
8074 if attributes ~= nil then
8075     table.insert(buf,
8076         "\\markdownRendererLinkAttributeContextEnd{ }")
8077 end
8078 return buf
8079 end

```

3.1.4.7 Formatter of Images

Define `writer->image` as a function that will transform an input image to the output format, where `lab` corresponds to the label, `src` to the URL, `tit` to the title of the image, and `attributes` to optional attributes.

```

8080 function self.image(lab, src, tit, attributes)
8081     if self.flatten_inlines then return lab end
8082     local buf = {}
8083     if attributes ~= nil then
8084         table.insert(buf,
8085             "\\markdownRendererImageAttributeContextBegin\n")
8086         table.insert(buf, self.attributes(attributes))
8087     end
8088     table.insert(buf, {"\\markdownRendererImage{",lab,"}",
8089         "{",self.string(src),"}",
8090         "{",self.uri(src),"}",
8091         "{",tit,"}"})
8092     if attributes ~= nil then
8093         table.insert(buf,
8094             "\\markdownRendererImageAttributeContextEnd{ }")
8095     end
8096     return buf
8097 end

```

3.1.4.8 Formatters of Lists

Define `writer->bulletlist` as a function that will transform an input bulleted list to the output format, where `items` is an array of the list items and `tight` specifies, whether the list is tight or not.

```

8098 function self.bulletlist(items,tight)
8099     if not self.is_writing then return "" end
8100     local buffer = {}

```

```

8101     for _,item in ipairs(items) do
8102         if item ~= "" then
8103             buffer[#buffer + 1] = self.bulletitem(item)
8104         end
8105     end
8106     local contents = util.intersperse(buffer,"\n")
8107     if tight and options.tightLists then
8108         return {"\\markdownRendererUlBeginTight\n",contents,
8109             "\n\\markdownRendererUlEndTight "}
8110     else
8111         return {"\\markdownRendererUlBegin\n",contents,
8112             "\n\\markdownRendererUlEnd "}
8113     end
8114 end

```

Define `writer->bulletitem` as a function that will transform an input bulleted list item to the output format, where `s` is the text of the list item.

```

8115 function self.bulletitem(s)
8116     return {"\\markdownRendererUlItem ",s,
8117         "\\markdownRendererUlItemEnd "}
8118 end

```

Define `writer->orderedlist` as a function that will transform an input ordered list to the output format, where `items` is an array of the list items and `tight` specifies, whether the list is tight or not. If the optional parameter `startnum` is present, it is the number of the first list item.

```

8119 function self.orderedlist(items,tight,startnum)
8120     if not self.is_writing then return "" end
8121     local buffer = {}
8122     local num = startnum
8123     for _,item in ipairs(items) do
8124         if item ~= "" then
8125             buffer[#buffer + 1] = self.ordereditem(item,num)
8126         end
8127         if num ~= nil and item ~= "" then
8128             num = num + 1
8129         end
8130     end
8131     local contents = util.intersperse(buffer,"\n")
8132     if tight and options.tightLists then
8133         return {"\\markdownRendererOlBeginTight\n",contents,
8134             "\n\\markdownRendererOlEndTight "}
8135     else
8136         return {"\\markdownRendererOlBegin\n",contents,
8137             "\n\\markdownRendererOlEnd "}
8138     end
8139 end

```

Define `writer->ordereditem` as a function that will transform an input ordered list item to the output format, where `s` is the text of the list item. If the optional parameter `num` is present, it is the number of the list item.

```

8140 function self.ordereditem(s,num)
8141   if num ~= nil then
8142     return {"\\markdownRendererOlItemWithNumber{" ,num,"} ",s,
8143           "\\markdownRendererOlItemEnd "}
8144   else
8145     return {"\\markdownRendererOlItem ",s,
8146           "\\markdownRendererOlItemEnd "}
8147   end
8148 end

```

3.1.4.9 Formatters of html Tags, Elements, and Comments

Define `writer->inline_html_comment` as a function that will transform the contents of an inline HTML comment, to the output format, where `contents` are the contents of the HTML comment.

```

8149 function self.inline_html_comment(contents)
8150   if self.flatten_inlines then return contents end
8151   return {"\\markdownRendererInlineHtmlComment{" ,contents,"}"}
8152 end

```

Define `writer->inline_html_tag` as a function that will transform the contents of an opening, closing, or empty inline HTML tag to the output format, where `contents` are the contents of the HTML tag.

```

8153 function self.inline_html_tag(contents)
8154   if self.flatten_inlines then return contents end
8155   return {"\\markdownRendererInlineHtmlTag{" ,
8156         self.string(contents),"}"}
8157 end

```

Define `writer->block_html_element` as a function that will transform the contents of a block HTML element to the output format, where `s` are the contents of the HTML element.

```

8158 function self.block_html_element(s)
8159   if not self.is_writing then return "" end
8160   local name = util.cache(options.cacheDir, s, nil, nil, ".verbatim")
8161   return {"\\markdownRendererInputBlockHtmlElement{" ,name,"}"}
8162 end

```

Define `writer->block_html_cdata_element` as a function that transforms the contents of a block HTML CDATA element such as `<script>`, `<pre>`, `<style>`, or `<textarea>` (CommonMark HTML block type 1) to the output format.

```

8163 function self.block_html_cdata_element(s)
8164   if not self.is_writing then return "" end
8165   local name = util.cache(options.cacheDir, s, nil, nil, ".verbatim")

```

```

8166     return {"\\markdownRendererInputBlockHtmlCdataElement{" ,name,""}
8167 end

```

Define `writer->block_html_comment` as a function that transforms the contents of a block HTML comment (CommonMark HTML block type 2) to the output format, where `s` is the full comment text.

```

8168 function self.block_html_comment(contents)
8169     if self.flatten_inlines then return contents end
8170     return {"\\markdownRendererBlockHtmlComment{" ,contents,""}
8171 end

```

Define `writer->block_html_processing_instruction` as a function that transforms the contents of a block HTML processing instruction (CommonMark HTML block type 3) to the output format.

```

8172 function self.block_html_processing_instruction(s)
8173     if not self.is_writing then return "" end
8174     local name = util.cache(options.cacheDir, s, nil, nil, ".verbatim")
8175     return {
8176         "\\markdownRendererInputBlockHtmlProcessingInstruction{" ,name,""}
8177 end

```

Define `writer->block_html_declaration` as a function that transforms the contents of a block HTML declaration (CommonMark HTML block type 4) to the output format.

```

8178 function self.block_html_declaration(s)
8179     if not self.is_writing then return "" end
8180     local name = util.cache(options.cacheDir, s, nil, nil, ".verbatim")
8181     return {
8182         "\\markdownRendererInputBlockHtmlDeclaration{" ,name,""}
8183 end

```

Define `writer->block_html_cdata_section` as a function that transforms the contents of a block HTML CDATA section (CommonMark HTML block type 5) to the output format.

```

8184 function self.block_html_cdata_section(s)
8185     if not self.is_writing then return "" end
8186     local name = util.cache(options.cacheDir, s, nil, nil, ".verbatim")
8187     return {"\\markdownRendererInputBlockHtmlCdataSection{" ,name,""}
8188 end

```

Define `writer->block_html_pCDATA_element` as a function that transforms the contents of a block HTML PCDATA element such as `<div>` or `<table>` (CommonMark HTML block type 6) to the output format.

```

8189 function self.block_html_pCDATA_element(s)
8190     if not self.is_writing then return "" end
8191     local name = util.cache(options.cacheDir, s, nil, nil, ".verbatim")
8192     return {"\\markdownRendererInputBlockHtmlPcdataElement{" ,name,""}
8193 end

```

Define `writer->block_html_standalone_tag` as a function that transforms the contents of a block HTML element that does not fall into types 1–6 (CommonMark HTML block type 7) to the output format.

```
8194 function self.block_html_standalone_tag(contents)
8195     if self.flatten_inlines then return contents end
8196     return {"\\markdownRendererBlockHtmlStandaloneTag{",
8197           self.string(contents),"}"}
8198 end
```

Define `writer->inline_html_processing_instruction` as a function that transforms the contents of an inline HTML processing instruction to the output format.

```
8199 function self.inline_html_processing_instruction(contents)
8200     if self.flatten_inlines then return contents end
8201     return {"\\markdownRendererInlineHtmlProcessingInstruction{",
8202           self.string(contents),"}"}
8203 end
```

Define `writer->inline_html_declaration` as a function that transforms the contents of an inline HTML declaration to the output format.

```
8204 function self.inline_html_declaration(contents)
8205     if self.flatten_inlines then return contents end
8206     return {"\\markdownRendererInlineHtmlDeclaration{",
8207           self.string(contents),"}"}
8208 end
```

Define `writer->inline_html_cdata_section` as a function that transforms the contents of an inline HTML CDATA section to the output format.

```
8209 function self.inline_html_cdata_section(contents)
8210     if self.flatten_inlines then return contents end
8211     return {"\\markdownRendererInlineHtmlCdataSection{",
8212           self.string(contents),"}"}
8213 end
```

Define `writer->inline_html_open_tag` as a function that transforms the contents of an inline HTML opening tag to the output format.

```
8214 function self.inline_html_open_tag(contents)
8215     if self.flatten_inlines then return contents end
8216     return {"\\markdownRendererInlineHtmlOpenTag{",
8217           self.string(contents),"}"}
8218 end
```

Define `writer->inline_html_close_tag` as a function that transforms the contents of an inline HTML closing tag to the output format.

```
8219 function self.inline_html_close_tag(contents)
8220     if self.flatten_inlines then return contents end
8221     return {"\\markdownRendererInlineHtmlCloseTag{",
8222           self.string(contents),"}"}
8223 end
```

Define `writer->inline_html_empty_tag` as a function that transforms the contents of an inline HTML self-closing (empty) tag to the output format.

```
8224 function self.inline_html_empty_tag(contents)
8225   if self.flatten_inlines then return contents end
8226   return {"\\markdownRendererInlineHtmlEmptyTag{",
8227           self.string(contents),"}"}
8228 end
```

3.1.4.10 Formatter of Emphasis

Define `writer->emphasis` as a function that will transform an emphasized span `s` of input text to the output format.

```
8229 function self.emphasis(s)
8230   if self.flatten_inlines then return s end
8231   return {"\\markdownRendererEmphasis{",s,""}
8232 end
```

3.1.4.11 Formatter of Strong Emphasis

Define `writer->strong` as a function that will transform a strongly emphasized span `s` of input text to the output format.

```
8233 function self.strong(s)
8234   if self.flatten_inlines then return s end
8235   return {"\\markdownRendererStrongEmphasis{",s,""}
8236 end
```

3.1.4.12 Formatter of Tickboxes

Define `writer->tickbox` as a function that will transform a number `f` to the output format.

```
8237 function self.tickbox(f)
8238   if f == 1.0 then
8239     return "☒ "
8240   elseif f == 0.0 then
8241     return "☐ "
8242   else
8243     return "◻ "
8244   end
8245 end
```

3.1.4.13 Formatter of Blockquotes

Define `writer->blockquote` as a function that will transform an input block quote `s` to the output format.

```
8246 function self.blockquote(s)
8247   if not self.is_writing then return "" end
8248   return {"\\markdownRendererBlockQuoteBegin\n",s,
```



```

8249         "\\markdownRendererBlockQuoteEnd "}
8250     end

```

3.1.4.14 Formatter of Code Blocks

Define `writer->verbatim` as a function that will transform an input code block `s` to the output format.

```

8251     function self.verbatim(s)
8252         if not self.is_writing then return "" end
8253         s = s:gsub("\n$", "")
8254         local name = util.cache_verbatim(options.cacheDir, s)
8255         return {"\\markdownRendererInputVerbatim{" ,name,""} }
8256     end

```

3.1.4.15 Formatter of Documents

Define `writer->document` as a function that will transform a document `d` to the output format.

```

8257     function self.document(d)
8258         local buf = {"\\markdownRendererDocumentBegin\n"}
8259
8260         -- warn against the `hybrid` option
8261         if options.hybrid then
8262             local text = "The `hybrid` option has been soft-deprecated."
8263             local more = "Consider using one of the following better options "
8264                 .. "for mixing TeX and markdown: `contentBlocks`, "
8265                 .. "`rawAttribute`, `texComments`, `texMathDollars`, "
8266                 .. "`texMathSingleBackslash`, and "
8267                 .. "`texMathDoubleBackslash`. "
8268             .. "For more information, see the user manual at "
8269             .. "<https://witiko.github.io/markdown/>."
8270             table.insert(buf, self.warning(text, more))
8271         end
8272
8273         -- insert the text of the document
8274         table.insert(buf, d)
8275
8276         -- pop all attributes
8277         table.insert(buf, self.pop_attributes())
8278
8279         table.insert(buf, "\\markdownRendererDocumentEnd")
8280
8281         return buf
8282     end

```

3.1.4.16 Formatter of Attributes

Define `writer->attributes` as a function that will transform input attributes `attrs` to the output format.

```
8283 local seen_identifiers = {}
8284 local key_value_regex = "([^\s= ]+)%s*=%s*(.*)"
8285 local function normalize_attributes(attributes, auto_identifiers)
8286   -- normalize attributes
8287   local normalized_attributes = {}
8288   local has_explicit_identifiers = false
8289   local key, value
8290   for _, attribute in ipairs(attributes or {}) do
8291     if attribute:sub(1, 1) == "#" then
8292       table.insert(normalized_attributes, attribute)
8293       has_explicit_identifiers = true
8294       seen_identifiers[attribute:sub(2)] = true
8295     elseif attribute:sub(1, 1) == "." then
8296       table.insert(normalized_attributes, attribute)
8297     else
8298       key, value = attribute:match(key_value_regex)
8299       if key:lower() == "id" then
8300         table.insert(normalized_attributes, "#" .. value)
8301       elseif key:lower() == "class" then
8302         local classes = {}
8303         for class in value:gmatch("%S+") do
8304           table.insert(classes, class)
8305         end
8306         table.sort(classes)
8307         for _, class in ipairs(classes) do
8308           table.insert(normalized_attributes, "." .. class)
8309         end
8310       else
8311         table.insert(normalized_attributes, attribute)
8312       end
8313     end
8314   end
8315
8316   -- if no explicit identifiers exist, add auto identifiers
8317   if not has_explicit_identifiers and auto_identifiers ~= nil then
8318     local seen_auto_identifiers = {}
8319     for _, auto_identifier in ipairs(auto_identifiers) do
8320       if seen_auto_identifiers[auto_identifier] == nil then
8321         seen_auto_identifiers[auto_identifier] = true
8322         if seen_identifiers[auto_identifier] == nil then
8323           seen_identifiers[auto_identifier] = true
8324           table.insert(normalized_attributes,
8325             "#" .. auto_identifier)
8326         end
8327       end
8328       local auto_identifier_number = 1
```

```

8328         while true do
8329             local numbered_auto_identifier = auto_identifier .. "-"
8330                 .. auto_identifier_number
8331             if seen_identifiers[numbered_auto_identifier] == nil then
8332                 seen_identifiers[numbered_auto_identifier] = true
8333                 table.insert(normalized_attributes,
8334                     "#" .. numbered_auto_identifier)
8335                 break
8336             end
8337             auto_identifier_number = auto_identifier_number + 1
8338         end
8339     end
8340 end
8341 end
8342 end
8343
8344 -- sort and deduplicate normalized attributes
8345 table.sort(normalized_attributes)
8346 local seen_normalized_attributes = {}
8347 local deduplicated_normalized_attributes = {}
8348 for _, attribute in ipairs(normalized_attributes) do
8349     if seen_normalized_attributes[attribute] == nil then
8350         seen_normalized_attributes[attribute] = true
8351         table.insert(deduplicated_normalized_attributes, attribute)
8352     end
8353 end
8354
8355 return deduplicated_normalized_attributes
8356 end
8357
8358 function self.attributes(attributes, should_normalize_attributes)
8359     local normalized_attributes
8360     if should_normalize_attributes == false then
8361         normalized_attributes = attributes
8362     else
8363         normalized_attributes = normalize_attributes(attributes)
8364     end
8365
8366     local buf = {}
8367     local key, value
8368     for _, attribute in ipairs(normalized_attributes) do
8369         if attribute:sub(1, 1) == "#" then
8370             table.insert(buf, {"\\markdownRenderAttributeIdentifier{",
8371                 attribute:sub(2), "}"}
8372         elseif attribute:sub(1, 1) == "." then
8373             table.insert(buf, {"\\markdownRenderAttributeClassName{",
8374                 attribute:sub(2), "}"}

```

```

8375         else
8376             key, value = attribute:match(key_value_regex)
8377             table.insert(buf, {"\\markdownRendererAttributeKeyValue{",
8378                             key, "}{" , value, "}")
8379         end
8380     end
8381
8382     return buf
8383 end

```

3.1.4.17 Tracking Active Attributes

Define `writer->active_attributes` as a stack of block-level attributes that are currently active. The `writer->active_attributes` member variable is mutable.

```

8384     self.active_attributes = {}

```

Define `writer->attribute_type_levels` as a hash table that maps attribute types to the number of attributes of said type in `writer->active_attributes`.

```

8385     self.attribute_type_levels = {}
8386     setmetatable(self.attribute_type_levels,
8387                 { __index = function() return 0 end })

```

Define `writer->push_attributes` and `writer->pop_attributes` as functions that will add a new set of active block-level attributes or remove the most current attributes from `writer->active_attributes`.

```

8388     local function apply_attributes()
8389         local buf = {}
8390         for i = 1, #self.active_attributes do
8391             local start_output = self.active_attributes[i][3]
8392             if start_output ~= nil then
8393                 table.insert(buf, start_output)
8394             end
8395         end
8396         return buf
8397     end
8398
8399     local function tear_down_attributes()
8400         local buf = {}
8401         for i = #self.active_attributes, 1, -1 do
8402             local end_output = self.active_attributes[i][4]
8403             if end_output ~= nil then
8404                 table.insert(buf, end_output)
8405             end
8406         end
8407         return buf
8408     end

```

The `writer->push_attributes` method adds `attributes` of type `attribute_type` to `writer->active_attributes`. The `start_output` string is used to construct a rope that will be returned by this function, together with output produced as a result of slicing (see `slice`). The `end_output` string is stored together with `attributes` and is used to construct the return value of the `writer->pop_attributes` method.

```

8409  function self.push_attributes(attribute_type, attributes,
8410                                start_output, end_output)
8411      local attribute_type_level
8412      = self.attribute_type_levels[attribute_type]
8413      self.attribute_type_levels[attribute_type]
8414      = attribute_type_level + 1
8415
8416      -- index attributes in a hash table for easy lookup
8417      attributes = attributes or {}
8418      for i = 1, #attributes do
8419          attributes[attributes[i]] = true
8420      end
8421
8422      local buf = {}
8423      -- handle slicing
8424      if attributes["#" .. self.slice_end_identifier] ~= nil and
8425          self.slice_end_type == "^" then
8426          if self.is_writing then
8427              table.insert(buf, self.undosep())
8428              table.insert(buf, tear_down_attributes())
8429          end
8430          self.is_writing = false
8431      end
8432      if attributes["#" .. self.slice_begin_identifier] ~= nil and
8433          self.slice_begin_type == "^" then
8434          table.insert(buf, apply_attributes())
8435          self.is_writing = true
8436      end
8437      if self.is_writing and start_output ~= nil then
8438          table.insert(buf, start_output)
8439      end
8440      table.insert(self.active_attributes,
8441                  {attribute_type, attributes,
8442                   start_output, end_output})
8443      return buf
8444  end
8445

```

The `writer->pop_attributes` method removes the most current of active block-level attributes from `writer->active_attributes` until attributes of type `attribute_type` have been removed. The method returns a rope constructed from the `end_output` string specified in the calls of `writer->push_attributes` that

produced the most current attributes, and also from output produced as a result of slicing (see [slice](#)).

```
8446 function self.pop_attributes(attribute_type)
8447     local buf = {}
8448     -- pop attributes until we find attributes of correct type
8449     -- or until no attributes remain
8450     local current_attribute_type = false
8451     while current_attribute_type ~= attribute_type and
8452         #self.active_attributes > 0 do
8453         local attributes, _, end_output
8454         current_attribute_type, attributes, _, end_output = table.unpack(
8455             self.active_attributes[#self.active_attributes])
8456         local attribute_type_level
8457         = self.attribute_type_levels[current_attribute_type]
8458         self.attribute_type_levels[current_attribute_type]
8459         = attribute_type_level - 1
8460         if self.is_writing and end_output ~= nil then
8461             table.insert(buf, end_output)
8462         end
8463         table.remove(self.active_attributes, #self.active_attributes)
8464         -- handle slicing
8465         if attributes["#" .. self.slice_end_identifier] ~= nil
8466             and self.slice_end_type == "$" then
8467             if self.is_writing then
8468                 table.insert(buf, self.undosep())
8469                 table.insert(buf, tear_down_attributes())
8470             end
8471             self.is_writing = false
8472         end
8473         if attributes["#" .. self.slice_begin_identifier] ~= nil and
8474             self.slice_begin_type == "$" then
8475             self.is_writing = true
8476             table.insert(buf, apply_attributes())
8477         end
8478     end
8479     return buf
8480 end
```

3.1.4.18 Automatically Generated Identifiers for Headings

Create an auto identifier string by stripping and converting characters from string `s`.

```
8481 local function create_auto_identifier(s)
8482     local buffer = {}
8483     local prev_space = false
8484     local letter_found = false
8485     local normalized_s = s
```

```

8486     if not options.unicodeNormalization
8487         or options.unicodeNormalizationForm ~= "nfc" then
8488         normalized_s = util.normalize(normalized_s, "nfc")
8489     end
8490
8491     for _, code in utf8.codes(normalized_s) do
8492         local char = utf8.char(code)
8493
8494         -- Remove everything up to the first letter.
8495         if not letter_found then
8496             local is_letter = lpeg.match(
8497                 parsers.unicode.alpha,
8498                 char
8499             )
8500             if is_letter then
8501                 letter_found = true
8502             else
8503                 goto continue
8504             end
8505         end
8506
8507         -- Remove all non-alphanumeric characters, except underscores,
8508         -- hyphens, and periods.
8509         if not lpeg.match(
8510             ( parsers.underscore
8511               + parsers.dash
8512               + parsers.period
8513               + parsers.unicode.word
8514               + #parsers.unicode.whitespace ),
8515             char
8516         ) then
8517             goto continue
8518         end
8519
8520         -- Replace all spaces and newlines with hyphens.
8521         if lpeg.match(
8522             ( parsers.newline
8523               + #parsers.unicode.whitespace ),
8524             char
8525         ) then
8526             char = "-"
8527             if prev_space then
8528                 goto continue
8529             else
8530                 prev_space = true
8531             end
8532         else

```

```

8533         -- Case-fold all alphabetic characters.
8534         local form = nil
8535         if options.unicodeNormalization then
8536             form = options.unicodeNormalizationForm
8537         end
8538         char = util.casefold(char, form)
8539         prev_space = false
8540     end
8541
8542     table.insert(buffer, char)
8543
8544     ::continue::
8545 end
8546
8547 if prev_space then
8548     table.remove(buffer)
8549 end
8550
8551 local identifier = #buffer == 0 and "section"
8552                  or table.concat(buffer, "")
8553 return identifier
8554 end

```

Create an GitHub-flavored auto identifier string by stripping and converting characters from string `s`.

```

8555 local function create_gfm_auto_identifier(s)
8556     local buffer = {}
8557     local prev_space = false
8558     local letter_found = false
8559     local normalized_s = s
8560     if not options.unicodeNormalization
8561         or options.unicodeNormalizationForm ~= "nfc" then
8562         normalized_s = util.normalize(normalized_s, "nfc")
8563     end
8564
8565     for _, code in utf8.codes(normalized_s) do
8566         local char = utf8.char(code)
8567
8568         -- Remove everything up to the first non-space.
8569         if not letter_found then
8570             local is_letter = not lpeg.match(
8571                 #parsers.unicode.whitespace,
8572                 char
8573             )
8574             if is_letter then
8575                 letter_found = true
8576             else

```



```

8577         goto continue
8578     end
8579 end
8580
8581     -- Remove all non-alphanumeric characters, except underscores
8582     -- and hyphens.
8583     if not lpeg.match(
8584         ( parsers.underscore
8585         + parsers.dash
8586         + parsers.unicode.word
8587         + #parsers.unicode.whitespace ),
8588         char
8589     ) then
8590         prev_space = false
8591         goto continue
8592     end
8593
8594     -- Replace all spaces and newlines with hyphens.
8595     if lpeg.match(
8596         ( parsers.newline
8597         + #parsers.unicode.whitespace ),
8598         char
8599     ) then
8600         char = "-"
8601         if prev_space then
8602             goto continue
8603         else
8604             prev_space = true
8605         end
8606     else
8607         -- Case-fold all alphabetic characters.
8608         local form = nil
8609         if options.unicodeNormalization then
8610             form = options.unicodeNormalizationForm
8611         end
8612         char = util.casefold(char, form)
8613         prev_space = false
8614     end
8615
8616     table.insert(buffer, char)
8617
8618     ::continue::
8619 end
8620
8621 if prev_space then
8622     table.remove(buffer)
8623 end

```

```

8624
8625     local identifier = #buffer == 0 and "section"
8626                     or table.concat(buffer, "")
8627     return identifier
8628 end

```

3.1.4.19 Formatter of Headings

Define `writer->heading` as a function that will transform an input heading `s` at level `level` with attributes `attributes` to the output format.

```

8629 self.secbegin_text = "\\markdownRendererSectionBegin\n"
8630 self.seccend_text = "\n\\markdownRendererSectionEnd "
8631 function self.heading(s, level, attributes)
8632     local buf = {}
8633     local flat_text, inlines = table.unpack(s)
8634
8635     -- push empty attributes for implied sections
8636     while self.attribute_type_levels["heading"] < level - 1 do
8637         table.insert(buf,
8638                     self.push_attributes("heading",
8639                                         nil,
8640                                         self.secbegin_text,
8641                                         self.seccend_text))
8642     end
8643
8644     -- pop attributes for sections that have ended
8645     while self.attribute_type_levels["heading"] >= level do
8646         table.insert(buf, self.pop_attributes("heading"))
8647     end
8648
8649     -- construct attributes for the new section
8650     local auto_identifiers = {}
8651     if self.options.autoIdentifiers then
8652         table.insert(auto_identifiers, create_auto_identifier(flat_text))
8653     end
8654     if self.options.gfmAutoIdentifiers then
8655         table.insert(auto_identifiers,
8656                     create_gfm_auto_identifier(flat_text))
8657     end
8658     local normalized_attributes = normalize_attributes(attributes,
8659                                                         auto_identifiers)
8660
8661     -- push attributes for the new section
8662     local start_output = {}
8663     local end_output = {}
8664     table.insert(start_output, self.secbegin_text)
8665     table.insert(end_output, self.seccend_text)

```

```

8666
8667     table.insert(buf, self.push_attributes("heading",
8668                                           normalized_attributes,
8669                                           start_output,
8670                                           end_output))
8671     assert(self.attribute_type_levels["heading"] == level)
8672
8673     -- render the heading and its attributes
8674     if self.is_writing and #normalized_attributes > 0 then
8675         table.insert(buf,
8676                     "\\markdownRendererHeaderAttributeContextBegin\n")
8677         table.insert(buf, self.attributes(normalized_attributes, false))
8678     end
8679
8680     local cmd
8681     level = level + options.shiftHeadings
8682     if level <= 1 then
8683         cmd = "\\markdownRendererHeadingOne"
8684     elseif level == 2 then
8685         cmd = "\\markdownRendererHeadingTwo"
8686     elseif level == 3 then
8687         cmd = "\\markdownRendererHeadingThree"
8688     elseif level == 4 then
8689         cmd = "\\markdownRendererHeadingFour"
8690     elseif level == 5 then
8691         cmd = "\\markdownRendererHeadingFive"
8692     elseif level >= 6 then
8693         cmd = "\\markdownRendererHeadingSix"
8694     else
8695         cmd = ""
8696     end
8697     if self.is_writing then
8698         table.insert(buf, {cmd, "{", inlines, "}"})
8699     end
8700
8701     if self.is_writing and #normalized_attributes > 0 then
8702         table.insert(buf, "\\markdownRendererHeaderAttributeContextEnd{")
8703     end
8704
8705     return buf
8706 end

```

3.1.4.20 Managing State and Deferred Writer Calls

Define `writer->get_state` as a function that returns the current state of the writer, where the state of a writer are its mutable member variables.

```

8707     function self.get_state()

```

```

8708     return {
8709         is_writing=self.is_writing,
8710         flatten_inlines=self.flatten_inlines,
8711         active_attributes={table.unpack(self.active_attributes)},
8712     }
8713 end

```

Define `writer->set_state` as a function that restores the input state `s` and returns the previous state of the writer.

```

8714 function self.set_state(s)
8715     local previous_state = self.get_state()
8716     for key, value in pairs(s) do
8717         self[key] = value
8718     end
8719     return previous_state
8720 end

```

Define `writer->defer_call` as a function that will encapsulate the input function `f`, so that `f` is called with the state of the writer at the time of calling `writer->defer_call`.

```

8721 function self.defer_call(f)
8722     local previous_state = self.get_state()
8723     return function(...)
8724         local state = self.set_state(previous_state)
8725         local return_value = f(...)
8726         self.set_state(state)
8727         return return_value
8728     end
8729 end
8730
8731 return self
8732 end

```

3.1.5 Parsers

The `parsers` hash table stores PEG patterns that are static and can be reused between different `reader` objects.

```

8733 parsers = {}

```

3.1.5.1 Basic Parsers

```

8734 parsers.percent = P("%")
8735 parsers.at = P("@")
8736 parsers.comma = P(",")
8737 parsers.asterisk = P("*")
8738 parsers.dash = P("-")
8739 parsers.plus = P("+")

```

```

8740 parsers.underscore      = P("_")
8741 parsers.period           = P(".")
8742 parsers.hash              = P("#")
8743 parsers.dollar            = P("$")
8744 parsers.ampersand         = P("&")
8745 parsers.backtick          = P("`")
8746 parsers.less              = P("<")
8747 parsers.more              = P(">")
8748 parsers.space             = P(" ")
8749 parsers.squote            = P("'")
8750 parsers.dquote            = P('"')
8751 parsers.lparent           = P("(")
8752 parsers.rparent           = P(")")
8753 parsers.lbracket          = P("[")
8754 parsers.rbracket          = P("]")
8755 parsers.lbrace            = P("{")
8756 parsers.rbrace            = P("}")
8757 parsers.circumflex        = P("^")
8758 parsers.slash             = P("/")
8759 parsers.equal             = P("=")
8760 parsers.colon             = P(":")
8761 parsers.semicolon         = P(";")
8762 parsers.exclamation       = P("!")
8763 parsers.pipe              = P("|")
8764 parsers.tilde             = P("~")
8765 parsers.backslash         = P("\\")
8766 parsers.tab               = P("\t")
8767 parsers.newline           = P("\n")
8768
8769 parsers.digit             = R("09")
8770 parsers.hexdigit          = R("09","af","AF")
8771 parsers.letter            = R("AZ","az")
8772 parsers.alphanumeric      = R("AZ","az","09")
8773 parsers.keyword           = parsers.letter
8774                          * (parsers.alphanumeric + parsers.dash)^0
8775
8776 parsers.doubleasterisks   = P("**")
8777 parsers.doubleunderscores = P("__")
8778 parsers.doubletildes      = P("~~")
8779 parsers.fourspace         = P("    ")
8780
8781 parsers.any               = P(1)
8782 parsers.eof               = P(-1)
8783 parsers.succeed           = P(true)
8784 parsers.fail              = P(false)
8785
8786 parsers.internal_punctuation = S(":;,.?")

```

```

8787 parsers.ascii_punctuation      = S("!\"#$%&'()*+,-./:;<=>?@[\\]^_`{|}~")
8788
8789 parsers.escapable                = parsers.ascii_punctuation
8790 parsers.anyescaped                = parsers.backslash / ""
8791                                 * parsers.escapable
8792                                 + parsers.any
8793
8794 parsers.spacechar                 = S("\t ")
8795 parsers.spacing                   = S(" \n\r\t")
8796 parsers.nonspacechar              = parsers.any - parsers.spacing
8797 parsers.optionalspace             = parsers.spacechar^0
8798
8799 parsers.normalchar                = parsers.any - (V("SpecialChar")
8800                                     + parsers.spacing)
8801 parsers.nonindentspace            = parsers.space^-3 * - parsers.spacechar
8802 parsers.indent                    = parsers.space^-3 * parsers.tab
8803                                 + parsers.fourspace / ""
8804 parsers.linechar                  = P(1 - parsers.newline)
8805
8806 parsers.blankline                 = parsers.optionalspace
8807                                 * parsers.newline / "\n"
8808 parsers.blanklines                = parsers.blankline^0
8809 parsers.skipblanklines            = ( parsers.optionalspace
8810                                     * parsers.newline)^0
8811 parsers.indentedline              = parsers.indent / ""
8812                                 * C( parsers.linechar^1
8813                                     * parsers.newline^-1)
8814 parsers.optionallyindentedline    = parsers.indent^-1 / ""
8815                                 * C( parsers.linechar^1
8816                                     * parsers.newline^-1)
8817 parsers.sp                        = parsers.spacing^0
8818 parsers.spnl                      = parsers.optionalspace
8819                                 * ( parsers.newline
8820                                     * parsers.optionalspace)^-1
8821 parsers.line                      = parsers.linechar^0 * parsers.newline
8822 parsers.nonemptyline              = parsers.line - parsers.blankline
8823

```

3.1.5.2 Parsers for Unicode Character Classes and Categories

We define high-level parsers in table `parsers.unicode` based on the low-level parsers in `unicode_data.categories`, defined in Section 3.1.1.5. Unlike the low-level parsers, the high-level parsers are invariant to the number of bytes the Unicode characters occupy after conversion to UTF-8.

```

8824 parsers.unicode = {}
8825 parsers.unicode.preceding_punctuation = parsers.fail
8826 parsers.unicode.punctuation = parsers.fail

```

```

8827 parsers.unicode.alpha = parsers.fail
8828 parsers.unicode.numeric = parsers.fail
8829 parsers.unicode.word = parsers.fail
8830 parsers.unicode.preceding_whitespace = parsers.fail
8831 parsers.unicode.whitespace = parsers.fail
8832 for n = 1, 4 do

```

For punctuation, accept any characters from Unicode categories P (punctuation) and S (symbol), as mandated by the CommonMark standard⁴⁰.

```

8833   local punctuation_of_length_n
8834       = unicode_data.categories.P[n]
8835       + unicode_data.categories.S[n]
8836   parsers.unicode.preceding_punctuation
8837       = parsers.unicode.preceding_punctuation
8838       + B(punctuation_of_length_n)
8839   parsers.unicode.punctuation
8840       = parsers.unicode.punctuation
8841       + punctuation_of_length_n

```

For alphabetical characters, accept any characters from Unicode category L (letter), similar to the character class ‘Unicode.

```

8842   local alpha_of_length_n = unicode_data.categories.L[n]
8843   parsers.unicode.alpha
8844       = parsers.unicode.alpha
8845       + alpha_of_length_n

```

For numeric characters, accept any characters from Unicode category N (number), similar to the character class ‘Unicode.

```

8846   local numeric_of_length_n = unicode_data.categories.N[n]
8847   parsers.unicode.numeric
8848       = parsers.unicode.numeric
8849       + numeric_of_length_n

```

For word characters, accept any characters from Unicode categories L (letter), N (number), and Pc (connector punctuation), similar to the character class ‘

```

8850   local word_of_length_n
8851       = alpha_of_length_n
8852       + numeric_of_length_n
8853       + unicode_data.categories.Pc[n]
8854   parsers.unicode.word
8855       = parsers.unicode.word
8856       + word_of_length_n

```

For space characters, accept any characters from Unicode category Z (separator), as well as the ASCII control characters 9 (horizontal tab) through 13 (carriage return), similar to the character class ‘Lua library Selene Unicode.

```

8857   local whitespace_of_length_n = unicode_data.categories.Z[n]

```

⁴⁰See <https://spec.commonmark.org/0.31.2/#unicode-punctuation-character>.

```

8858   if n == 1 then
8859       whitespace_of_length_n
8860       = whitespace_of_length_n
8861       + R("\t\r")
8862   end
8863   parsers.unicode.preceding_whitespace
8864   = parsers.unicode.preceding_whitespace
8865   + B(whitespace_of_length_n)
8866   parsers.unicode.whitespace
8867   = parsers.unicode.whitespace
8868   + whitespace_of_length_n
8869 end

```

3.1.5.3 Parsers Used for Indentation

```

8870
8871 parsers.leader      = parsers.space^-3
8872

```

Check if a trail exists and is non-empty in the indent table `indent_table`.

```

8873 local function has_trail(indent_table)
8874     return indent_table ~= nil and
8875         indent_table.trail ~= nil and
8876         next(indent_table.trail) ~= nil
8877 end
8878

```

Check if indent table `indent_table` has any indents.

```

8879 local function has_indents(indent_table)
8880     return indent_table ~= nil and
8881         indent_table.indents ~= nil and
8882         next(indent_table.indents) ~= nil
8883 end
8884

```

Add a trail `trail_info` to the indent table `indent_table`.

```

8885 local function add_trail(indent_table, trail_info)
8886     indent_table.trail = trail_info
8887     return indent_table
8888 end
8889

```

Remove a trail `trail_info` from the indent table `indent_table`.

```

8890 local function remove_trail(indent_table)
8891     indent_table.trail = nil
8892     return indent_table
8893 end
8894

```


Update the indent table `indent_table` by adding or removing a new indent `add`.

```
8895 local function update_indent_table(indent_table, new_indent, add)
8896     indent_table = remove_trail(indent_table)
8897
8898     if not has_indents(indent_table) then
8899         indent_table.indents = {}
8900     end
8901
8902
8903     if add then
8904         indent_table.indents[#indent_table.indents + 1] = new_indent
8905     else
8906         if indent_table.indents[#indent_table.indents].name
8907             == new_indent.name then
8908             indent_table.indents[#indent_table.indents] = nil
8909         end
8910     end
8911
8912     return indent_table
8913 end
8914
```

Remove an indent by its name `name`.

```
8915 local function remove_indent(name)
8916     local remove_indent_level =
8917         function(s, i, indent_table) -- luacheck: ignore s i
8918             indent_table = update_indent_table(indent_table, {name=name},
8919                                                 false)
8920             return true, indent_table
8921         end
8922
8923     return Cg(Cmt(Cb("indent_info"), remove_indent_level), "indent_info")
8924 end
8925
```

Process the spacing of a string of spaces and tabs `spacing` with preceding indent width from the start of the line `indent` and strip up to `left_strip_length` spaces. Return the remainder `remainder` and whether there is enough spaces to produce a code `is_code`. Return how many spaces were stripped, as well as if the minimum was met `is_minimum` and what remainder it left `minimum_remainder`.

```
8926 local function process_starter_spacing(indent, spacing,
8927                                         minimum, left_strip_length)
8928     left_strip_length = left_strip_length or 0
8929
8930     local count = 0
8931     local tab_value = 4 - (indent) % 4
8932
```

```

8933 local code_started, minimum_found = false, false
8934 local code_start, minimum_remainder = "", ""
8935
8936 local left_total_stripped = 0
8937 local full_remainder = ""
8938
8939 if spacing ~= nil then
8940     for i = 1, #spacing do
8941         local character = spacing:sub(i, i)
8942
8943         if character == "\t" then
8944             count = count + tab_value
8945             tab_value = 4
8946         elseif character == " " then
8947             count = count + 1
8948             tab_value = 4 - (1 - tab_value) % 4
8949         end
8950
8951         if (left_strip_length ~= 0) then
8952             local possible_to_strip = math.min(count, left_strip_length)
8953             count = count - possible_to_strip
8954             left_strip_length = left_strip_length - possible_to_strip
8955             left_total_stripped = left_total_stripped + possible_to_strip
8956         else
8957             full_remainder = full_remainder .. character
8958         end
8959
8960         if (minimum_found) then
8961             minimum_remainder = minimum_remainder .. character
8962         elseif (count >= minimum) then
8963             minimum_found = true
8964             minimum_remainder = minimum_remainder
8965                 .. string.rep(" ", count - minimum)
8966         end
8967
8968         if (code_started) then
8969             code_start = code_start .. character
8970         elseif (count >= minimum + 4) then
8971             code_started = true
8972             code_start = code_start
8973                 .. string.rep(" ", count - (minimum + 4))
8974         end
8975     end
8976 end
8977
8978 local remainder
8979 if (code_started) then

```

```

8980     remainder = code_start
8981 else
8982     remainder = string.rep(" ", count - minimum)
8983 end
8984
8985 local is_minimum = count >= minimum
8986 return {
8987     is_code = code_started,
8988     remainder = remainder,
8989     left_total_stripped = left_total_stripped,
8990     is_minimum = is_minimum,
8991     minimum_remainder = minimum_remainder,
8992     total_length = count,
8993     full_remainder = full_remainder
8994 }
8995 end
8996

```

Count the total width of all indents in the indent table `indent_table`.

```

8997 local function count_indent_tab_level(indent_table)
8998     local count = 0
8999     if not has_indents(indent_table) then
9000         return count
9001     end
9002
9003     for i=1, #indent_table.indents do
9004         count = count + indent_table.indents[i].length
9005     end
9006     return count
9007 end
9008

```

Count the total width of a delimiter `delimiter`.

```

9009 local function total_delimiter_length(delimiter)
9010     local count = 0
9011     if type(delimiter) == "string" then return #delimiter end
9012     for _, value in pairs(delimiter) do
9013         count = count + total_delimiter_length(value)
9014     end
9015     return count
9016 end
9017

```

Process the container starter `starter` of a type `indent_type`. Adjust the width of the indent if the delimiter is followed only by whitespaces `is_blank`.

```

9018 local function process_starter_indent(_, _, indent_table, starter,
9019                                     is_blank, indent_type, breakable)
9020     local last_trail = starter[1]

```

```

9021 local delimiter = starter[2]
9022 local raw_new_trail = starter[3]
9023
9024 if indent_type == "bq" and not breakable then
9025     indent_table.ignore_blockquote_blank = true
9026 end
9027
9028 if has_trail(indent_table) then
9029     local trail = indent_table.trail
9030     if trail.is_code then
9031         return false
9032     end
9033     last_trail = trail.remainder
9034 else
9035     local sp = process_starter_spacing(0, last_trail, 0, 0)
9036
9037     if sp.is_code then
9038         return false
9039     end
9040     last_trail = sp.remainder
9041 end
9042
9043 local preceding_indentation = count_indent_tab_level(indent_table) % 4
9044 local last_trail_length = #last_trail
9045 local delimiter_length = total_delimiter_length(delimiter)
9046
9047 local total_indent_level = preceding_indentation + last_trail_length
9048                        + delimiter_length
9049
9050 local sp = {}
9051 if not is_blank then
9052     sp = process_starter_spacing(total_indent_level, raw_new_trail,
9053                                0, 1)
9054 end
9055
9056 local del_trail_length = sp.left_total_stripped
9057 if is_blank then
9058     del_trail_length = 1
9059 elseif not sp.is_code then
9060     del_trail_length = del_trail_length + #sp.remainder
9061 end
9062
9063 local indent_length = last_trail_length + delimiter_length
9064                        + del_trail_length
9065 local new_indent_info = {name=indent_type, length=indent_length}
9066
9067 indent_table = update_indent_table(indent_table, new_indent_info,

```

```

9068                                     true)
9069   indent_table = add_trail(indent_table,
9070                           {is_code=sp.is_code,
9071                           remainder=sp.remainder,
9072                           total_length=sp.total_length,
9073                           full_remainder=sp.full_remainder})
9074
9075   return true, indent_table
9076 end
9077

```

Return the pattern corresponding with the indent name `name`.

```

9078 local function decode_pattern(name)
9079   local delimiter = parsers.succeed
9080   if name == "bq" then
9081     delimiter = parsers.more
9082   end
9083
9084   return C(parsers.optionalspace) * C(delimiter)
9085         * C(parsers.optionalspace) * Cp()
9086 end
9087

```

Find the first blank-only indent of the indent table `indent_table` followed by blank-only indents.

```

9088 local function left_blank_starter(indent_table)
9089   local blank_starter_index
9090
9091   if not has_indents(indent_table) then
9092     return
9093   end
9094
9095   for i = #indent_table.indents,1,-1 do
9096     local value = indent_table.indents[i]
9097     if value.name == "li" then
9098       blank_starter_index = i
9099     else
9100       break
9101     end
9102   end
9103
9104   return blank_starter_index
9105 end
9106

```

Apply the patterns decoded from the indents of the indent table `indent_table` iteratively starting at position `index` of the string `s`. If the `is_optional` mode is selected, match as many patterns as possible, else match all or fail. With the option

`is_blank`, the parsing behaves as optional after the position of a blank-only indent has been surpassed.

```
9107 local function traverse_indent(s, i, indent_table, is_optional,
9108                               is_blank, current_line_indents)
9109   local new_index = i
9110
9111   local preceding_indentation = 0
9112   local current_trail = {}
9113
9114   local blank_starter = left_blank_starter(indent_table)
9115
9116   if current_line_indents == nil then
9117     current_line_indents = {}
9118   end
9119
9120   for index = 1, #indent_table.indents do
9121     local value = indent_table.indents[index]
9122     local pattern = decode_pattern(value.name)
9123
9124     -- match decoded pattern
9125     local new_indent_info = lpeg.match(Ct(pattern), s, new_index)
9126     if new_indent_info == nil then
9127       local blankline_end = lpeg.match(
9128         Ct(parsers.blankline * Cg(Cp(), "pos")), s, new_index)
9129       if is_optional or not indent_table.ignore_blockquote_blank
9130         or not blankline_end then
9131         return is_optional, new_index, current_trail,
9132             current_line_indents
9133       end
9134
9135       return traverse_indent(s, tonumber(blankline_end.pos),
9136                             indent_table, is_optional, is_blank,
9137                             current_line_indents)
9138     end
9139
9140     local raw_last_trail = new_indent_info[1]
9141     local delimiter = new_indent_info[2]
9142     local raw_new_trail = new_indent_info[3]
9143     local next_index = new_indent_info[4]
9144
9145     local space_only = delimiter == ""
9146
9147     -- check previous trail
9148     if not space_only and next(current_trail) == nil then
9149       local sp = process_starter_spacing(0, raw_last_trail, 0, 0)
9150       current_trail = {is_code=sp.is_code, remainder=sp.remainder,
9151                       total_length=sp.total_length,
```

```

9152             full_remainder=sp.full_remainder}
9153     end
9154
9155     if next(current_trail) ~= nil then
9156         if not space_only and current_trail.is_code then
9157             return is_optional, new_index, current_trail,
9158                 current_line_indents
9159         end
9160         if current_trail.internal_remainder ~= nil then
9161             raw_last_trail = current_trail.internal_remainder
9162         end
9163     end
9164
9165     local raw_last_trail_length = 0
9166     local delimiter_length = 0
9167
9168     if not space_only then
9169         delimiter_length = #delimiter
9170         raw_last_trail_length = #raw_last_trail
9171     end
9172
9173     local total_indent_level = preceding_indentation
9174                             + raw_last_trail_length + delimiter_length
9175
9176     local spacing_to_process
9177     local minimum = 0
9178     local left_strip_length = 0
9179
9180     if not space_only then
9181         spacing_to_process = raw_new_trail
9182         left_strip_length = 1
9183     else
9184         spacing_to_process = raw_last_trail
9185         minimum = value.length
9186     end
9187
9188     local sp = process_starter_spacing(total_indent_level,
9189                                       spacing_to_process, minimum,
9190                                       left_strip_length)
9191
9192     if space_only and not sp.is_minimum then
9193         return is_optional or (is_blank and blank_starter <= index),
9194             new_index, current_trail, current_line_indents
9195     end
9196
9197     local indent_length = raw_last_trail_length + delimiter_length
9198                       + sp.left_total_stripped

```

```

9199
9200     -- update info for the next pattern
9201     if not space_only then
9202         preceding_indentation = preceding_indentation + indent_length
9203     else
9204         preceding_indentation = preceding_indentation + value.length
9205     end
9206
9207     current_trail = {is_code=sp.is_code, remainder=sp.remainder,
9208                     internal_remainder=sp.minimum_remainder,
9209                     total_length=sp.total_length,
9210                     full_remainder=sp.full_remainder}
9211
9212     current_line_indents[#current_line_indents + 1] = new_indent_info
9213     new_index = next_index
9214 end
9215
9216 return true, new_index, current_trail, current_line_indents
9217 end
9218

```

Check if a code trail is expected.

```

9219 local function check_trail(expect_code, is_code)
9220     return (expect_code and is_code) or (not expect_code and not is_code)
9221 end
9222

```

Check if the current trail of the [indent_table](#) would produce code if it is expected [expect_code](#) or it would not if it is not. If there is no trail, process and check the current spacing [spacing](#).

```

9223 local check_trail_joined =
9224     function(s, i, indent_table, -- luacheck: ignore s i
9225             spacing, expect_code, omit_remainder)
9226         local is_code
9227         local remainder
9228
9229         if has_trail(indent_table) then
9230             local trail = indent_table.trail
9231             is_code = trail.is_code
9232             if is_code then
9233                 remainder = trail.remainder
9234             else
9235                 remainder = trail.full_remainder
9236             end
9237         else
9238             local sp = process_starter_spacing(0, spacing, 0, 0)
9239             is_code = sp.is_code
9240             if is_code then

```



```

9241         remainder = sp.remainder
9242     else
9243         remainder = sp.full_remainder
9244     end
9245 end
9246
9247 local result = check_trail(expect_code, is_code)
9248 if omit_remainder then
9249     return result
9250 end
9251 return result, remainder
9252 end
9253

```

Check if the current trail of the `indent_table` is of length between `min` and `max`.

```

9254 local check_trail_length =
9255     function(s, i, indent_table, -- luacheck: ignore s i
9256         spacing, min, max)
9257         local trail
9258
9259         if has_trail(indent_table) then
9260             trail = indent_table.trail
9261         else
9262             trail = process_starter_spacing(0, spacing, 0, 0)
9263         end
9264
9265         local total_length = trail.total_length
9266         if total_length == nil then
9267             return false
9268         end
9269
9270         return min <= total_length and total_length <= max
9271     end
9272

```

Check the indentation of the continuation line, optionally with the mode `is_optional` selected. Check blank line exclusively with `is_blank`.

```

9273 local function check_continuation_indentation(s, i, indent_table,
9274     is_optional, is_blank)
9275     if not has_indents(indent_table) then
9276         return true
9277     end
9278
9279     local passes, new_index, current_trail, current_line_indents =
9280         traverse_indent(s, i, indent_table, is_optional, is_blank)
9281
9282     if passes then
9283         indent_table.current_line_indents = current_line_indents

```

```

9284     indent_table = add_trail(indent_table, current_trail)
9285     return new_index, indent_table
9286 end
9287 return false
9288 end
9289

```

Get name of the last indent from the `indent_table`.

```

9290 local function get_last_indent_name(indent_table)
9291     if has_indents(indent_table) then
9292         return indent_table.indents[#indent_table.indents].name
9293     end
9294 end
9295

```

Remove the remainder altogether if the last indent from the `indent_table` is blank-only.

```

9296 local function remove_remainder_if_blank(indent_table, remainder)
9297     if get_last_indent_name(indent_table) == "li" then
9298         return ""
9299     end
9300     return remainder
9301 end
9302

```

Take the trail `trail` or create a new one from `spacing` and compare it with the expected `trail_type`. On success return the index `i` and the remainder of the trail.

```

9303 local check_trail_type =
9304     function(s, i, -- luacheck: ignore s i
9305         trail, spacing, trail_type)
9306         if trail == nil then
9307             trail = process_starter_spacing(0, spacing, 0, 0)
9308         end
9309
9310         if trail_type == "non-code" then
9311             return check_trail(false, trail.is_code)
9312         end
9313         if trail_type == "code" then
9314             return check_trail(true, trail.is_code)
9315         end
9316         if trail_type == "full-code" then
9317             if (trail.is_code) then
9318                 return i, trail.remainder
9319             end
9320             return i, ""
9321         end
9322         if trail_type == "full-any" then
9323             return i, trail.internal_remainder
9324         end
9325     end
9326

```

```

9324     end
9325 end
9326

```

Stores or restores an `is_freezing` trail from indent table `indent_table`.

```

9327 local trail_freezing =
9328   function(s, i, -- luacheck: ignore s i
9329     indent_table, is_freezing)
9330     if is_freezing then
9331       if indent_table.is_trail_frozen then
9332         indent_table.trail = indent_table.frozen_trail
9333       else
9334         indent_table.frozen_trail = indent_table.trail
9335         indent_table.is_trail_frozen = true
9336       end
9337     else
9338       indent_table.frozen_trail = nil
9339       indent_table.is_trail_frozen = false
9340     end
9341     return true, indent_table
9342   end
9343

```

Check the indentation of the continuation line, optionally with the mode `is_optional` selected. Check blank line specifically with `is_blank`. Additionally, also directly check the new trail with a type `trail_type`.

```

9344 local check_continuation_indentation_and_trail =
9345   function (s, i, indent_table, is_optional, is_blank, trail_type,
9346     reset_rem, omit_remainder)
9347     if not has_indents(indent_table) then
9348       local spacing, new_index = lpeg.match( C(parsers.spacechar^0)
9349         * Cp(), s, i)
9350       local result, remainder = check_trail_type(s, i,
9351         indent_table.trail, spacing, trail_type)
9352       if remainder == nil then
9353         if result then
9354           return new_index
9355         end
9356         return false
9357       end
9358       if result then
9359         return new_index, remainder
9360       end
9361       return false
9362     end
9363
9364     local passes, new_index, current_trail = traverse_indent(s, i,
9365       indent_table, is_optional, is_blank)

```

```

9366
9367     if passes then
9368         local spacing
9369         if current_trail == nil then
9370             local newer_spacing, newer_index = lpeg.match(
9371                 C(parsers.spacechar^0) * Cp(), s, i)
9372             current_trail = process_starter_spacing(0, newer_spacing, 0, 0)
9373             new_index = newer_index
9374             spacing = newer_spacing
9375         else
9376             spacing = current_trail.remainder
9377         end
9378         local result, remainder = check_trail_type(s, new_index,
9379             current_trail, spacing, trail_type)
9380         if remainder == nil or omit_remainder then
9381             if result then
9382                 return new_index
9383             end
9384             return false
9385         end
9386
9387         if is_blank and reset_rem then
9388             remainder = remove_remainder_if_blank(indent_table, remainder)
9389         end
9390         if result then
9391             return new_index, remainder
9392         end
9393         return false
9394     end
9395     return false
9396 end
9397

```

The following patterns check whitespace indentation at the start of a block.

```

9398 parsers.check_trail = Cmt( Cb("indent_info") * C(parsers.spacechar^0)
9399                             * Cc(false), check_trail_joined)
9400
9401 parsers.check_trail_no_rem = Cmt( Cb("indent_info")
9402                                   * C(parsers.spacechar^0) * Cc(false)
9403                                   * Cc(true), check_trail_joined)
9404
9405 parsers.check_code_trail = Cmt( Cb("indent_info")
9406                                  * C(parsers.spacechar^0)
9407                                  * Cc(true), check_trail_joined)
9408
9409 parsers.check_trail_length_range = function(min, max)
9410     return Cmt( Cb("indent_info") * C(parsers.spacechar^0) * Cc(min)
9411                 * Cc(max), check_trail_length)

```

```

9412 end
9413
9414 parsers.check_trail_length = function(n)
9415   return parsers.check_trail_length_range(n, n)
9416 end
9417

```

The following patterns handle trail backup, to prevent a failing pattern to modify it before passing it to the next.

```

9418 parsers.freeze_trail = Cg( Cmt(Cb("indent_info")
9419                               * Cc(true), trail_freezing), "indent_info")
9420
9421 parsers.unfreeze_trail = Cg(Cmt(Cb("indent_info") * Cc(false),
9422                                   trail_freezing), "indent_info")
9423

```

The following patterns check indentation in continuation lines as defined by the container start.

```

9424 parsers.check_minimal_indent = Cmt(Cb("indent_info") * Cc(false),
9425                                       check_continuation_indentation)
9426
9427 parsers.check_optional_indent = Cmt(Cb("indent_info") * Cc(true),
9428                                       check_continuation_indentation)
9429
9430 parsers.check_minimal_blank_indent
9431   = Cmt( Cb("indent_info") * Cc(false)
9432         * Cc(true)
9433         , check_continuation_indentation)
9434

```

The following patterns check indentation in continuation lines as defined by the container start. Additionally the subsequent trail is also directly checked.

```

9435
9436 parsers.check_minimal_indent_and_trail =
9437   Cmt( Cb("indent_info")
9438       * Cc(false) * Cc(false) * Cc("non-code") * Cc(true)
9439       , check_continuation_indentation_and_trail)
9440
9441 parsers.check_minimal_indent_and_code_trail =
9442   Cmt( Cb("indent_info")
9443       * Cc(false) * Cc(false) * Cc("code") * Cc(false)
9444       , check_continuation_indentation_and_trail)
9445
9446 parsers.check_minimal_blank_indent_and_full_code_trail =
9447   Cmt( Cb("indent_info")
9448       * Cc(false) * Cc(true) * Cc("full-code") * Cc(true)
9449       , check_continuation_indentation_and_trail)
9450

```

```

9451 parsers.check_minimal_indent_and_any_trail =
9452     Cmt( Cb("indent_info")
9453         * Cc(false) * Cc(false) * Cc("full-any") * Cc(true) * Cc(false)
9454         , check_continuation_indentation_and_trail)
9455
9456 parsers.check_minimal_blank_indent_and_any_trail =
9457     Cmt( Cb("indent_info")
9458         * Cc(false) * Cc(true) * Cc("full-any") * Cc(true) * Cc(false)
9459         , check_continuation_indentation_and_trail)
9460
9461 parsers.check_minimal_blank_indent_and_any_trail_no_rem =
9462     Cmt( Cb("indent_info")
9463         * Cc(false) * Cc(true) * Cc("full-any") * Cc(true) * Cc(true)
9464         , check_continuation_indentation_and_trail)
9465
9466 parsers.check_optional_indent_and_any_trail =
9467     Cmt( Cb("indent_info")
9468         * Cc(true) * Cc(false) * Cc("full-any") * Cc(true) * Cc(false)
9469         , check_continuation_indentation_and_trail)
9470
9471 parsers.check_optional_blank_indent_and_any_trail =
9472     Cmt( Cb("indent_info")
9473         * Cc(true) * Cc(true) * Cc("full-any") * Cc(true) * Cc(false)
9474         , check_continuation_indentation_and_trail)
9475

```

The following patterns specify behaviour around newlines.

```

9476
9477 parsers.spnlc_noexc = parsers.optionalspace
9478                     * ( parsers.newline
9479                       * parsers.check_minimal_indent_and_any_trail)^-1
9480
9481 parsers.spnlc = parsers.optionalspace
9482               * (V("EndlineNoSub"))^-1
9483
9484 parsers.spnlc_sep = parsers.optionalspace * V("EndlineNoSub")
9485                  + parsers.spacechar^1
9486
9487 parsers.only_blank = parsers.spacechar^0
9488                   * (parsers.newline + parsers.eof)
9489

```

The `parsers.commented_line^1` parser recognizes the regular language of T_EX comments, see an equivalent finite automaton in Figure 8.

```

9490 parsers.commented_line_letter = parsers.linechar
9491                               + parsers.newline
9492                               - parsers.backslash
9493                               - parsers.percent

```



```

9494 parsers.commented_line = Cg(Cc(""), "backslashes")
9495 * Cg(Cc(true), "pure_comment")
9496 * ((#(parsers.commented_line_letter
9497   - parsers.newline)
9498   * Cb("backslashes")
9499   * Cs(parsers.commented_line_letter
9500     - parsers.newline)^1 -- initial
9501   * Cg(Cc(""), "backslashes")
9502   * Cg(Cc(false), "pure_comment"))
9503 + #( parsers.backslash
9504   * (parsers.backslash + parsers.newline))
9505 * Cg((parsers.backslash -- even backslash
9506   * ( parsers.backslash
9507     + #parsers.newline))^1, "backslashes")
9508 * Cg(Cc(false), "pure_comment")
9509 + (parsers.backslash
9510   * (#parsers.percent
9511     * Cb("backslashes")
9512     / function(backslashes)
9513       return string.rep("\\", #backslashes / 2)
9514     end
9515     * C(parsers.percent)
9516     + #parsers.commented_line_letter
9517     * Cb("backslashes")
9518     * Cc("\\")
9519     * C(parsers.commented_line_letter))
9520   * Cg(Cc(""), "backslashes")
9521   * Cg(Cc(false), "pure_comment"))^0
9522 * (#parsers.percent
9523   * Cb("backslashes")
9524   / function(backslashes)
9525     return string.rep("\\", #backslashes / 2)
9526   end
9527 * ((Cb("pure_comment")
9528   * parsers.percent -- comment
9529   * parsers.line
9530   * #parsers.blankline) -- blank line
9531 / function(is_pure)
9532   return is_pure and "" or "\n"
9533 end
9534 + parsers.percent -- comment
9535 * parsers.line
9536 * parsers.optionalspace) -- leading spaces
9537 + #(parsers.newline)
9538 * Cb("backslashes")
9539 * C(parsers.newline))
9540

```



```

9541 parsers.chunk = parsers.line * (parsers.optionallyindentedline
9542                               - parsers.blankline)^0
9543
9544 parsers.attribute_key_char = parsers.unicode.alpha
9545                             + parsers.unicode.numeric
9546                             + S("_:.")
9547 parsers.attribute_raw_char = parsers.unicode.alpha
9548                             + parsers.unicode.numeric
9549                             + S("-_")
9550 parsers.attribute_key = (parsers.attribute_key_char
9551                         - parsers.dash - parsers.digit)
9552                         * parsers.attribute_key_char^0
9553 parsers.attribute_value = ( (parsers.dquote / "\"")
9554                           * (parsers.anyescaped - parsers.dquote)^0
9555                           * (parsers.dquote / "\""))
9556                       + ( (parsers.squote / "\"")
9557                           * (parsers.anyescaped - parsers.squote)^0
9558                           * (parsers.squote / "\""))
9559                       + ( parsers.anyescaped
9560                           - parsers.dquote
9561                           - parsers.rbrace
9562                           - parsers.space)^0
9563 parsers.attribute_identifier = parsers.attribute_key_char^1
9564 parsers.attribute_classname = parsers.unicode.alpha
9565                             * parsers.attribute_key_char^0
9566 parsers.attribute_raw = parsers.attribute_raw_char^1
9567
9568 parsers.attribute = (parsers.dash * Cc(".unnumbered"))
9569                   + C( parsers.hash
9570                       * parsers.attribute_identifier)
9571                   + C( parsers.period
9572                       * parsers.attribute_classname)
9573                   + Cs( parsers.attribute_key
9574                       * parsers.optionalspace
9575                       * parsers.equal
9576                       * parsers.optionalspace
9577                       * parsers.attribute_value)
9578 parsers.attributes = parsers.lbrace
9579                   * parsers.optionalspace
9580                   * parsers.attribute
9581                   * (parsers.spacechar^1
9582                   * parsers.attribute)^0
9583                   * parsers.optionalspace
9584                   * parsers.rbrace
9585
9586 parsers.raw_attribute = parsers.lbrace
9587                   * parsers.optionalspace

```

```

9588             * parsers.equal
9589             * C(parsers.attribute_raw)
9590             * parsers.optionalspace
9591             * parsers.rbrace
9592
9593 -- block followed by 0 or more optionally
9594 -- indented blocks with first line indented.
9595 parsers.indented_blocks = function(bl)
9596   return Cs( bl
9597     * ( parsers.blankline~1
9598       * parsers.indent
9599       * -parsers.blankline
9600       * bl)^0
9601     * (parsers.blankline~1 + parsers.eof) )
9602 end

```

3.1.5.4 Parsers Used for html Entities

```

9603 local function repeat_between(pattern, min, max)
9604   return -pattern^(max + 1) * pattern^min
9605 end
9606
9607 parsers.hexentity = parsers.ampersand * parsers.hash * C(S("Xx"))
9608                   * C(repeat_between(parsers.hexdigit, 1, 6))
9609                   * parsers.semicolon
9610 parsers.decentity = parsers.ampersand * parsers.hash
9611                   * C(repeat_between(parsers.digit, 1, 7))
9612                   * parsers.semicolon
9613 parsers.tagentity = parsers.ampersand * C(parsers.alphanumeric~1)
9614                   * parsers.semicolon
9615
9616 parsers.html_entities
9617   = parsers.hexentity / entities.hex_entity_with_x_char
9618   + parsers.decentity / entities.dec_entity
9619   + parsers.tagentity / entities.char_entity
9620 parsers.html_space_entity_char
9621   = Cmt(parsers.html_entities, function(_, i, entity)
9622     return entity == " " and i or nil
9623   end)

```

3.1.5.5 Parsers Used for Markdown Lists

```

9624 parsers.bullet = function(bullet_char, interrupting)
9625   local allowed_end
9626   if interrupting then
9627     allowed_end = C(parsers.spacechar~1) * #parsers.linechar
9628   else
9629     allowed_end = C(parsers.spacechar~1)

```

```

9630             + #(parsers.newline + parsers.eof)
9631     end
9632     return parsers.check_trail
9633         * Ct(C(bullet_char) * Cc(""))
9634         * allowed_end
9635 end
9636
9637 local function tickbox(interior)
9638     return parsers.optionalspace * parsers.lbracket
9639         * interior * parsers.rbracket * parsers.spacechar^1
9640 end
9641
9642 parsers.ticked_box = tickbox(S("xX")) * Cc(1.0)
9643 parsers.halfticked_box = tickbox(S("./")) * Cc(0.5)
9644 parsers.unticked_box = tickbox(parsers.spacechar^1) * Cc(0.0)
9645

```

3.1.5.6 Parsers Used for Markdown Code Spans

```

9646 parsers.openticks = Cg(parsers.backtick^1, "ticks")
9647
9648 local function captures_equal_length(_,i,a,b)
9649     return #a == #b and i
9650 end
9651
9652 parsers.closeticks = Cmt(C(parsers.backtick^1)
9653     * Cb("ticks"), captures_equal_length)
9654
9655 parsers.intickschar = (parsers.any - S("\n\r`"))
9656     + V("NoSoftLineBreakEndline")
9657     + (parsers.backtick^1 - parsers.closeticks)
9658
9659 local function process_inticks(s)
9660     s = s:gsub("\n", " ")
9661     s = s:gsub("^ (.*) $", "%1")
9662     return s
9663 end
9664
9665 parsers.inticks = parsers.openticks
9666     * C(parsers.space^0)
9667     * parsers.closeticks
9668     + parsers.openticks
9669     * Cs(Cs(parsers.intickschar^0) / process_inticks)
9670     * parsers.closeticks
9671

```

3.1.5.7 Parsers Used for html

```

9672 -- case-insensitive match (we assume s is lowercase)
9673 -- must be single byte encoding
9674 parsers.keyword_exact = function(s)
9675     local parser = P(0)
9676     for i=1,#s do
9677         local c = s:sub(i,i)
9678         local m = c .. upper(c)
9679         parser = parser * S(m)
9680     end
9681     return parser
9682 end
9683
9684 parsers.special_block_keyword =
9685     parsers.keyword_exact("pre") +
9686     parsers.keyword_exact("script") +
9687     parsers.keyword_exact("style") +
9688     parsers.keyword_exact("textarea")
9689
9690 parsers.block_keyword =
9691     parsers.keyword_exact("address") +
9692     parsers.keyword_exact("article") +
9693     parsers.keyword_exact("aside") +
9694     parsers.keyword_exact("base") +
9695     parsers.keyword_exact("basefont") +
9696     parsers.keyword_exact("blockquote") +
9697     parsers.keyword_exact("body") +
9698     parsers.keyword_exact("caption") +
9699     parsers.keyword_exact("center") +
9700     parsers.keyword_exact("col") +
9701     parsers.keyword_exact("colgroup") +
9702     parsers.keyword_exact("dd") +
9703     parsers.keyword_exact("details") +
9704     parsers.keyword_exact("dialog") +
9705     parsers.keyword_exact("dir") +
9706     parsers.keyword_exact("div") +
9707     parsers.keyword_exact("dl") +
9708     parsers.keyword_exact("dt") +
9709     parsers.keyword_exact("fieldset") +
9710     parsers.keyword_exact("figcaption") +
9711     parsers.keyword_exact("figure") +
9712     parsers.keyword_exact("footer") +
9713     parsers.keyword_exact("form") +
9714     parsers.keyword_exact("frame") +
9715     parsers.keyword_exact("frameset") +
9716     parsers.keyword_exact("h1") +
9717     parsers.keyword_exact("h2") +
9718     parsers.keyword_exact("h3") +

```

```

9719     parsers.keyword_exact("h4") +
9720     parsers.keyword_exact("h5") +
9721     parsers.keyword_exact("h6") +
9722     parsers.keyword_exact("head") +
9723     parsers.keyword_exact("header") +
9724     parsers.keyword_exact("hr") +
9725     parsers.keyword_exact("html") +
9726     parsers.keyword_exact("iframe") +
9727     parsers.keyword_exact("legend") +
9728     parsers.keyword_exact("li") +
9729     parsers.keyword_exact("link") +
9730     parsers.keyword_exact("main") +
9731     parsers.keyword_exact("menu") +
9732     parsers.keyword_exact("menuitem") +
9733     parsers.keyword_exact("nav") +
9734     parsers.keyword_exact("noframes") +
9735     parsers.keyword_exact("ol") +
9736     parsers.keyword_exact("optgroup") +
9737     parsers.keyword_exact("option") +
9738     parsers.keyword_exact("p") +
9739     parsers.keyword_exact("param") +
9740     parsers.keyword_exact("section") +
9741     parsers.keyword_exact("source") +
9742     parsers.keyword_exact("summary") +
9743     parsers.keyword_exact("table") +
9744     parsers.keyword_exact("tbody") +
9745     parsers.keyword_exact("td") +
9746     parsers.keyword_exact("tfoot") +
9747     parsers.keyword_exact("th") +
9748     parsers.keyword_exact("thead") +
9749     parsers.keyword_exact("title") +
9750     parsers.keyword_exact("tr") +
9751     parsers.keyword_exact("track") +
9752     parsers.keyword_exact("ul")
9753
9754 -- end conditions
9755 parsers.html_blankline_end_condition
9756 = parsers.linechar^0
9757 * ( parsers.newline
9758     * (parsers.check_minimal_blank_indent_and_any_trail
9759         * #parsers.blankline
9760         + parsers.check_minimal_indent_and_any_trail)
9761     * parsers.linechar^1)^0
9762 * (parsers.newline^-1 / "")
9763
9764 local function remove_trailing_blank_lines(s)
9765     return s:gsub("[\n\r]+%s*$", "")

```

```

9766 end
9767
9768 parsers.html_until_end = function(end_marker)
9769   return (
9770     Cs(C( parsers.newline
9771         * (parsers.check_minimal_blank_indent_and_any_trail
9772           * #parsers.blankline
9773           + parsers.check_minimal_indent_and_any_trail)
9774         + parsers.linechar - end_marker)^0)
9775     * (C(parsers.linechar^0 * parsers.newline^-1)
9776       / remove_trailing_blank_lines)
9777   )
9778 end
9779
9780 -- attributes
9781 parsers.html_attribute_spacing = parsers.optionalspace
9782                               * V("NoSoftLineBreakEndline")
9783                               * parsers.optionalspace
9784                               + parsers.spacechar^1
9785
9786 parsers.html_attribute_name = ( parsers.letter
9787                               + parsers.colon
9788                               + parsers.underscore)
9789                               * ( parsers.alphanumeric
9790                               + parsers.colon
9791                               + parsers.underscore
9792                               + parsers.period
9793                               + parsers.dash)^0
9794
9795 parsers.html_attribute_value = parsers.squote
9796                               * (parsers.linechar - parsers.squote)^0
9797                               * parsers.squote
9798                               + parsers.dquote
9799                               * (parsers.linechar - parsers.dquote)^0
9800                               * parsers.dquote
9801                               + ( parsers.any
9802                               - parsers.spacechar
9803                               - parsers.newline
9804                               - parsers.dquote
9805                               - parsers.squote
9806                               - parsers.backtick
9807                               - parsers.equal
9808                               - parsers.less
9809                               - parsers.more)^1
9810
9811 parsers.html_inline_attribute_value = parsers.squote
9812                                     * (V("NoSoftLineBreakEndline")

```

```

9813         + parsers.any
9814         - parsers.blankline^2
9815         - parsers.squote)^0
9816     * parsers.squote
9817     + parsers.dquote
9818     * (V("NoSoftLineBreakEndline")
9819         + parsers.any
9820         - parsers.blankline^2
9821         - parsers.dquote)^0
9822     * parsers.dquote
9823     + (parsers.any
9824         - parsers.spacechar
9825         - parsers.newline
9826         - parsers.dquote
9827         - parsers.squote
9828         - parsers.backtick
9829         - parsers.equal
9830         - parsers.less
9831         - parsers.more)^1
9832
9833 parsers.html_attribute_value_specification
9834     = parsers.optionalspace
9835     * parsers.equal
9836     * parsers.optionalspace
9837     * parsers.html_attribute_value
9838
9839 parsers.html_spnl = parsers.optionalspace
9840                 * (V("NoSoftLineBreakEndline")
9841                 * parsers.optionalspace)^-1
9842
9843 parsers.html_inline_attribute_value_specification
9844     = parsers.html_spnl
9845     * parsers.equal
9846     * parsers.html_spnl
9847     * parsers.html_inline_attribute_value
9848
9849 parsers.html_attribute
9850     = parsers.html_attribute_spacing
9851     * parsers.html_attribute_name
9852     * parsers.html_inline_attribute_value_specification^-1
9853
9854 parsers.html_non_newline_attribute
9855     = parsers.spacechar^1
9856     * parsers.html_attribute_name
9857     * parsers.html_attribute_value_specification^-1
9858
9859 parsers.nested_breaking_blank = parsers.newline

```

```

9860             * parsers.check_minimal_blank_indent
9861             * parsers.blankline
9862
9863 parsers.html_comment_start = P("<!--")
9864             * parsers.optionalspace
9865
9866 parsers.html_comment_end = parsers.optionalspace
9867             * P("-->")
9868
9869 parsers.html_comment
9870     = parsers.html_comment_start
9871     * parsers.html_until_end(parsers.html_comment_end)
9872
9873 parsers.html_inline_comment = (parsers.html_comment_start / "")
9874     * -P(">") * -P("->")
9875     * Cs(( parsers.any
9876         - parsers.nested_breaking_blank
9877         - parsers.html_comment_end)^0)
9878     * (parsers.html_comment_end / "")
9879
9880 parsers.html_cdatasection_start = P("<![CDATA[")
9881
9882 parsers.html_cdatasection_end = P("]]>")
9883
9884 parsers.html_cdatasection
9885     = Cs( parsers.html_cdatasection_start
9886         * parsers.html_until_end(parsers.html_cdatasection_end))
9887     / remove_trailing_blank_lines
9888
9889 parsers.html_inline_cdatasection
9890     = parsers.html_cdatasection_start
9891     * Cs(V("NoSoftLineBreakEndline") + parsers.any
9892         - parsers.nested_breaking_blank - parsers.html_cdatasection_end)^0
9893     * parsers.html_cdatasection_end
9894
9895 parsers.html_declaration_start = P("<!") * parsers.letter
9896
9897 parsers.html_declaration_end = P(">")
9898
9899 parsers.html_declaration
9900     = Cs( parsers.html_declaration_start
9901         * parsers.html_until_end(parsers.html_declaration_end))
9902     / remove_trailing_blank_lines
9903
9904 parsers.html_inline_declaration
9905     = parsers.html_declaration_start
9906     * Cs(V("NoSoftLineBreakEndline") + parsers.any

```



```

9907         - parsers.nested_breaking_blank - parsers.html_declaration_end)^0
9908     * parsers.html_declaration_end
9909
9910 parsers.html_instruction_start = P("<?")
9911
9912 parsers.html_instruction_end = P("?>")
9913
9914 parsers.html_instruction
9915     = Cs( parsers.html_instruction_start
9916         * parsers.html_until_end(parsers.html_instruction_end))
9917     / remove_trailing_blank_lines
9918
9919 parsers.html_inline_instruction = parsers.html_instruction_start
9920                                 * Cs( V("NoSoftLineBreakEndline")
9921                                     + parsers.any
9922                                     - parsers.nested_breaking_blank
9923                                     - parsers.html_instruction_end)^0
9924                                 * parsers.html_instruction_end
9925
9926 parsers.html_blankline = parsers.newline
9927                       * parsers.optionalspace
9928                       * parsers.newline
9929
9930 parsers.html_tag_start = parsers.less
9931
9932 parsers.html_tag_closing_start = parsers.less
9933                               * parsers.slash
9934
9935 parsers.html_tag_end = parsers.html_spnl
9936                     * parsers.more
9937
9938 parsers.html_empty_tag_end = parsers.html_spnl
9939                           * parsers.slash
9940                           * parsers.more
9941
9942 -- opening tags
9943 parsers.html_any_open_inline_tag = parsers.html_tag_start
9944                                 * parsers.keyword
9945                                 * parsers.html_attribute^0
9946                                 * parsers.html_tag_end
9947
9948 parsers.html_any_open_tag = parsers.html_tag_start
9949                           * parsers.keyword
9950                           * parsers.html_non_newline_attribute^0
9951                           * parsers.html_tag_end
9952
9953 parsers.html_open_tag = parsers.html_tag_start

```

```

9954         * parsers.block_keyword
9955         * parsers.html_attribute^0
9956         * parsers.html_tag_end
9957
9958 parsers.html_open_special_tag = parsers.html_tag_start
9959         * parsers.special_block_keyword
9960         * parsers.html_attribute^0
9961         * parsers.html_tag_end
9962
9963 -- incomplete tags
9964 parsers.incomplete_tag_following = parsers.spacechar
9965         + parsers.more
9966         + parsers.slash * parsers.more
9967         + #(parsers.newline + parsers.eof)
9968
9969 parsers.incomplete_special_tag_following = parsers.spacechar
9970         + parsers.more
9971         + #( parsers.newline
9972             + parsers.eof)
9973
9974 parsers.html_incomplete_open_tag = parsers.html_tag_start
9975         * parsers.block_keyword
9976         * parsers.incomplete_tag_following
9977
9978 parsers.html_incomplete_open_special_tag
9979     = parsers.html_tag_start
9980     * parsers.special_block_keyword
9981     * parsers.incomplete_special_tag_following
9982
9983 parsers.html_incomplete_close_tag = parsers.html_tag_closing_start
9984         * parsers.block_keyword
9985         * parsers.incomplete_tag_following
9986
9987 parsers.html_incomplete_close_special_tag
9988     = parsers.html_tag_closing_start
9989     * parsers.special_block_keyword
9990     * parsers.incomplete_tag_following
9991
9992 -- closing tags
9993 parsers.html_close_tag = parsers.html_tag_closing_start
9994         * parsers.block_keyword
9995         * parsers.html_tag_end
9996
9997 parsers.html_any_close_tag = parsers.html_tag_closing_start
9998         * parsers.keyword
9999         * parsers.html_tag_end
10000

```

```

10001 parsers.html_close_special_tag = parsers.html_tag_closing_start
10002                                     * parsers.special_block_keyword
10003                                     * parsers.html_tag_end
10004
10005 -- empty tags
10006 parsers.html_any_empty_inline_tag = parsers.html_tag_start
10007                                     * parsers.keyword
10008                                     * parsers.html_attribute^0
10009                                     * parsers.html_empty_tag_end
10010
10011 parsers.html_any_empty_tag = parsers.html_tag_start
10012                               * parsers.keyword
10013                               * parsers.html_non_newline_attribute^0
10014                               * parsers.optionalspace
10015                               * parsers.slash
10016                               * parsers.more
10017
10018 parsers.html_empty_tag = parsers.html_tag_start
10019                           * parsers.block_keyword
10020                           * parsers.html_attribute^0
10021                           * parsers.html_empty_tag_end
10022
10023 parsers.html_empty_special_tag = parsers.html_tag_start
10024                                   * parsers.special_block_keyword
10025                                   * parsers.html_attribute^0
10026                                   * parsers.html_empty_tag_end
10027
10028 parsers.html_incomplete_blocks
10029     = parsers.html_incomplete_open_tag
10030     + parsers.html_incomplete_open_special_tag
10031     + parsers.html_incomplete_close_tag
10032
10033 -- parse special html blocks
10034 parsers.html_blankline_ending_special_block_opening
10035     = ( parsers.html_close_special_tag
10036         + parsers.html_empty_special_tag)
10037     * #( parsers.optionalspace
10038         * (parsers.newline + parsers.eof))
10039
10040 parsers.html_blankline_ending_special_block
10041     = parsers.html_blankline_ending_special_block_opening
10042     * parsers.html_blankline_end_condition
10043
10044 parsers.html_special_block_opening
10045     = parsers.html_incomplete_open_special_tag
10046     - parsers.html_empty_special_tag
10047

```

```

10048 parsers.html_closing_special_block
10049   = Cs( parsers.html_special_block_opening
10050         * parsers.html_until_end(parsers.html_close_special_tag))
10051   / remove_trailing_blank_lines
10052
10053 parsers.html_special_block
10054   = parsers.html_blankline_ending_special_block
10055   + parsers.html_closing_special_block
10056
10057 -- parse html blocks
10058 parsers.html_block_opening = parsers.html_incomplete_open_tag
10059                             + parsers.html_incomplete_close_tag
10060
10061 parsers.html_block = parsers.html_block_opening
10062                     * parsers.html_blankline_end_condition
10063
10064 -- parse any html blocks
10065 parsers.html_any_block_opening
10066   = ( parsers.html_any_open_tag
10067       + parsers.html_any_close_tag
10068       + parsers.html_any_empty_tag)
10069   * #(parsers.optionalspace * (parsers.newline + parsers.eof))
10070
10071 parsers.html_any_block = parsers.html_any_block_opening
10072                         * parsers.html_blankline_end_condition
10073
10074 parsers.html_inline_comment_full = parsers.html_comment_start
10075                                   * -P(">") * -P("->")
10076                                   * Cs(( parsers.any - P("--")
10077                                         - parsers.nested_breaking_blank
10078                                         - parsers.html_comment_end)^0)
10079                                   * parsers.html_comment_end
10080
10081 parsers.html_inline_tags = parsers.html_inline_comment_full
10082                           + parsers.html_any_empty_inline_tag
10083                           + parsers.html_inline_instruction
10084                           + parsers.html_inline_cdatasection
10085                           + parsers.html_inline_declaration
10086                           + parsers.html_any_open_inline_tag
10087                           + parsers.html_any_close_tag
10088

```

3.1.5.8 Parsers Used for Markdown Tags and Links

```

10089 parsers.urlchar = parsers.anyescaped
10090                 - parsers.newline
10091                 - parsers.more

```

```

10092
10093 parsers.auto_link_scheme_part = parsers.alphanumeric
10094                                + parsers.plus
10095                                + parsers.period
10096                                + parsers.dash
10097
10098 parsers.auto_link_scheme = parsers.letter
10099                            * parsers.auto_link_scheme_part
10100                            * parsers.auto_link_scheme_part~-30
10101
10102 parsers.absolute_uri = parsers.auto_link_scheme * parsers.colon
10103                       * ( parsers.any - parsers.spacing
10104                           - parsers.less - parsers.more)^0
10105
10106 parsers.printable_characters = S("!.#$%&'*/+/?^_`{|}~-")
10107
10108 parsers.email_address_local_part_char = parsers.alphanumeric
10109                                         + parsers.printable_characters
10110
10111 parsers.email_address_local_part
10112     = parsers.email_address_local_part_char^1
10113
10114 parsers.email_address_dns_label = parsers.alphanumeric
10115                                 * ( parsers.alphanumeric
10116                                     + parsers.dash)^-62
10117                                 * B(parsers.alphanumeric)
10118
10119 parsers.email_address_domain = parsers.email_address_dns_label
10120                               * ( parsers.period
10121                                   * parsers.email_address_dns_label)^0
10122
10123 parsers.email_address = parsers.email_address_local_part
10124                         * parsers.at
10125                         * parsers.email_address_domain
10126
10127 parsers.auto_link_url = parsers.less
10128                       * C(parsers.absolute_uri)
10129                       * parsers.more
10130
10131 parsers.auto_link_email = parsers.less
10132                         * C(parsers.email_address)
10133                         * parsers.more
10134
10135 parsers.auto_link_relative_reference = parsers.less
10136                                       * C(parsers.urlchar^1)
10137                                       * parsers.more
10138

```

```

10139 parsers.autolink = parsers.auto_link_url
10140                     + parsers.auto_link_email
10141
10142 -- content in balanced brackets, parentheses, or quotes:
10143 parsers.bracketed = P{ parsers.lbracket
10144                       * (( parsers.backslash / "\"" * parsers.rbracket
10145                           + parsers.any - (parsers.lbracket
10146                                           + parsers.rbracket
10147                                           + parsers.blankline^2)
10148                           ) + V(1))^0
10149                       * parsers.rbracket }
10150
10151 parsers.inparens = P{ parsers.lparent
10152                      * ((parsers.anyescaped - (parsers.lparent
10153                                              + parsers.rparent
10154                                              + parsers.blankline^2)
10155                      ) + V(1))^0
10156                      * parsers.rparent }
10157
10158 parsers.squoted = P{ parsers.squote * parsers.alphanumeric
10159                      * ((parsers.anyescaped - (parsers.squote
10160                                              + parsers.blankline^2)
10161                      ) + V(1))^0
10162                      * parsers.squote }
10163
10164 parsers.dquoted = P{ parsers.dquote * parsers.alphanumeric
10165                      * ((parsers.anyescaped - (parsers.dquote
10166                                              + parsers.blankline^2)
10167                      ) + V(1))^0
10168                      * parsers.dquote }
10169
10170 parsers.link_text = parsers.lbracket
10171                   * Cs((parsers.alphanumeric^1
10172                       + parsers.bracketed
10173                       + parsers.inticks
10174                       + parsers.autolink
10175                       + V("InlineHtml")
10176                       + ( parsers.backslash * parsers.backslash)
10177                       + ( parsers.backslash
10178                           * ( parsers.lbracket
10179                               + parsers.rbracket)
10180                       + V("Space")
10181                       + V("NoSoftLineBreakEndline")
10182                       + (parsers.any
10183                         - ( parsers.newline
10184                           + parsers.lbracket
10185                           + parsers.rbracket

```

```

10186             + parsers.blankline^2))))^0)
10187         * parsers.rbracket
10188
10189 parsers.link_label_body = -#(parsers.sp * parsers.rbracket)
10190             * #( ( parsers.any
10191                 - parsers.rbracket)^-999
10192                 * parsers.rbracket)
10193             * Cs((parsers.alphanumeric^1
10194                 + parsers.inticks
10195                 + parsers.autolink
10196                 + V("InlineHtml")
10197                 + ( parsers.backslash * parsers.backslash)
10198                 + ( parsers.backslash
10199                     * ( parsers.lbracket
10200                         + parsers.rbracket)
10201                     + V("Space")
10202                     + V("NoSoftLineBreakEndline")
10203                     + (parsers.any
10204                         - ( parsers.newline
10205                             + parsers.lbracket
10206                             + parsers.rbracket
10207                             + parsers.blankline^2))))^1)
10208
10209 parsers.link_label = parsers.lbracket
10210             * parsers.link_label_body
10211             * parsers.rbracket
10212
10213 parsers.inparens_url = P{ parsers.lparent
10214             * ((parsers.anyescaped - (parsers.lparent
10215                                     + parsers.rparent
10216                                     + parsers.spacing)
10217                 ) + V(1))^0
10218             * parsers.rparent }
10219
10220 -- url for markdown links, allowing nested brackets:
10221 parsers.url = parsers.less * Cs((parsers.anyescaped
10222             - parsers.newline
10223             - parsers.less
10224             - parsers.more)^0)
10225             * parsers.more
10226             + -parsers.less
10227             * Cs((parsers.inparens_url + (parsers.anyescaped
10228                 - parsers.spacing
10229                 - parsers.lparent
10230                 - parsers.rparent))^1)
10231
10232 -- quoted text:

```

```

10233 parsers.title_s      = parsers.squote
10234                       * Cs((parsers.html_entities
10235                             + V("Space")
10236                             + V("NoSoftLineBreakEndline")
10237                             + ( parsers.anyescaped
10238                               - parsers.newline
10239                               - parsers.squote
10240                               - parsers.blankline^2))^0)
10241                       * parsers.squote
10242
10243 parsers.title_d         = parsers.dquote
10244                       * Cs((parsers.html_entities
10245                             + V("Space")
10246                             + V("NoSoftLineBreakEndline")
10247                             + ( parsers.anyescaped
10248                               - parsers.newline
10249                               - parsers.dquote
10250                               - parsers.blankline^2))^0)
10251                       * parsers.dquote
10252
10253 parsers.title_p         = parsers.lparent
10254                       * Cs((parsers.html_entities
10255                             + V("Space")
10256                             + V("NoSoftLineBreakEndline")
10257                             + ( parsers.anyescaped
10258                               - parsers.newline
10259                               - parsers.lparent
10260                               - parsers.rparent
10261                               - parsers.blankline^2))^0)
10262                       * parsers.rparent
10263
10264 parsers.title           = parsers.title_d + parsers.title_s + parsers.title_p
10265
10266
10267 parsers.optionaltitle   = parsers.spnlc * parsers.title * parsers.spacechar^0 + Cc("")
10268
10269

```

3.1.5.9 Helpers for Links and Link Reference Definitions

```

10270 -- parse a reference definition: [foo]: /bar "title"
10271 parsers.define_reference_parser = (parsers.check_trail / "")
10272                                * parsers.link_label * parsers.colon
10273                                * parsers.spnlc * parsers.url
10274                                * ( parsers.spnlc_sep * parsers.title
10275                                  * parsers.only_blank
10276                                  + Cc("") * parsers.only_blank)

```


3.1.5.10 Inline Elements

```
10277 parsers.Inline          = V("Inline")
10278
10279 -- parse many p between starter and ender
10280 parsers.between = function(p, starter, ender)
10281   local ender2 = B(parsers.nonspacechar) * ender
10282   return ( starter
10283           * #parsers.nonspacechar
10284           * Ct(p * (p - ender2)^0)
10285           * ender2)
10286 end
10287
```

3.1.5.11 Block Elements

```
10288 parsers.lineof = function(c)
10289   return ( parsers.check_trail_no_rem
10290           * (P(c) * parsers.optionalspace)^3
10291           * (parsers.newline + parsers.eof))
10292 end
10293
10294 parsers.thematic_break_lines = parsers.lineof(parsers.asterisk)
10295                               + parsers.lineof(parsers.dash)
10296                               + parsers.lineof(parsers.underscore)
```

3.1.5.12 Headings

```
10297 -- parse Atx heading start and return level
10298 parsers.heading_start = #parsers.hash * C(parsers.hash^-6)
10299                       * -parsers.hash / length
10300
10301 -- parse setext header ending and return level
10302 parsers.heading_level
10303   = parsers.nonindentSPACE * parsers.equal^1
10304   * parsers.optionalspace * #parsers.newline * Cc(1)
10305   + parsers.nonindentSPACE * parsers.dash^1
10306   * parsers.optionalspace * #parsers.newline * Cc(2)
10307
10308 local function strip_atx_end(s)
10309   return s:gsub("%s+#+%s*\n$", "")
10310 end
10311
10312 parsers.atx_heading = parsers.check_trail_no_rem
10313                     * Cg(parsers.heading_start, "level")
10314                     * (C( parsers.optionalspace
10315                           * parsers.hash^0
10316                           * parsers.optionalspace
10317                           * parsers.newline)
```

```

10318         + parsers.spacechar^1
10319         * C(parsers.line))

```

3.1.6 Markdown Reader

This section documents the `reader` object, which implements the routines for parsing the markdown input. The object corresponds to the markdown reader object that was located in the `lunamark/reader/markdown.lua` file in the Lunamark Lua module.

The `reader.new` method creates and returns a new TeX reader object associated with the Lua interface options (see Section 2.1.3) `options` and with a writer object `writer`. When `options` are unspecified, it is assumed that an empty table was passed to the method.

The objects produced by the `reader.new` method expose instance methods and variables of their own. As a convention, I will refer to these *member*s as `reader->member`.

```

10320 M.reader = {}
10321 function M.reader.new(writer, options)
10322     local self = {}

```

Make the `writer` and `options` parameters available as `reader->writer` and `reader->options`, respectively, so that they are accessible from extensions.

```

10323     self.writer = writer
10324     self.options = options

```

Create a `reader->parsers` hash table that stores PEG patterns that depend on the received `options`. Make `reader->parsers` inherit from the global `parsers` table.

```

10325     self.parsers = {}
10326     (function(parsers)
10327         setmetatable(self.parsers, {
10328             __index = function (_, key)
10329                 return parsers[key]
10330             end
10331         })
10332     end)(parsers)

```

Make `reader->parsers` available as a local `parsers` variable that will shadow the global `parsers` table and will make `reader->parsers` easier to type in the rest of the reader code.

```

10333     local parsers = self.parsers

```

3.1.6.1 Top-Level Helper Functions

Define `reader->normalize_tag` as a function that normalizes a markdown reference tag by lowercasing it, and by collapsing any adjacent whitespace characters.

```

10334     function self.normalize_tag(tag)
10335         tag = util.rope_to_string(tag)

```

```

10336     tag = tag:gsub("[ \n\r\t]+", " ")
10337     tag = tag:gsub("^ ", ""):gsub(" $", "")
10338     local form = nil
10339     if options.unicodeNormalization then
10340         form = options.unicodeNormalizationForm
10341     end
10342     tag = util.casefold(tag, form)
10343     return tag
10344 end

```

Define `iterlines` as a function that iterates over the lines of the input string `s`, transforms them using an input function `f`, and reassembles them into a new string, which it returns.

```

10345     local function iterlines(s, f)
10346         local rope = lpeg.match(Ct((parsers.line / f)^1), s)
10347         return util.rope_to_string(rope)
10348     end

```

Define `expandtabs` either as an identity function, when the `preserveTabs` Lua interface option is enabled, or to a function that expands tabs into spaces otherwise.

```

10349     if options.preserveTabs then
10350         self.expandtabs = function(s) return s end
10351     else
10352         self.expandtabs = function(s)
10353             if s:find("\t") then
10354                 return iterlines(s, util.expand_tabs_in_line)
10355             else
10356                 return s
10357             end
10358         end
10359     end

```

3.1.6.2 High-Level Parser Functions

Create a `reader->parser_functions` hash table that stores high-level parser functions. Define `reader->create_parser` as a function that will create a high-level parser function `reader->parser_functions.name`, that matches input using grammar `grammar`. If `toplevel` is true, the input is expected to come straight from the user, not from a recursive call, and will be preprocessed.

```

10360     self.parser_functions = {}
10361     self.create_parser = function(name, grammar, toplevel)
10362         self.parser_functions[name] = function(str)

```

If the parser function is top-level and the `stripIndent` Lua option is enabled, we will first expand tabs in the input string `str` into spaces and then we will count the minimum indent across all lines, skipping blank lines. Next, we will remove the minimum indent from all lines.

```

10363         if toplevel and options.stripIndent then
10364             local min_prefix_length, min_prefix = nil, ''
10365             str = iterlines(str, function(line)
10366                 if lpeg.match(parsers.nonemptyline, line) == nil then
10367                     return line
10368                 end
10369                 line = util.expand_tabs_in_line(line)
10370                 local prefix = lpeg.match(C(parsers.optionalspace), line)
10371                 local prefix_length = #prefix
10372                 local is_shorter = min_prefix_length == nil
10373                 if not is_shorter then
10374                     is_shorter = prefix_length < min_prefix_length
10375                 end
10376                 if is_shorter then
10377                     min_prefix_length, min_prefix = prefix_length, prefix
10378                 end
10379                 return line
10380             end)
10381             str = str:gsub('^' .. min_prefix, '')
10382         end

```

If the parser is top-level and the `texComments` or `hybrid` Lua options are enabled, we will strip all plain TeX comments from the input string `str` together with the trailing newline characters.

```

10383         if toplevel and (options.texComments or options.hybrid) then
10384             str = lpeg.match(Ct(parsers.commented_line^1), str)
10385             str = util.rope_to_string(str)
10386         end
10387         local res = lpeg.match(grammar(), str)
10388         if res == nil then
10389             return writer.error(
10390                 format("Parser `%s` failed to process the input text.", name),
10391                 format("Here are the first 20 characters of the remaining "
10392                     .. "unprocessed text: `%s`.", str:sub(1,20))
10393             )
10394         else
10395             return res
10396         end
10397     end
10398 end
10399
10400 self.create_parser("parse_blocks",
10401     function()
10402         return parsers.blocks
10403     end, true)
10404
10405 self.create_parser("parse_blocks_nested",

```

```

10406         function()
10407             return parsers.blocks_nested
10408         end, false)
10409
10410     self.create_parser("parse_inlines",
10411         function()
10412             return parsers.inlines
10413         end, false)
10414
10415     self.create_parser("parse_inlines_no_inline_note",
10416         function()
10417             return parsers.inlines_no_inline_note
10418         end, false)
10419
10420     self.create_parser("parse_inlines_no_html",
10421         function()
10422             return parsers.inlines_no_html
10423         end, false)
10424
10425     self.create_parser("parse_inlines_nbsp",
10426         function()
10427             return parsers.inlines_nbsp
10428         end, false)
10429
10430     self.create_parser("parse_inlines_no_link_or_emphasis",
10431         function()
10432             return parsers.inlines_no_link_or_emphasis
10433         end, false)
10434
10435     self.create_parser("parse_inlines_identity",
10436         function()
10437             return parsers.inlines_identity
10438         end, false)
10439
10440     self.create_parser("parse_inlines_string",
10441         function()
10442             return parsers.inlines_string
10443         end, false)
10444
10445     self.create_parser("parse_inlines_math",
10446         function()
10447             return parsers.inlines_math
10448         end, false)

```

3.1.6.3 Parsers Used for Indentation (local)

The following patterns represent basic building blocks of indented content.

```

10449 parsers.minimally_indented_blankline
10450     = parsers.check_minimal_indent * (parsers.blankline / "")
10451
10452 parsers.minimally_indented_block
10453     = parsers.check_minimal_indent * V("Block")
10454
10455 parsers.minimally_indented_block_or_paragraph
10456     = parsers.check_minimal_indent * V("BlockOrParagraph")
10457
10458 parsers.minimally_indented_paragraph
10459     = parsers.check_minimal_indent * V("Paragraph")
10460
10461 parsers.minimally_indented_plain
10462     = parsers.check_minimal_indent * V("Plain")
10463
10464 parsers.minimally_indented_par_or_plain
10465     = parsers.minimally_indented_paragraph
10466     + parsers.minimally_indented_plain
10467
10468 parsers.minimally_indented_par_or_plain_no_blank
10469     = parsers.minimally_indented_par_or_plain
10470     - parsers.minimally_indented_blankline
10471
10472 parsers.minimally_indented_ref
10473     = parsers.check_minimal_indent * V("Reference")
10474
10475 parsers.minimally_indented_blank
10476     = parsers.check_minimal_indent * V("Blank")
10477
10478 parsers.conditionally_indented_blankline
10479     = parsers.check_minimal_blank_indent * (parsers.blankline / "")
10480
10481 parsers.minimally_indented_ref_or_block
10482     = parsers.minimally_indented_ref
10483     + parsers.minimally_indented_block
10484     - parsers.minimally_indented_blankline
10485
10486 parsers.minimally_indented_ref_or_block_or_par
10487     = parsers.minimally_indented_ref
10488     + parsers.minimally_indented_block_or_paragraph
10489     - parsers.minimally_indented_blankline
10490

```

The following pattern parses the properly indented content that follows the initial container start.

```

10491
10492 function parsers.separator_loop(separated_block, paragraph,

```

```

10493                                     block_separator, paragraph_separator)
10494     return separated_block
10495         + block_separator
10496         * paragraph
10497         * separated_block
10498         + paragraph_separator
10499         * paragraph
10500 end
10501
10502 function parsers.create_loop_body_pair(separated_block, paragraph,
10503                                     block_separator,
10504                                     paragraph_separator)
10505     return {
10506         block = parsers.separator_loop(separated_block, paragraph,
10507                                     block_separator, block_separator),
10508         par = parsers.separator_loop(separated_block, paragraph,
10509                                     block_separator, paragraph_separator)
10510     }
10511 end
10512
10513 parsers.block_sep_group = function(blank)
10514     return blank^0 * parsers.eof
10515         + ( blank^2 / writer.paragraphsep
10516           + blank^0 / writer.interblocksep
10517         )
10518 end
10519
10520 parsers.par_sep_group = function(blank)
10521     return blank^0 * parsers.eof
10522         + blank^0 / writer.paragraphsep
10523 end
10524
10525 parsers.sep_group_no_output = function(blank)
10526     return blank^0 * parsers.eof
10527         + blank^0
10528 end
10529
10530 parsers.content_blank = parsers.minimally_indented_blankline
10531
10532 parsers.ref_or_block_separated
10533     = parsers.sep_group_no_output(parsers.content_blank)
10534     * ( parsers.minimally_indented_ref
10535       - parsers.content_blank)
10536     + parsers.block_sep_group(parsers.content_blank)
10537     * ( parsers.minimally_indented_block
10538       - parsers.content_blank)
10539

```

```

10540 parsers.loop_body_pair =
10541     parsers.create_loop_body_pair(
10542         parsers.ref_or_block_separated,
10543         parsers.minimally_indented_par_or_plain_no_blank,
10544         parsers.block_sep_group(parsers.content_blank),
10545         parsers.par_sep_group(parsers.content_blank))
10546
10547 parsers.content_loop = ( V("Block")
10548     * parsers.loop_body_pair.block^0
10549     + (V("Paragraph") + V("Plain"))
10550     * parsers.ref_or_block_separated
10551     * parsers.loop_body_pair.block^0
10552     + (V("Paragraph") + V("Plain"))
10553     * parsers.loop_body_pair.par^0
10554     * parsers.content_blank^0
10555
10556 parsers.indented_content = function()
10557     return Ct( (V("Reference") + (parsers.blankline / ""))
10558         * parsers.content_blank^0
10559         * parsers.check_minimal_indent
10560         * parsers.content_loop
10561         + (V("Reference") + (parsers.blankline / ""))
10562         * parsers.content_blank^0
10563         + parsers.content_loop)
10564 end
10565
10566 parsers.add_indent = function(pattern, name, breakable)
10567     return Cg(Cmt( Cb("indent_info")
10568         * Ct(pattern)
10569         * ( #parsers.linechar -- check if starter is blank
10570         * Cc(false) + Cc(true))
10571         * Cc(name)
10572         * Cc(breakable),
10573         process_starter_indent), "indent_info")
10574 end
10575

```

3.1.6.4 Parsers Used for Markdown Lists (local)

```

10576 if options.hashEnumerators then
10577     parsers.dig = parsers.digit + parsers.hash
10578 else
10579     parsers.dig = parsers.digit
10580 end
10581
10582 parsers.enumerator = function(delimiter_type, interrupting)
10583     local delimiter_range

```



```

10584     local allowed_end
10585     if interrupting then
10586         delimiter_range = P("1")
10587         allowed_end = C(parsers.spacechar^1) * #parsers.linechar
10588     else
10589         delimiter_range = parsers.dig * parsers.dig^-8
10590         allowed_end = C(parsers.spacechar^1)
10591                     + #(parsers.newline + parsers.eof)
10592     end
10593
10594     return parsers.check_trail
10595             * Ct(C(delimiter_range) * C(delimiter_type))
10596             * allowed_end
10597 end
10598
10599 parsers.starter = parsers.bullet(parsers.dash)
10600                  + parsers.bullet(parsers.asterisk)
10601                  + parsers.bullet(parsers.plus)
10602                  + parsers.enumerator(parsers.period)
10603                  + parsers.enumerator(parsers.rparent)
10604

```

3.1.6.5 Parsers Used for Blockquotes (local)

```

10605 parsers.blockquote_start
10606     = parsers.check_trail
10607     * C(parsers.more)
10608     * C(parsers.spacechar^0)
10609
10610 parsers.blockquote_body
10611     = parsers.add_indent(parsers.blockquote_start, "bq", true)
10612     * parsers.indented_content()
10613     * remove_indent("bq")
10614
10615 if not options.breakableBlockquotes then
10616     parsers.blockquote_body
10617         = parsers.add_indent(parsers.blockquote_start, "bq", false)
10618         * parsers.indented_content()
10619         * remove_indent("bq")
10620 end

```

3.1.6.6 Helpers for Emphasis and Strong Emphasis (local)

Parse the content of a table `content_part` with links, images and emphasis disabled.

```

10621 local function parse_content_part(content_part)
10622     local rope = util.rope_to_string(content_part)
10623     local parsed

```

```

10624         = self.parser_functions.parse_inlines_no_link_or_emphasis(rope)
10625     parsed.indent_info = nil
10626     return parsed
10627 end
10628

```

Collect the content between the `opening_index` and `closing_index` in the delimiter table `t`.

```

10629     local collect_emphasis_content =
10630     function(t, opening_index, closing_index)
10631         local content = {}
10632
10633         local content_part = {}
10634         for i = opening_index, closing_index do
10635             local value = t[i]
10636
10637             if value.rendered ~= nil then
10638                 content[#content + 1] = parse_content_part(content_part)
10639                 content_part = {}
10640                 content[#content + 1] = value.rendered
10641                 value.rendered = nil
10642             else
10643                 if value.warning ~= nil then
10644                     if next(content_part) ~= nil then
10645                         content[#content + 1] = parse_content_part(content_part)
10646                     end
10647                     content_part = {}
10648
10649                     content[#content + 1] = value.warning
10650                     value.warning = nil
10651                 end
10652                 if value.type == "delimiter"
10653                     and value.element == "emphasis" then
10654                     if value.is_active then
10655                         content_part[#content_part + 1]
10656                             = string.rep(value.character, value.current_count)
10657                     end
10658                 else
10659                     content_part[#content_part + 1] = value.content
10660                 end
10661                 value.content = ''
10662                 value.is_active = false
10663             end
10664         end
10665
10666         if next(content_part) ~= nil then
10667             content[#content + 1] = parse_content_part(content_part)

```

```

10668         end
10669
10670         return content
10671     end
10672

```

Render content between the `opening_index` and `closing_index` in the delimiter table `t` as emphasis.

```

10673     local function fill_emph(t, opening_index, closing_index)
10674         local content
10675         = collect_emphasis_content(t, opening_index + 1,
10676                                   closing_index - 1)
10677         t[opening_index + 1].is_active = true
10678         t[opening_index + 1].rendered = writer.emphasis(content)
10679     end
10680

```

Render content between the `opening_index` and `closing_index` in the delimiter table `t` as strong emphasis.

```

10681     local function fill_strong(t, opening_index, closing_index)
10682         local content
10683         = collect_emphasis_content(t, opening_index + 1,
10684                                   closing_index - 1)
10685         t[opening_index + 1].is_active = true
10686         t[opening_index + 1].rendered = writer.strong(content)
10687     end
10688

```

Check whether the opening delimiter `opening_delimiter` and closing delimiter `closing_delimiter` break rule three together.

```

10689     local function breaks_three_rule(opening_delimiter, closing_delimiter)
10690         return ( opening_delimiter.is_closing
10691                 or closing_delimiter.is_opening)
10692                 and (( opening_delimiter.original_count
10693                       + closing_delimiter.original_count) % 3 == 0)
10694                 and ( opening_delimiter.original_count % 3 ~= 0
10695                       or closing_delimiter.original_count % 3 ~= 0)
10696     end
10697

```

Look for the first potential emphasis opener in the delimiter table `t` in the range from `bottom_index` to `latest_index` that has the same character `character` as the closing delimiter `closing_delimiter`.

```

10698     local find_emphasis_opener = function(t, bottom_index, latest_index,
10699                                         character, closing_delimiter)
10700         for i = latest_index, bottom_index, -1 do
10701             local value = t[i]
10702             if value.is_active and

```

```

10703         value.is_opening and
10704         value.type == "delimiter" and
10705         value.element == "emphasis" and
10706         (value.character == character) and
10707         (value.current_count > 0) then
10708             if not breaks_three_rule(value, closing_delimiter) then
10709                 return i
10710             end
10711         end
10712     end
10713 end
10714

```

Iterate over the delimiters in the delimiter table `t`, producing emphasis or strong emphasis macros.

```

10715 local function process_emphasis(t, opening_index, closing_index)
10716     for i = opening_index, closing_index do
10717         local value = t[i]
10718         if value.type == "delimiter" and value.element == "emphasis" then
10719             local delimiter_length = string.len(value.content)
10720             value.character = string.sub(value.content, 1, 1)
10721             value.current_count = delimiter_length
10722             value.original_count = delimiter_length
10723         end
10724     end
10725
10726     local openers_bottom = {
10727         ['*'] = {
10728             [true] = {opening_index, opening_index, opening_index},
10729             [false] = {opening_index, opening_index, opening_index}
10730         },
10731         ['_'] = {
10732             [true] = {opening_index, opening_index, opening_index},
10733             [false] = {opening_index, opening_index, opening_index}
10734         }
10735     }
10736
10737     local current_position = opening_index
10738     local max_position = closing_index
10739
10740     while current_position <= max_position do
10741         local value = t[current_position]
10742
10743         if value.type ~= "delimiter" or
10744            value.element ~= "emphasis" or
10745            not value.is_active or
10746            not value.is_closing or

```

```

10747         (value.current_count <= 0) then
10748             current_position = current_position + 1
10749             goto continue
10750         end
10751
10752         local character = value.character
10753         local is_opening = value.is_opening
10754         local closing_length_modulo_three = value.original_count % 3
10755
10756         local current_openers_bottom
10757             = openers_bottom[character][is_opening]
10758                 [closing_length_modulo_three + 1]
10759
10760         local opener_position
10761             = find_emphasis_opener(t, current_openers_bottom,
10762                 current_position - 1, character, value)
10763
10764         if (opener_position == nil) then
10765             openers_bottom[character][is_opening]
10766                 [closing_length_modulo_three + 1]
10767                 = current_position
10768             current_position = current_position + 1
10769             goto continue
10770         end
10771
10772         local opening_delimiter = t[opener_position]
10773
10774         local current_opening_count = opening_delimiter.current_count
10775         local current_closing_count = t[current_position].current_count
10776
10777         if (current_opening_count >= 2)
10778             and (current_closing_count >= 2) then
10779             opening_delimiter.current_count = current_opening_count - 2
10780             t[current_position].current_count = current_closing_count - 2
10781             fill_strong(t, opener_position, current_position)
10782         else
10783             opening_delimiter.current_count = current_opening_count - 1
10784             t[current_position].current_count = current_closing_count - 1
10785             fill_emph(t, opener_position, current_position)
10786         end
10787
10788         ::continue::
10789     end
10790 end
10791
10792 parsers.delimiter_run = function(character)
10793     return (B(parsers.backslash * character) + -B(character))

```

```

10794         * character^1
10795         * -#character
10796     end
10797
10798     parsers.left_flanking_delimiter_run = function(character)
10799         return (B( parsers.any)
10800             * ( parsers.unicode.preceding_punctuation
10801               + parsers.unicode.preceding_whitespace)
10802             + -B(parsers.any))
10803         * parsers.delimiter_run(character)
10804         * #parsers.unicode.punctuation
10805         + parsers.delimiter_run(character)
10806         * -( #parsers.unicode.punctuation
10807           + #parsers.unicode.whitespace
10808           + parsers.eof)
10809     end
10810
10811     parsers.right_flanking_delimiter_run = function(character)
10812         return parsers.unicode.preceding_punctuation
10813             * parsers.delimiter_run(character)
10814             * ( #parsers.unicode.punctuation
10815               + #parsers.unicode.whitespace
10816               + parsers.eof)
10817         + (B(parsers.any)
10818           * -( parsers.unicode.preceding_punctuation
10819             + parsers.unicode.preceding_whitespace))
10820         * parsers.delimiter_run(character)
10821     end
10822
10823     if options.underscores then
10824         parsers.emph_start
10825             = parsers.left_flanking_delimiter_run(parsers.asterisk)
10826             + ( -#parsers.right_flanking_delimiter_run(parsers.underscore)
10827               + ( parsers.unicode.preceding_punctuation
10828                 * #parsers.right_flanking_delimiter_run(parsers.underscore)))
10829             * parsers.left_flanking_delimiter_run(parsers.underscore)
10830
10831         parsers.emph_end
10832             = parsers.right_flanking_delimiter_run(parsers.asterisk)
10833             + ( -#parsers.left_flanking_delimiter_run(parsers.underscore)
10834               + #( parsers.left_flanking_delimiter_run(parsers.underscore)
10835                 * #parsers.unicode.punctuation))
10836             * parsers.right_flanking_delimiter_run(parsers.underscore)
10837     else
10838         parsers.emph_start
10839             = parsers.left_flanking_delimiter_run(parsers.asterisk)
10840

```

```

10841     parsers.emph_end
10842     = parsers.right_flanking_delimiter_run(parsers.asterisk)
10843 end
10844
10845 parsers.emph_capturing_open_and_close
10846 = #parsers.emph_start * #parsers.emph_end
10847 * Ct( Cg(Cc("delimiter"), "type")
10848     * Cg(Cc("emphasis"), "element")
10849     * Cg(C(parsers.emph_start), "content")
10850     * Cg(Cc(true), "is_opening")
10851     * Cg(Cc(true), "is_closing"))
10852
10853 parsers.emph_capturing_open = Ct( Cg(Cc("delimiter"), "type")
10854     * Cg(Cc("emphasis"), "element")
10855     * Cg(C(parsers.emph_start), "content")
10856     * Cg(Cc(true), "is_opening")
10857     * Cg(Cc(false), "is_closing"))
10858
10859 parsers.emph_capturing_close = Ct( Cg(Cc("delimiter"), "type")
10860     * Cg(Cc("emphasis"), "element")
10861     * Cg(C(parsers.emph_end), "content")
10862     * Cg(Cc(false), "is_opening")
10863     * Cg(Cc(true), "is_closing"))
10864
10865 parsers.emph_open_or_close = parsers.emph_capturing_open_and_close
10866     + parsers.emph_capturing_open
10867     + parsers.emph_capturing_close
10868
10869 parsers.emph_open = parsers.emph_capturing_open_and_close
10870     + parsers.emph_capturing_open
10871
10872 parsers.emph_close = parsers.emph_capturing_open_and_close
10873     + parsers.emph_capturing_close
10874

```

3.1.6.7 Helpers for Links and Link Reference Definitions (local)

```

10875 -- List of references defined in the document
10876 local references
10877
10878 -- List of note references defined in the document
10879 parsers.rawnotes = {}
10880

```

The `reader->register_link` method registers a link reference, where `tag` is the link label, `url` is the link destination, `title` is the optional link title, and `attributes` are the optional attributes.

```

10881 function self.register_link(_, tag, url, title,

```

```

10882             attributes)
10883     local normalized_tag = self.normalize_tag(tag)
10884     if references[normalized_tag] == nil then
10885         references[normalized_tag] = {
10886             url = url,
10887             title = title,
10888             attributes = attributes
10889         }
10890     return ""
10891 else
10892     local text
10893     = string.format('Multiply defined link reference "%s"', tag)
10894     local more = string.format("Look for the text `[%s]: ...`.", tag)
10895     return writer.warning(text, more)
10896 end
10897 end
10898

```

The `reader->lookup_reference` method looks up a reference with link label `tag`.

```

10899 function self.lookup_reference(tag)
10900     return references[self.normalize_tag(tag)]
10901 end
10902

```

The `reader->lookup_note_reference` method looks up a note reference with label `tag`.

```

10903 function self.lookup_note_reference(tag)
10904     return parsers.rawnotes[self.normalize_tag(tag)]
10905 end
10906
10907 parsers.title_s_direct_ref = parsers.squote
10908                             * Cs((parsers.html_entities
10909                                 + ( parsers.anyescaped
10910                                   - parsers.squote
10911                                   - parsers.blankline^2))^0)
10912                             * parsers.squote
10913
10914 parsers.title_d_direct_ref = parsers.dquote
10915                             * Cs((parsers.html_entities
10916                                 + ( parsers.anyescaped
10917                                   - parsers.dquote
10918                                   - parsers.blankline^2))^0)
10919                             * parsers.dquote
10920
10921 parsers.title_p_direct_ref = parsers.lparent
10922                             * Cs((parsers.html_entities
10923                                 + ( parsers.anyescaped
10924                                   - parsers.lparent

```



```

10925             - parsers.rparent
10926             - parsers.blankline^2))^0)
10927         * parsers.rparent
10928
10929 parsers.title_direct_ref = parsers.title_s_direct_ref
10930                         + parsers.title_d_direct_ref
10931                         + parsers.title_p_direct_ref
10932
10933 parsers.inline_direct_ref_inside = parsers.lparent * parsers.spnl
10934                                 * Cg(parsers.url + Cc(""), "url")
10935                                 * parsers.spnl
10936                                 * Cg( parsers.title_direct_ref
10937                                   + Cc(""), "title")
10938                                 * parsers.spnl * parsers.rparent
10939
10940 parsers.inline_direct_ref = parsers.lparent * parsers.spnlc
10941                           * Cg(parsers.url + Cc(""), "url")
10942                           * parsers.spnlc
10943                           * Cg(parsers.title + Cc(""), "title")
10944                           * parsers.spnlc * parsers.rparent
10945
10946 parsers.empty_link = parsers.lbracket
10947                   * parsers.rbracket
10948
10949 parsers.inline_link = parsers.link_text
10950                   * parsers.inline_direct_ref
10951
10952 parsers.full_link = parsers.link_text
10953                   * parsers.link_label
10954
10955 parsers.shortcut_link = parsers.link_label
10956                      * -(parsers.empty_link + parsers.link_label)
10957
10958 parsers.collapsed_link = parsers.link_label
10959                      * parsers.empty_link
10960
10961 parsers.image_opening = #(parsers.exclamation * parsers.inline_link)
10962                       * Cg(Cc("inline"), "link_type")
10963                       + #(parsers.exclamation * parsers.full_link)
10964                       * Cg(Cc("full"), "link_type")
10965                       + #( parsers.exclamation
10966                         * parsers.collapsed_link)
10967                       * Cg(Cc("collapsed"), "link_type")
10968                       + #(parsers.exclamation * parsers.shortcut_link)
10969                       * Cg(Cc("shortcut"), "link_type")
10970                       + #(parsers.exclamation * parsers.empty_link)
10971                       * Cg(Cc("empty"), "link_type")

```

```

10972
10973 parsers.link_opening = #parsers.inline_link
10974                       * Cg(Cc("inline"), "link_type")
10975                       + #parsers.full_link
10976                       * Cg(Cc("full"), "link_type")
10977                       + #parsers.collapsed_link
10978                       * Cg(Cc("collapsed"), "link_type")
10979                       + #parsers.shortcut_link
10980                       * Cg(Cc("shortcut"), "link_type")
10981                       + #parsers.empty_link
10982                       * Cg(Cc("empty_link"), "link_type")
10983                       + #parsers.link_text
10984                       * Cg(Cc("link_text"), "link_type")
10985
10986 parsers.note_opening = #(parsers.circumflex * parsers.link_text)
10987                       * Cg(Cc("note_inline"), "link_type")
10988
10989 parsers.raw_note_opening = #( parsers.lbracket
10990                             * parsers.circumflex
10991                             * parsers.link_label_body
10992                             * parsers.rbracket)
10993                             * Cg(Cc("raw_note"), "link_type")
10994
10995 local inline_note_element = Cg(Cc("note"), "element")
10996                             * parsers.note_opening
10997                             * Cg( parsers.circumflex
10998                               * parsers.lbracket, "content")
10999
11000 local image_element = Cg(Cc("image"), "element")
11001                       * parsers.image_opening
11002                       * Cg( parsers.exclamation
11003                         * parsers.lbracket, "content")
11004
11005 local note_element = Cg(Cc("note"), "element")
11006                       * parsers.raw_note_opening
11007                       * Cg( parsers.lbracket
11008                         * parsers.circumflex, "content")
11009
11010 local link_element = Cg(Cc("link"), "element")
11011                       * parsers.link_opening
11012                       * Cg(parsers.lbracket, "content")
11013
11014 local opening_elements = parsers.fail
11015
11016 if options.inlineNotes then
11017   opening_elements = opening_elements + inline_note_element
11018 end

```

```

11019
11020 opening_elements = opening_elements + image_element
11021
11022 if options.notes then
11023     opening_elements = opening_elements + note_element
11024 end
11025
11026 opening_elements = opening_elements + link_element
11027
11028 parsers.link_image_opening = Ct( Cg(Cc("delimiter"), "type")
11029     * Cg(Cc(true), "is_opening")
11030     * Cg(Cc(false), "is_closing")
11031     * opening_elements)
11032
11033 parsers.link_image_closing = Ct( Cg(Cc("delimiter"), "type")
11034     * Cg(Cc("link"), "element")
11035     * Cg(Cc(false), "is_opening")
11036     * Cg(Cc(true), "is_closing")
11037     * ( Cg(Cc(true), "is_direct")
11038     * Cg( parsers.rbracket
11039         * #parsers.inline_direct_ref,
11040         "content")
11041     + Cg(Cc(false), "is_direct")
11042     * Cg(parsers.rbracket, "content")))
11043
11044 parsers.link_image_open_or_close = parsers.link_image_opening
11045     + parsers.link_image_closing
11046
11047 if options.html then
11048     parsers.link_emph_precedence = parsers.inticks
11049     + parsers.autolink
11050     + parsers.html_inline_tags
11051 else
11052     parsers.link_emph_precedence = parsers.inticks
11053     + parsers.autolink
11054 end
11055
11056 parsers.link_and_emph_endline = parsers.newline
11057     * ((parsers.check_minimal_indent
11058     * -V("EndlineExceptions")
11059     + parsers.check_optional_indent
11060     * -V("EndlineExceptions")
11061     * -V("ListStarter")) / "")
11062     * parsers.spacechar^0 / "\n"
11063
11064 parsers.link_and_emph_content
11065     = Ct( Cg(Cc("content"), "type")

```

```

11066      * Cg(Cs(( parsers.link_emph_precedence
11067                + parsers.backslash * parsers.linechar
11068                + parsers.link_and_emph_endline
11069                + (parsers.linechar
11070                  - parsers.blankline^2
11071                  - parsers.link_image_open_or_close
11072                  - parsers.emph_open_or_close))^0), "content"))
11073
11074  parsers.link_and_emph_table
11075    = (parsers.link_image_opening + parsers.emph_open)
11076    * parsers.link_and_emph_content
11077    * ((parsers.link_image_open_or_close + parsers.emph_open_or_close)
11078       * parsers.link_and_emph_content)^1
11079

```

Collect the content between the `opening_index` and `closing_index` in the delimiter table `t`.

```

11080  local function collect_link_content(t, opening_index, closing_index)
11081    local content = {}
11082    for i = opening_index, closing_index do
11083      content[#content + 1] = t[i].content
11084    end
11085    return util.rope_to_string(content)
11086  end
11087

```

Look for the closest potential link opener in the delimiter table `t` in the range from `bottom_index` to `latest_index`.

```

11088  local function find_link_opener(t, bottom_index, latest_index)
11089    for i = latest_index, bottom_index, -1 do
11090      local value = t[i]
11091      if value.type == "delimiter" and
11092         value.is_opening and
11093         ( value.element == "link"
11094         or value.element == "image"
11095         or value.element == "note")
11096         and not value.removed then
11097        if value.is_active then
11098          return i
11099        end
11100        value.removed = true
11101        return nil
11102      end
11103    end
11104  end
11105

```

Find the position of a delimiter that closes a full link after an an index `latest_index` in the delimiter table `t`.

```

11106  local function find_next_link_closing_index(t, latest_index)
11107      for i = latest_index, #t do
11108          local value = t[i]
11109          if value.is_closing and
11110             value.element == "link" and
11111             not value.removed then
11112              return i
11113          end
11114      end
11115  end
11116

```

Disable all preceding opening link delimiters by marking them inactive with the `is_active` property to prevent links within links. Images within links are allowed.

```

11117  local function disable_previous_link_openers(t, opening_index)
11118      if t[opening_index].element == "image" then
11119          return
11120      end
11121
11122      for i = opening_index, 1, -1 do
11123          local value = t[i]
11124          if value.is_active and
11125             value.type == "delimiter" and
11126             value.is_opening and
11127             value.element == "link" then
11128              value.is_active = false
11129          end
11130      end
11131  end
11132

```

Disable the delimiters between the `opening_index` and `closing_index` in the delimiter table `t` by marking them inactive with the `is_active` property.

```

11133  local function disable_range(t, opening_index, closing_index)
11134      for i = opening_index, closing_index do
11135          local value = t[i]
11136          if value.is_active then
11137              value.is_active = false
11138              if value.type == "delimiter" then
11139                  value.removed = true
11140              end
11141          end
11142      end
11143  end
11144

```

Clear the parsed content between the `opening_index` and `closing_index` in the delimiter table `t`.

```
11145 local delete_parsed_content_in_range =
11146   function(t, opening_index, closing_index)
11147     for i = opening_index, closing_index do
11148       t[i].rendered = nil
11149     end
11150   end
11151
```

Clear the content between the `opening_index` and `closing_index` in the delimiter table `t`.

```
11152 local function empty_content_in_range(t, opening_index, closing_index)
11153   for i = opening_index, closing_index do
11154     t[i].content = ''
11155   end
11156 end
11157
```

Join the attributes from the link reference definition `reference_attributes` with the link's own attributes `own_attributes`.

```
11158 local function join_attributes(reference_attributes, own_attributes)
11159   local merged_attributes = {}
11160   for _, attribute in ipairs(reference_attributes or {}) do
11161     table.insert(merged_attributes, attribute)
11162   end
11163   for _, attribute in ipairs(own_attributes or {}) do
11164     table.insert(merged_attributes, attribute)
11165   end
11166   if next(merged_attributes) == nil then
11167     merged_attributes = nil
11168   end
11169   return merged_attributes
11170 end
11171
```

Parse content between two delimiters in the delimiter table `t`. Produce the respective link and image macros.

```
11172 local render_link_or_image =
11173   function(t, opening_index, closing_index, content_end_index,
11174     reference)
11175     process_emphasis(t, opening_index, content_end_index)
11176     local mapped = collect_emphasis_content(t, opening_index + 1,
11177       content_end_index - 1)
11178
11179     local rendered = {}
11180     if (t[opening_index].element == "link") then
11181       rendered = writer.link(mapped, reference.url,
```

```

11182             reference.title, reference.attributes)
11183         end
11184
11185         if (t[opening_index].element == "image") then
11186             rendered = writer.image(mapped, reference.url,
11187                 self.parser_functions.parse_inlines_string(reference.title),
11188                 reference.attributes)
11189         end
11190
11191         if (t[opening_index].element == "note") then
11192             if (t[opening_index].link_type == "note_inline") then
11193                 rendered = writer.note(mapped)
11194             end
11195             if (t[opening_index].link_type == "raw_note") then
11196                 rendered = writer.note(reference)
11197             end
11198         end
11199
11200         t[opening_index].rendered = rendered
11201         delete_parsed_content_in_range(t, opening_index + 1,
11202             closing_index)
11203         empty_content_in_range(t, opening_index, closing_index)
11204         disable_previous_link_openers(t, opening_index)
11205         disable_range(t, opening_index, closing_index)
11206     end
11207

```

Match the link destination of an inline link at index `closing_index` in table `t` when `match_reference` is true. Additionally, match attributes when the option `linkAttributes` is enabled.

```

11208     local resolve_inline_following_content =
11209         function(t, closing_index, match_reference, match_link_attributes)
11210             local content = ""
11211             for i = closing_index + 1, #t do
11212                 content = content .. t[i].content
11213             end
11214
11215             local matching_content = parsers.succeed
11216
11217             if match_reference then
11218                 matching_content = matching_content
11219                     * parsers.inline_direct_ref_inside
11220             end
11221
11222             if match_link_attributes then
11223                 matching_content = matching_content
11224                     * Cg(Ct(parsers.attributes^-1), "attributes")

```

```

11225     end
11226
11227     local matched = lpeg.match(Ct( matching_content
11228                                   * Cg(Cp(), "end_position")), content)
11229
11230     local matched_count = matched.end_position - 1
11231     for i = closing_index + 1, #t do
11232         local value = t[i]
11233
11234         local chars_left = matched_count
11235         matched_count = matched_count - #value.content
11236
11237         if matched_count <= 0 then
11238             value.content = value.content:sub(chars_left + 1)
11239             break
11240         end
11241
11242         value.content = ''
11243         value.is_active = false
11244     end
11245
11246     local attributes = matched.attributes
11247     if attributes == nil or next(attributes) == nil then
11248         attributes = nil
11249     end
11250
11251     return {
11252         url = matched.url or "",
11253         title = matched.title or "",
11254         attributes = attributes
11255     }
11256 end
11257

```

Resolve an inline link `[a](b "c")` from the delimiters at `opening_index` and `closing_index` within a delimiter table `t`. Here, compared to other types of links, no reference definition is needed.

```

11258     local function resolve_inline_link(t, opening_index, closing_index)
11259         local inline_content
11260         = resolve_inline_following_content(t, closing_index, true,
11261                                           t.match_link_attributes)
11262         render_link_or_image(t, opening_index, closing_index,
11263                             closing_index, inline_content)
11264     end
11265

```


Resolve an inline note `^[a]` from the delimiters at `opening_index` and `closing_index` within a delimiter table `t`.

```
11266 local resolve_note_inline_link =
11267   function(t, opening_index, closing_index)
11268     local inline_content
11269       = resolve_inline_following_content(t, closing_index,
11270                                         false, false)
11271     render_link_or_image(t, opening_index, closing_index,
11272                         closing_index, inline_content)
11273   end
11274
```

Resolve a shortcut link `[a]` from the delimiters at `opening_index` and `closing_index` within a delimiter table `t`. Continue if a tag `a` is not found in the references.

```
11275 local function resolve_shortcut_link(t, opening_index, closing_index)
11276   local content
11277     = collect_link_content(t, opening_index + 1, closing_index - 1)
11278   local r = self.lookup_reference(content)
11279
11280   if r then
11281     local inline_content
11282       = resolve_inline_following_content(t, closing_index, false,
11283                                         t.match_link_attributes)
11284     r.attributes
11285       = join_attributes(r.attributes, inline_content.attributes)
11286     render_link_or_image(t, opening_index, closing_index,
11287                         closing_index, r)
11288   end
11289 end
11290
```

Resolve a note `[^a]` from the delimiters at `opening_index` and `closing_index` within a delimiter table `t`. Continue if a tag `a` is not found in the rawnotes.

```
11291 local function resolve_raw_note_link(t, opening_index, closing_index)
11292   local content
11293     = collect_link_content(t, opening_index + 1, closing_index - 1)
11294   local r = self.lookup_note_reference(content)
11295
11296   if r then
11297     local parsed_ref = self.parser_functions.parse_blocks_nested(r)
11298     render_link_or_image(t, opening_index, closing_index,
11299                         closing_index, parsed_ref)
11300   end
11301 end
11302
```

Resolve a full link `[a][b]` from the delimiters at `opening_index` and `closing_index` within a delimiter table `t`. Continue if a tag `b` is not found in the references.

```

11303 local function resolve_full_link(t, opening_index, closing_index)
11304     local next_link_closing_index
11305     = find_next_link_closing_index(t, closing_index + 4)
11306     local next_link_content
11307     = collect_link_content(t, closing_index + 3,
11308                           next_link_closing_index - 1)
11309     local r = self.lookup_reference(next_link_content)
11310
11311     if r then
11312         local inline_content
11313         = resolve_inline_following_content(t, next_link_closing_index,
11314                                           false,
11315                                           t.match_link_attributes)
11316         r.attributes
11317         = join_attributes(r.attributes, inline_content.attributes)
11318         render_link_or_image(t, opening_index, next_link_closing_index,
11319                             closing_index, r)
11320     else
11321         local text = string.format('Undefined link reference "%s"',
11322                                   next_link_content)
11323         local more = string.format("Look for the text `[...] [%s]`.",
11324                                   next_link_content)
11325         t[opening_index].warning = writer.warning(text, more)
11326     end
11327 end
11328

```

Resolve a collapsed link `[a][]` from the delimiters at `opening_index` and `closing_index` within a delimiter table `t`. Continue if a tag `a` is not found in the references.

```

11329 local function resolve_collapsed_link(t, opening_index, closing_index)
11330     local next_link_closing_index
11331     = find_next_link_closing_index(t, closing_index + 4)
11332     local content
11333     = collect_link_content(t, opening_index + 1, closing_index - 1)
11334     local r = self.lookup_reference(content)
11335
11336     if r then
11337         local inline_content
11338         = resolve_inline_following_content(t, closing_index, false,
11339                                           t.match_link_attributes)
11340         r.attributes
11341         = join_attributes(r.attributes, inline_content.attributes)
11342         render_link_or_image(t, opening_index, next_link_closing_index,
11343                             closing_index, r)
11344     end
11345

```

```

11344     else
11345         local text = string.format('Undefined link reference "%s"',
11346                                   content)
11347         local more = string.format("Look for the text `[%s] []`.",
11348                                   content)
11349         t[opening_index].warning = writer.warning(text, more)
11350     end
11351 end
11352

```

Parse a table of link and emphasis delimiters **t**. First, iterate over the link delimiters and produce either link or image macros. Then run **process_emphasis** over the entire delimiter table, resolving emphasis and strong emphasis and parsing any content outside of closed delimiters.

```

11353 local function process_links_and_emphasis(t)
11354     for _,value in ipairs(t) do
11355         value.is_active = true
11356     end
11357
11358     for i,value in ipairs(t) do
11359         if not value.is_closing
11360             or value.type ~= "delimiter"
11361             or not ( value.element == "link"
11362                    or value.element == "image"
11363                    or value.element == "note")
11364             or value.removed then
11365             goto continue
11366         end
11367
11368         local opener_position = find_link_opener(t, 1, i - 1)
11369         if (opener_position == nil) then
11370             goto continue
11371         end
11372
11373         local opening_delimiter = t[opener_position]
11374         opening_delimiter.removed = true
11375
11376         local link_type = opening_delimiter.link_type
11377
11378         if (link_type == "inline") then
11379             resolve_inline_link(t, opener_position, i)
11380         end
11381         if (link_type == "shortcut") then
11382             resolve_shortcut_link(t, opener_position, i)
11383         end
11384         if (link_type == "full") then
11385             resolve_full_link(t, opener_position, i)

```

```

11386     end
11387     if (link_type == "collapsed") then
11388         resolve_collapsed_link(t, opener_position, i)
11389     end
11390     if (link_type == "note_inline") then
11391         resolve_note_inline_link(t, opener_position, i)
11392     end
11393     if (link_type == "raw_note") then
11394         resolve_raw_note_link(t, opener_position, i)
11395     end
11396
11397     ::continue::
11398 end
11399
11400 t[#t].content = t[#t].content:gsub("%s*$","")
11401
11402 process_emphasis(t, 1, #t)
11403 local final_result = collect_emphasis_content(t, 1, #t)
11404 return final_result
11405 end
11406
11407 function self.defer_link_and_emphasis_processing(delimiter_table)
11408     return writer.defer_call(function()
11409         return process_links_and_emphasis(delimiter_table)
11410     end)
11411 end
11412

```

3.1.6.8 Inline Elements (local)

```

11413 parsers.Str      = ( parsers.normalchar
11414                     * (parsers.normalchar + parsers.at)^0)
11415                     / writer.string
11416
11417 parsers.Symbol    = (parsers.backtick^1 + V("SpecialChar"))
11418                     / writer.string
11419
11420 parsers.Ellipsis  = P("...") / writer.ellipsis
11421
11422 parsers.Smart     = parsers.Ellipsis
11423
11424 parsers.Code      = parsers.inticks / writer.code
11425
11426 if options.blankBeforeBlockquote then
11427     parsers.bqstart = parsers.fail
11428 else
11429     parsers.bqstart = parsers.blockquote_start

```

```

11430 end
11431
11432 if options.blankBeforeHeading then
11433     parsers.headerstart = parsers.fail
11434 else
11435     parsers.headerstart = parsers.atx_heading
11436 end
11437
11438 if options.blankBeforeList then
11439     parsers.interrupting_bullets = parsers.fail
11440     parsers.interrupting_enumerators = parsers.fail
11441 else
11442     parsers.interrupting_bullets
11443     = parsers.bullet(parsers.dash, true)
11444     + parsers.bullet(parsers.asterisk, true)
11445     + parsers.bullet(parsers.plus, true)
11446
11447     parsers.interrupting_enumerators
11448     = parsers.enumerator(parsers.period, true)
11449     + parsers.enumerator(parsers.rparent, true)
11450 end
11451
11452 if options.html then
11453     parsers.html_interrupting
11454     = parsers.check_trail
11455     * ( parsers.html_incomplete_open_tag
11456       + parsers.html_incomplete_close_tag
11457       + parsers.html_incomplete_open_special_tag
11458       + parsers.html_comment_start
11459       + parsers.html_cdatasection_start
11460       + parsers.html_declaration_start
11461       + parsers.html_instruction_start
11462       - parsers.html_close_special_tag
11463       - parsers.html_empty_special_tag)
11464 else
11465     parsers.html_interrupting = parsers.fail
11466 end
11467
11468 if options.blankBeforeHtmlBlock then
11469     parsers.html_interrupting = parsers.fail
11470 end
11471
11472 parsers.ListStarter = parsers.starter
11473
11474 parsers.EndlineExceptions
11475     = parsers.blankline -- paragraph break
11476     + parsers.eof       -- end of document

```

```

11477         + parsers.bqstart
11478         + parsers.thematic_break_lines
11479         + parsers.interrupting_bullets
11480         + parsers.interrupting_enumerators
11481         + parsers.headerstart
11482         + parsers.html_interrupting
11483
11484 parsers.NoSoftLineBreakEndlineExceptions = parsers.EndlineExceptions
11485
11486 parsers.endline = parsers.newline
11487     * (parsers.check_minimal_indent
11488     * -V("EndlineExceptions")
11489     + parsers.check_optional_indent
11490     * -V("EndlineExceptions")
11491     * -V("ListStarter")) / function(_) return end
11492     * parsers.spacechar^0
11493
11494 parsers.Endline = parsers.endline
11495     / writer.soft_line_break
11496
11497 parsers.EndlineNoSub = parsers.endline
11498
11499 parsers.NoSoftLineBreakEndline
11500     = parsers.newline
11501     * (parsers.check_minimal_indent
11502     * -V("NoSoftLineBreakEndlineExceptions")
11503     + parsers.check_optional_indent
11504     * -V("NoSoftLineBreakEndlineExceptions")
11505     * -V("ListStarter"))
11506     * parsers.spacechar^0
11507     / writer.space
11508
11509 parsers.EndlineBreak = parsers.backslash * parsers.endline
11510     / writer.hard_line_break
11511
11512 parsers.OptionalIndent
11513     = parsers.spacechar^1 / writer.space
11514
11515 parsers.Space = parsers.spacechar^2 * parsers.endline
11516     / writer.hard_line_break
11517     + parsers.spacechar^1
11518     * parsers.endline^-1
11519     * parsers.eof / self.expandtabs
11520     + parsers.spacechar^1 * parsers.endline
11521     / writer.soft_line_break
11522     + parsers.spacechar^1
11523     * -parsers.newline / self.expandtabs

```

```

11524         + parsers.spacechar^1
11525         + ( parsers.spacechar
11526           + parsers.html_space_entity_char)^1
11527         * parsers.endline / writer.soft_line_break
11528
11529     parsers.NonbreakingEndline
11530         = parsers.endline
11531         / writer.nbsp
11532
11533     parsers.NonbreakingSpace
11534         = parsers.spacechar^2 * parsers.endline
11535           / writer.nbsp
11536         + parsers.spacechar^1
11537         * parsers.endline^-1 * parsers.eof / ""
11538         + parsers.spacechar^1 * parsers.endline
11539           * parsers.optionalspace
11540           / writer.nbsp
11541         + parsers.spacechar^1 * parsers.optionalspace
11542           / writer.nbsp
11543

```

The `reader->auto_link_url` method produces an autolink to a URL or a relative reference in the output format, where `url` is the link destination and `attributes` are the optional attributes.

```

11544 function self.auto_link_url(url, attributes)
11545     return writer.link(writer.escape(url),
11546                       url, nil, attributes)
11547 end

```

The `reader->auto_link_email` method produces an autolink to an e-mail in the output format, where `email` is the email address destination and `attributes` are the optional attributes.

```

11548 function self.auto_link_email(email, attributes)
11549     return writer.link(writer.escape(email),
11550                       "mailto:".email,
11551                       nil, attributes)
11552 end
11553
11554     parsers.AutoLinkUrl = parsers.auto_link_url
11555                       / self.auto_link_url
11556
11557     parsers.AutoLinkEmail
11558         = parsers.auto_link_email
11559         / self.auto_link_email
11560
11561     parsers.AutoLinkRelativeReference
11562         = parsers.auto_link_relative_reference

```

```

11563             / self.auto_link_url
11564
11565     parsers.LinkAndEmph = Ct(parsers.link_and_emph_table)
11566             / self.defer_link_and_emphasis_processing
11567
11568     parsers.EscapedChar = parsers.backslash
11569             * C(parsers.escapable) / writer.string
11570
11571     if options.htmlOutput == "commonmark" then
11572         parsers.InlineHtml
11573             = Cs(parsers.html_inline_comment)
11574             / self.parser_functions.parse_inlines_no_html
11575             / writer.inline_html_comment
11576             + Cs(parsers.html_any_empty_inline_tag)
11577             / writer.inline_html_empty_tag
11578             + Cs(parsers.html_inline_instruction)
11579             / writer.inline_html_processing_instruction
11580             + Cs(parsers.html_inline_cdatasection)
11581             / writer.inline_html_cdata_section
11582             + Cs(parsers.html_inline_declaration)
11583             / writer.inline_html_declaration
11584             + Cs(parsers.html_any_open_inline_tag)
11585             / writer.inline_html_open_tag
11586             + Cs(parsers.html_any_close_tag)
11587             / writer.inline_html_close_tag
11588     else
11589         parsers.InlineHtml = Cs(parsers.html_inline_comment)
11590             / self.parser_functions.parse_inlines_no_html
11591             / writer.inline_html_comment
11592             + Cs( parsers.html_any_empty_inline_tag
11593                 + parsers.html_inline_instruction
11594                 + parsers.html_inline_cdatasection
11595                 + parsers.html_inline_declaration
11596                 + parsers.html_any_open_inline_tag
11597                 + parsers.html_any_close_tag)
11598             / writer.inline_html_tag
11599     end
11600
11601     parsers.HtmlEntity = parsers.html_entities / writer.string

```

3.1.6.9 Block Elements (local)

```

11602     if options.htmlOutput == "commonmark" then
11603         parsers.DisplayHtml
11604             = parsers.check_trail
11605             * ( parsers.html_comment
11606                 / self.parser_functions.parse_blocks_nested

```



```

11607         / writer.block_html_comment)
11608     + Cs(parsers.check_trail * parsers.html_special_block)
11609     / writer.block_html_cdata_element
11610     + Cs(parsers.check_trail * parsers.html_block)
11611     / writer.block_html_pdata_element
11612     + Cs(parsers.check_trail * parsers.html_any_block)
11613     / writer.block_html_standalone_tag
11614     + Cs(parsers.check_trail * parsers.html_instruction)
11615     / writer.block_html_processing_instruction
11616     + Cs(parsers.check_trail * parsers.html_cdatasection)
11617     / writer.block_html_cdata_section
11618     + Cs(parsers.check_trail * parsers.html_declaration)
11619     / writer.block_html_declaration
11620 else
11621     parsers.DisplayHtml = Cs( parsers.check_trail
11622                             * ( parsers.html_comment
11623                               + parsers.html_special_block
11624                               + parsers.html_block
11625                               + parsers.html_any_block
11626                               + parsers.html_instruction
11627                               + parsers.html_cdatasection
11628                               + parsers.html_declaration))
11629                             / writer.block_html_element
11630 end
11631
11632 parsers.indented_non_blank_line = parsers.indentedline
11633                               - parsers.blankline
11634
11635 parsers.Verbatim
11636     = Cs( parsers.check_code_trail
11637         * (parsers.line - parsers.blankline)
11638         * (( parsers.check_minimal_blank_indent_and_full_code_trail
11639           * parsers.blankline)^0
11640         * ( (parsers.check_minimal_indent / "")
11641           * parsers.check_code_trail
11642           * (parsers.line - parsers.blankline))^1)^0)
11643     / self.expandtabs / writer.verbatim
11644
11645 parsers.Blockquote    = parsers.blockquote_body
11646                       / writer.blockquote
11647
11648 parsers.ThematicBreak = parsers.thematic_break_lines
11649                       / writer.thematic_break
11650
11651 parsers.Reference     = parsers.define_reference_parser
11652                       / self.register_link
11653

```

```

11654 parsers.Paragraph = parsers.freeze_trail
11655                     * (Ct((parsers.Inline)^1)
11656                       * (parsers.newline + parsers.eof)
11657                       * parsers.unfreeze_trail
11658                       / writer.paragraph)
11659
11660 parsers.Plain       = parsers.nonindentspace * Ct(parsers.Inline^1)
11661                   / writer.plain

```

3.1.6.10 Lists (local)

```

11662
11663 if options.taskLists then
11664   parsers.tickbox = ( parsers.ticked_box
11665                     + parsers.halfticked_box
11666                     + parsers.unticked_box
11667                     ) / writer.tickbox
11668 else
11669   parsers.tickbox = parsers.fail
11670 end
11671
11672 parsers.list_blank = parsers.conditionally_indented_blankline
11673
11674 parsers.ref_or_block_list_separated
11675   = parsers.sep_group_no_output(parsers.list_blank)
11676   * parsers.minimally_indented_ref
11677   + parsers.block_sep_group(parsers.list_blank)
11678   * parsers.minimally_indented_block
11679
11680 parsers.ref_or_block_non_separated
11681   = parsers.minimally_indented_ref
11682   + (parsers.succeed / writer.interblocksep)
11683   * parsers.minimally_indented_block
11684   - parsers.minimally_indented_blankline
11685
11686 parsers.tight_list_loop_body_pair =
11687   parsers.create_loop_body_pair(
11688     parsers.ref_or_block_non_separated,
11689     parsers.minimally_indented_par_or_plain_no_blank,
11690     (parsers.succeed / writer.interblocksep),
11691     (parsers.succeed / writer.paragraphsep))
11692
11693 parsers.loose_list_loop_body_pair =
11694   parsers.create_loop_body_pair(
11695     parsers.ref_or_block_list_separated,
11696     parsers.minimally_indented_par_or_plain,
11697     parsers.block_sep_group(parsers.list_blank),

```

```

11698     parsers.par_sep_group(parsers.list_blank))
11699
11700 parsers.tight_list_content_loop
11701     = V("Block")
11702     * parsers.tight_list_loop_body_pair.block^0
11703     + (V("Paragraph") + V("Plain"))
11704     * parsers.ref_or_block_non_separated
11705     * parsers.tight_list_loop_body_pair.block^0
11706     + (V("Paragraph") + V("Plain"))
11707     * parsers.tight_list_loop_body_pair.par^0
11708
11709 parsers.loose_list_content_loop
11710     = V("Block")
11711     * parsers.loose_list_loop_body_pair.block^0
11712     + (V("Paragraph") + V("Plain"))
11713     * parsers.ref_or_block_list_separated
11714     * parsers.loose_list_loop_body_pair.block^0
11715     + (V("Paragraph") + V("Plain"))
11716     * parsers.loose_list_loop_body_pair.par^0
11717
11718 parsers.list_item_tightness_condition
11719     = -#( parsers.list_blank^0
11720         * parsers.minimally_indented_ref_or_block_or_par)
11721     * remove_indent("li")
11722     + remove_indent("li")
11723     * parsers.fail
11724
11725 parsers.indented_content_tight
11726     = Ct( (parsers.blankline / "")
11727         * #parsers.list_blank
11728         * remove_indent("li")
11729         + ( (V("Reference") + (parsers.blankline / ""))
11730             * parsers.check_minimal_indent
11731             * parsers.tight_list_content_loop
11732             + (V("Reference") + (parsers.blankline / ""))
11733             + (parsers.tickbox~-1 / writer.escape)
11734             * parsers.tight_list_content_loop
11735             )
11736         * parsers.list_item_tightness_condition)
11737
11738 parsers.indented_content_loose
11739     = Ct( (parsers.blankline / "")
11740         * #parsers.list_blank
11741         + ( (V("Reference") + (parsers.blankline / ""))
11742             * parsers.check_minimal_indent
11743             * parsers.loose_list_content_loop
11744             + (V("Reference") + (parsers.blankline / ""))

```

```

11745         + (parsers.tickbox~-1 / writer.escape)
11746         * parsers.loose_list_content_loop))
11747
11748     parsers.TightListItem = function(starter)
11749         return -parsers.ThematicBreak
11750             * parsers.add_indent(starter, "li")
11751             * parsers.indented_content_tight
11752     end
11753
11754     parsers.LooseListItem = function(starter)
11755         return -parsers.ThematicBreak
11756             * parsers.add_indent(starter, "li")
11757             * parsers.indented_content_loose
11758             * remove_indent("li")
11759     end
11760
11761     parsers.BulletListOfType = function(bullet_type)
11762         local bullet = parsers.bullet(bullet_type)
11763         return ( Ct( parsers.TightListItem(bullet)
11764             * ( (parsers.check_minimal_indent / "")
11765                 * parsers.TightListItem(bullet)
11766             )^0
11767             )
11768             * Cc(true)
11769             * -#( (parsers.list_blank^0 / "")
11770                 * parsers.check_minimal_indent
11771                 * (bullet - parsers.ThematicBreak)
11772             )
11773             + Ct( parsers.LooseListItem(bullet)
11774                 * ( (parsers.list_blank^0 / "")
11775                     * (parsers.check_minimal_indent / "")
11776                     * parsers.LooseListItem(bullet)
11777                 )^0
11778             )
11779             * Cc(false)
11780         ) / writer.bulletlist
11781     end
11782
11783     parsers.BulletList = parsers.BulletListOfType(parsers.dash)
11784         + parsers.BulletListOfType(parsers.asterisk)
11785         + parsers.BulletListOfType(parsers.plus)
11786
11787     local function ordered_list(items,tight,starter)
11788         local startnum = starter[2][1]
11789         if options.startNumber then
11790             startnum = tonumber(startnum) or 1 -- fallback for '#'
11791             if startnum ~= nil then

```

```

11792         startnum = math.floor(startnum)
11793     end
11794     else
11795         startnum = nil
11796     end
11797     return writer.orderedlist(items,tight,startnum)
11798 end
11799
11800 parsers.OrderedListOfType = function(delimiter_type)
11801     local enumerator = parsers.enumerator(delimiter_type)
11802     return Cg(enumerator, "listtype")
11803         * (Ct( parsers.TightListItem(Cb("listtype"))
11804             * ( (parsers.check_minimal_indent / "")
11805                 * parsers.TightListItem(enumerator))^0)
11806         * Cc(true)
11807         * -#((parsers.list_blank^0 / "")
11808             * parsers.check_minimal_indent * enumerator)
11809     + Ct( parsers.LooseListItem(Cb("listtype"))
11810         * ((parsers.list_blank^0 / "")
11811             * (parsers.check_minimal_indent / "")
11812             * parsers.LooseListItem(enumerator))^0)
11813         * Cc(false)
11814     ) * Ct(Cb("listtype")) / ordered_list
11815 end
11816
11817 parsers.OrderedList = parsers.OrderedListOfType(parsers.period)
11818     + parsers.OrderedListOfType(parsers.rparent)

```

3.1.6.11 Blank (local)

```

11819 parsers.Blank          = parsers.blankline / ""
11820                        + V("Reference")

```

3.1.6.12 Headings (local)

```

11821 function parsers.parse_heading_text(s)
11822     local inlines = self.parser_functions.parse_inlines(s)
11823     local flatten_inlines = self.writer.flatten_inlines
11824     self.writer.flatten_inlines = true
11825     local flat_text = self.parser_functions.parse_inlines(s)
11826     flat_text = util.rope_to_string(flat_text)
11827     self.writer.flatten_inlines = flatten_inlines
11828     return {flat_text, inlines}
11829 end
11830
11831 -- parse atx header
11832 parsers.AtxHeading = parsers.check_trail_no_rem
11833                     * Cg(parsers.heading_start, "level")

```

```

11834         * ((C( parsers.optionalspace
11835             * parsers.hash^0
11836             * parsers.optionalspace
11837             * parsers.newline)
11838         + parsers.spacechar^1
11839         * C(parsers.line))
11840         / strip_atx_end
11841         / parsers.parse_heading_text)
11842         * Cb("level")
11843         / writer.heading
11844
11845     parsers.heading_line = parsers.linechar^1
11846                         - parsers.thematic_break_lines
11847
11848     parsers.heading_text = parsers.heading_line
11849                         * ( (V("Endline") / "\n")
11850                         * ( parsers.heading_line
11851                           - parsers.heading_level))^0
11852                         * parsers.newline^-1
11853
11854     parsers.SettextHeading = parsers.freeze_trail
11855                         * parsers.check_trail_no_rem
11856                         * #( parsers.heading_text
11857                           * parsers.check_minimal_indent
11858                           * parsers.check_trail
11859                           * parsers.heading_level)
11860                         * Cs(parsers.heading_text)
11861                         / parsers.parse_heading_text
11862                         * parsers.check_minimal_indent_and_trail
11863                         * parsers.heading_level
11864                         * parsers.newline
11865                         * parsers.unfreeze_trail
11866                         / writer.heading
11867
11868     parsers.Heading = parsers.AtxHeading + parsers.SettextHeading

```

3.1.6.13 Syntax Specification

Define `reader->finalize_grammar` as a function that constructs the PEG grammar of markdown, applies syntax extensions `extensions` and returns a conversion function that takes a markdown string and turns it into a plain `TeX` output.

```

11869     function self.finalize_grammar(extensions)

```

Create a local writable copy of the global read-only `walkable_syntax` hash table. This table can be used by user-defined syntax extensions to insert new PEG patterns into existing rules of the PEG grammar of markdown using the

`reader->insert_pattern` method. Furthermore, built-in syntax extensions can use this table to override existing rules using the `reader->update_rule` method.

```

11870     local walkable_syntax = (function(global_walkable_syntax)
11871         local local_walkable_syntax = {}
11872         for lhs, rule in pairs(global_walkable_syntax) do
11873             local_walkable_syntax[lhs] = util.table_copy(rule)
11874         end
11875         return local_walkable_syntax
11876     end)(walkable_syntax)

```

The `reader->insert_pattern` method adds a pattern to `walkable_syntax[left-hand side terminal symbol]` before, instead of, or after a right-hand-side terminal symbol.

```

11877     local current_extension_name = nil
11878     self.insert_pattern = function(selector, pattern, pattern_name)
11879         assert(pattern_name == nil or type(pattern_name) == "string")
11880         local _, _, lhs, pos, rhs
11881         = selector:find("^(%a+)%s+([%a%s]+%a+)%s+(%a+)$")
11882         assert(lhs ~= nil,
11883             [[Expected selector in form ]]
11884             .. [[ "LHS (before|after|instead of) RHS", not "]]
11885             .. selector .. [[ "]]))
11886         assert(walkable_syntax[lhs] ~= nil,
11887             [[Rule ]] .. lhs
11888             .. [[ -> ... does not exist in markdown grammar]])
11889         assert(pos == "before" or pos == "after" or pos == "instead of",
11890             [[Expected positional specifier "before", "after", ]]
11891             .. [[or "instead of", not "]]
11892             .. pos .. [[ "]]))
11893         local rule = walkable_syntax[lhs]
11894         local index = nil
11895         for current_index, current_rhs in ipairs(rule) do
11896             if type(current_rhs) == "string" and current_rhs == rhs then
11897                 index = current_index
11898                 if pos == "after" then
11899                     index = index + 1
11900                 end
11901                 break
11902             end
11903         end
11904         assert(index ~= nil,
11905             [[Rule ]] .. lhs .. [[ -> ]] .. rhs
11906             .. [[ does not exist in markdown grammar]])
11907         local accountable_pattern
11908         if current_extension_name then
11909             accountable_pattern
11910                 = {pattern, current_extension_name, pattern_name}

```

```

11911     else
11912         assert(type(pattern) == "string",
11913             [[reader->insert_pattern() was called outside ]]
11914             .. [[an extension with ]]
11915             .. [[a PEG pattern instead of a rule name]])
11916         accountable_pattern = pattern
11917     end
11918     if pos == "instead of" then
11919         rule[index] = accountable_pattern
11920     else
11921         table.insert(rule, index, accountable_pattern)
11922     end
11923     -- TODO: Remove all occurrences of `pattern` after `index`
11924     --         to improve speed?
11925 end
11926 if options.htmlOverLinks then
11927     self.insert_pattern("Inline before AutoLinkUrl", "InlineHtml")
11928 end

```

Create a local `syntax` hash table that stores those rules of the PEG grammar of markdown that can't be represented as an ordered choice of terminal symbols.

```

11929     local syntax =
11930         { "Blocks",
11931
11932           Blocks = V("InitializeState")
11933                 * V("ExpectedJekyllData")
11934                 * V("Blank")^0

```

Only create interblock separators between pairs of blocks that are not both paragraphs. Between a pair of paragraphs, any number of blank lines will always produce a paragraph separator.

```

11935         * ( V("Block")
11936           * ( V("Blank")^0 * parsers.eof
11937             + ( V("Blank")^2 / writer.paragraphsep
11938               + V("Blank")^0 / writer.interblocksep
11939             )
11940           )
11941         + ( V("Paragraph") + V("Plain") )
11942         * ( V("Blank")^0 * parsers.eof
11943           + ( V("Blank")^2 / writer.paragraphsep
11944             + V("Blank")^0 / writer.interblocksep
11945           )
11946         )
11947         * V("Block")
11948         * ( V("Blank")^0 * parsers.eof
11949           + ( V("Blank")^2 / writer.paragraphsep
11950             + V("Blank")^0 / writer.interblocksep
11951           )

```



```

11952         )
11953         + ( V("Paragraph") + V("Plain") )
11954         * ( V("Blank")^0 * parsers.eof
11955           + V("Blank")^0 / writer.paragraphsep
11956         )
11957       )^0,
11958
11959   ExpectedJekyllData = parsers.succeed,
11960
11961   Blank                = parsers.Blank,
11962   Reference            = parsers.Reference,
11963
11964   Blockquote          = parsers.Blockquote,
11965   Verbatim            = parsers.Verbatim,
11966   ThematicBreak       = parsers.ThematicBreak,
11967   BulletList          = parsers.BulletList,
11968   OrderedList         = parsers.OrderedList,
11969   DisplayHtml         = parsers.DisplayHtml,
11970   Heading             = parsers.Heading,
11971   Paragraph           = parsers.Paragraph,
11972   Plain               = parsers.Plain,
11973
11974   ListStarter         = parsers.ListStarter,
11975   EndlineExceptions   = parsers.EndlineExceptions,
11976   NoSoftLineBreakEndlineExceptions
11977                       = parsers.NoSoftLineBreakEndlineExceptions,
11978
11979   Str                 = parsers.Str,
11980   Space               = parsers.Space,
11981   OptionalIndent      = parsers.OptionalIndent,
11982   Endline             = parsers.Endline,
11983   EndlineNoSub        = parsers.EndlineNoSub,
11984   NoSoftLineBreakEndline
11985                       = parsers.NoSoftLineBreakEndline,
11986   EndlineBreak        = parsers.EndlineBreak,
11987   LinkAndEmph         = parsers.LinkAndEmph,
11988   Code               = parsers.Code,
11989   AutoLinkUrl         = parsers.AutoLinkUrl,
11990   AutoLinkEmail       = parsers.AutoLinkEmail,
11991   AutoLinkRelativeReference
11992                       = parsers.AutoLinkRelativeReference,
11993   InlineHtml          = parsers.InlineHtml,
11994   HtmlEntity          = parsers.HtmlEntity,
11995   EscapedChar         = parsers.EscapedChar,
11996   Smart              = parsers.Smart,
11997   Symbol              = parsers.Symbol,
11998   SpecialChar         = parsers.fail,

```

```

11999         InitializeState    = parsers.succeed,
12000     }

```

Define `reader->update_rule` as a function that receives two arguments: a left-hand side terminal symbol and a function that accepts the current PEG pattern in `walkable_syntax[left-hand side terminal symbol]` if defined or `nil` otherwise and returns a PEG pattern that will (re)define `walkable_syntax[left-hand side terminal symbol]`.

```

12001     self.update_rule = function(rule_name, get_pattern)
12002         assert(current_extension_name ~= nil)
12003         assert(syntax[rule_name] ~= nil,
12004             [[Rule ]] .. rule_name
12005             .. [[ -> ... does not exist in markdown grammar]])
12006         local previous_pattern
12007         local extension_name
12008         if walkable_syntax[rule_name] then
12009             local previous_accountable_pattern
12010             = walkable_syntax[rule_name][1]
12011             previous_pattern = previous_accountable_pattern[1]
12012             extension_name
12013             = previous_accountable_pattern[2]
12014             .. ", " .. current_extension_name
12015         else
12016             previous_pattern = nil
12017             extension_name = current_extension_name
12018         end
12019         local pattern

```

Instead of a function, a PEG pattern `pattern` may also be supplied with roughly the same effect as supplying the following function, which will define `walkable_syntax[left-hand side terminal symbol]` unless it has been previously defined.

```

function(previous_pattern)
    assert(previous_pattern == nil)
    return pattern
end

```

```

12020         if type(get_pattern) == "function" then
12021             pattern = get_pattern(previous_pattern)
12022         else
12023             assert(previous_pattern == nil,
12024                 [[Rule ]] .. rule_name ..
12025                 [[ has already been updated by ]] .. extension_name)
12026             pattern = get_pattern
12027         end

```

```

12028     local accountable_pattern = { pattern, extension_name, rule_name }
12029     walkable_syntax[rule_name] = { accountable_pattern }
12030 end

```

Define a hash table of all characters with special meaning and add method `reader->add_special_character` that extends the hash table and updates the PEG grammar of markdown.

```

12031     local special_characters = {}
12032     self.add_special_character = function(c)
12033         table.insert(special_characters, c)
12034         syntax.SpecialChar = S(table.concat(special_characters, ""))
12035     end
12036
12037     self.add_special_character("*")
12038     self.add_special_character("[")
12039     self.add_special_character("]")
12040     self.add_special_character("<")
12041     self.add_special_character("!")
12042     self.add_special_character("\\")

```

Add method `reader->initialize_named_group` that defines named groups with a default capture value.

```

12043     self.initialize_named_group = function(name, value)
12044         local pattern = Ct("")
12045         if value ~= nil then
12046             pattern = pattern / value
12047         end
12048         syntax.InitializeState = syntax.InitializeState
12049             * Cg(pattern, name)
12050     end

```

Add a named group for indentation.

```

12051     self.initialize_named_group("indent_info")

```

Apply syntax extensions.

```

12052     for _, extension in ipairs(extensions) do
12053         current_extension_name = extension.name
12054         extension.extend_writer(writer)
12055         extension.extend_reader(self)
12056     end
12057     current_extension_name = nil

```

If the `debugExtensions` option is enabled, serialize `walkable_syntax` to a JSON for debugging purposes.

```

12058     if options.debugExtensions then
12059         local sorted_lhs = {}
12060         for lhs, _ in pairs(walkable_syntax) do
12061             table.insert(sorted_lhs, lhs)

```

```

12062     end
12063     table.sort(sorted_lhs)
12064
12065     local output_lines = {"{"}
12066     for lhs_index, lhs in ipairs(sorted_lhs) do
12067         local encoded_lhs = util.encode_json_string(lhs)
12068         table.insert(output_lines, [[      ]] .. encoded_lhs .. [[(: []]])
12069         local rule = walkable_syntax[lhs]
12070         for rhs_index, rhs in ipairs(rule) do
12071             local human_readable_rhs
12072             if type(rhs) == "string" then
12073                 human_readable_rhs = rhs
12074             else
12075                 local pattern_name
12076                 if rhs[3] then
12077                     pattern_name = rhs[3]
12078                 else
12079                     pattern_name = "Anonymous Pattern"
12080                 end
12081                 local extension_name = rhs[2]
12082                 human_readable_rhs = pattern_name .. [[ (]]
12083                     .. extension_name .. [[]]]
12084             end
12085             local encoded_rhs
12086                 = util.encode_json_string(human_readable_rhs)
12087             local output_line = [[      ]] .. encoded_rhs
12088             if rhs_index < #rule then
12089                 output_line = output_line .. ","
12090             end
12091             table.insert(output_lines, output_line)
12092         end
12093         local output_line = "    ]"
12094         if lhs_index < #sorted_lhs then
12095             output_line = output_line .. ","
12096         end
12097         table.insert(output_lines, output_line)
12098     end
12099     table.insert(output_lines, "}")
12100
12101     local output = table.concat(output_lines, "\n")
12102     local output_filename = options.debugExtensionsFileName
12103     local output_file = assert(io.open(output_filename, "w"),
12104         [[Could not open file ]] .. output_filename
12105         .. [[ for writing]])
12106     assert(output_file:write(output))
12107     assert(output_file:close())
12108 end

```

Materialize `walkable_syntax` and merge it into `syntax` to produce the complete PEG grammar of markdown. Whenever a rule exists in both `walkable_syntax` and `syntax`, the rule from `walkable_syntax` overrides the rule from `syntax`.

```
12109     for lhs, rule in pairs(walkable_syntax) do
12110         syntax[lhs] = parsers.fail
12111         for _, rhs in ipairs(rule) do
12112             local pattern
```

Although the interface of the `reader->insert_pattern` method does not document this (see Section 2.1.2), we allow the `reader->insert_pattern` and `reader->update_rule` methods to insert not just PEG patterns, but also rule names that reference the PEG grammar of Markdown.

```
12113             if type(rhs) == "string" then
12114                 pattern = V(rhs)
12115             else
12116                 pattern = rhs[1]
12117                 if type(pattern) == "string" then
12118                     pattern = V(pattern)
12119                 end
12120             end
12121             syntax[lhs] = syntax[lhs] + pattern
12122         end
12123     end
```

Finalize the parser by reacting to options and by producing special parsers for difficult edge cases such as blocks nested in definition lists or inline content nested in link, note, and image labels.

```
12124     if options.underscores then
12125         self.add_special_character("_")
12126     end
12127
12128     if not options.codeSpans then
12129         syntax.Code = parsers.fail
12130     else
12131         self.add_special_character("`")
12132     end
12133
12134     if not options.html then
12135         syntax.DisplayHtml = parsers.fail
12136         syntax.InlineHtml = parsers.fail
12137         syntax.HtmlEntity = parsers.fail
12138     else
12139         self.add_special_character("&")
12140     end
12141
12142     if options.preserveTabs then
12143         options.stripIndent = false
```

```

12144     end
12145
12146     if not options.smartEllipses then
12147         syntax.Smart = parsers.fail
12148     else
12149         self.add_special_character(".")
12150     end
12151
12152     if not options.relativeReferences then
12153         syntax.AutoLinkRelativeReference = parsers.fail
12154     end
12155
12156     if options.contentLevel == "inline" then
12157         syntax[1] = "Inlines"
12158         syntax.Inlines = V("InitializeState")
12159             * parsers.Inline^0
12160             * ( parsers.spacing^0
12161             * parsers.eof / "" )
12162         syntax.Space = parsers.Space + parsers.blankline / writer.space
12163     end
12164
12165     local blocks_nested_t = util.table_copy(syntax)
12166     blocks_nested_t.ExpectedJekyllData = parsers.succeed
12167     parsers.blocks_nested = Ct(blocks_nested_t)
12168
12169     parsers.blocks = Ct(syntax)
12170
12171     local inlines_t = util.table_copy(syntax)
12172     inlines_t[1] = "Inlines"
12173     inlines_t.Inlines = V("InitializeState")
12174         * parsers.Inline^0
12175         * ( parsers.spacing^0
12176         * parsers.eof / "" )
12177     parsers.inlines = Ct(inlines_t)
12178
12179     local inlines_no_inline_note_t = util.table_copy(inlines_t)
12180     inlines_no_inline_note_t.InlineNote = parsers.fail
12181     parsers.inlines_no_inline_note = Ct(inlines_no_inline_note_t)
12182
12183     local inlines_no_html_t = util.table_copy(inlines_t)
12184     inlines_no_html_t.DisplayHtml = parsers.fail
12185     inlines_no_html_t.InlineHtml = parsers.fail
12186     inlines_no_html_t.HtmlEntity = parsers.fail
12187     parsers.inlines_no_html = Ct(inlines_no_html_t)
12188
12189     local inlines_nbsp_t = util.table_copy(inlines_t)
12190     inlines_nbsp_t.Endline = parsers.NonbreakingEndline

```

```

12191     inlines_nbsp_t.Space = parsers.NonbreakingSpace
12192     parsers.inlines_nbsp = Ct(inlines_nbsp_t)
12193
12194     local inlines_identity_t = util.table_copy(inlines_t)
12195     inlines_identity_t.Str = parsers.any / function(s) return s end
12196     parsers.inlines_identity = Ct(inlines_identity_t)
12197
12198     local inlines_string_t = util.table_copy(inlines_t)
12199     inlines_string_t.Str = parsers.any / writer.string
12200     parsers.inlines_string = Ct(inlines_string_t)
12201
12202     local inlines_math_t = util.table_copy(inlines_t)
12203     inlines_math_t.Str = parsers.any / writer.math
12204     parsers.inlines_math = Ct(inlines_math_t)
12205
12206     local inlines_no_link_or_emphasis_t = util.table_copy(inlines_t)
12207     inlines_no_link_or_emphasis_t.LinkAndEmph = parsers.fail
12208     inlines_no_link_or_emphasis_t.EndlineExceptions
12209         = parsers.EndlineExceptions - parsers.eof
12210     parsers.inlines_no_link_or_emphasis
12211         = Ct(inlines_no_link_or_emphasis_t)

```

Return a function that converts markdown string `input` into a plain TeX output and returns it..

```

12212     return function(input)

```

Normalize the input.

```

12213         if options.unicodeNormalization then
12214             local form = options.unicodeNormalizationForm
12215             input = util.normalize(input, form)
12216         end

```

Since the Lua converter expects UNIX line endings, normalize the input. Also add a line ending at the end of the file in case the input file has none.

```

12217         input = input:gsub("\r\n?", "\n")
12218         if input:sub(-1) ~= "\n" then
12219             input = input .. "\n"
12220         end

```

Clear the table of references.

```

12221         references = {}
12222         local document = self.parser_functions.parse_blocks(input)
12223         local output = util.ropetostring(writer.document(document))

```

Remove block element / paragraph separators immediately followed by the output of `writer->undosep`, possibly interleaved by section ends. Then, remove any leftover output of `writer->undosep`.

```

12224         local undosep_start, undosep_end
12225         local potential_secend_start, secend_start

```

```

12226     local potential_sep_start, sep_start
12227     while true do
12228         -- find a `writer->undosep`
12229         undosep_start, undosep_end
12230         = output:find(writer.undosep_text, 1, true)
12231         if undosep_start == nil then break end
12232         -- skip any preceding section ends
12233         secend_start = undosep_start
12234         while true do
12235             potential_secend_start = secend_start - #writer.secend_text
12236             if potential_secend_start < 1
12237                 or output:sub(potential_secend_start,
12238                     secend_start - 1) ~= writer.secend_text
12239             then
12240                 break
12241             end
12242             secend_start = potential_secend_start
12243         end
12244         -- find an immediately preceding
12245         -- block element / paragraph separator
12246         sep_start = secend_start
12247         potential_sep_start = sep_start - #writer.interblocksep_text
12248         if potential_sep_start >= 1
12249             and output:sub(potential_sep_start,
12250                 sep_start - 1) == writer.interblocksep_text
12251         then
12252             sep_start = potential_sep_start
12253         else
12254             potential_sep_start = sep_start - #writer.paragraphsep_text
12255             if potential_sep_start >= 1
12256                 and output:sub(potential_sep_start,
12257                     sep_start - 1) == writer.paragraphsep_text
12258             then
12259                 sep_start = potential_sep_start
12260             end
12261         end
12262         -- remove `writer->undosep` and immediately preceding
12263         -- block element / paragraph separator
12264         output = output:sub(1, sep_start - 1)
12265             .. output:sub(secend_start, undosep_start - 1)
12266             .. output:sub(undosep_end + 1)
12267     end
12268     return output
12269 end
12270 end
12271 return self
12272 end

```


3.1.7 Built-In Syntax Extensions

Create `extensions` hash table that contains built-in syntax extensions. Syntax extensions are functions that produce objects with two methods: `extend_writer` and `extend_reader`. The `extend_writer` object takes a `writer` object as the only parameter and mutates it. Similarly, `extend_reader` takes a `reader` object as the only parameter and mutates it.

```
12273 M.extensions = {}
```

3.1.7.1 Acronyms

The `extensions.acronyms` function recognizes acronyms, initialisms, and other all-caps sequences in markdown text.

```
12274 M.extensions.acronyms = function(acronyms)
12275   assert(#acronyms > 0)
12276   return {
12277     name = "built-in acronyms syntax extension",
12278     extend_writer = function(self)
```

Define `writer->acronym` as a function that will transform an input acronym, initialism, or another all-caps sequence to the output format.

```
12279     function self.acronym(s)
12280       if self.flatten_inlines then return s end
12281       return {"\\markdownRendererAcronym{" , s, "}"}
12282     end
12283   end, extend_reader = function(self)
12284     local parsers = self.parsers
12285     local options = self.options
12286     local writer = self.writer
```

In order to minimize the size and speed of the parser, we will first construct prefix trees of all registered acronyms, initialisms, and other all-caps sequences.

```
12287     local prefix_tree = {_type = "intermediate"}
12288     for _, acronym in ipairs(acronyms) do
12289       local node = prefix_tree
```

Normalize each acronym, initialism, or another all-caps sequence.

```
12290       if options.unicodeNormalization then
12291         local form = options.unicodeNormalizationForm
12292         acronym = util.normalize(acronym, form)
12293       end
12294       for i = 1, #acronym do
12295         local acronym_byte = acronym:sub(i, i)
12296         if i < #acronym then
12297           if node[acronym_byte] == nil then
12298             node[acronym_byte] = {_type = "intermediate"}
12299           end
12300           node = node[acronym_byte]
```

```

12301         else
12302             table.insert(node, {acronym_byte, _type = "leaf"})
12303         end
12304     end
12305 end

```

Next, we will construct a parser out of the prefix tree.

```

12306     local subparsers = {}
12307     depth_first_search(prefix_tree, "", function(node, path)
12308         if node._type == "leaf" then
12309             local acronym_byte = table.unpack(node)
12310             if subparsers[path] == nil then
12311                 subparsers[path] = parsers.fail
12312             end
12313             subparsers[path] = subparsers[path] + P(acronym_byte)
12314         end
12315     end, function(_, path)
12316         if #path > 0 then
12317             local byte = path:sub(#path, #path)
12318             local parent_path = path:sub(1, #path-1)
12319             local prefix = P(byte)
12320             local suffix = prefix * subparsers[path]
12321             if subparsers[parent_path] == nil then
12322                 subparsers[parent_path] = parsers.fail
12323             end
12324             subparsers[parent_path] = subparsers[parent_path] + suffix
12325         end
12326     end)
12327     assert(subparsers[""] ~= nil)

```

Only match acronyms at word boundaries.

```

12328     local Acronym = ( parsers.unicode.punctuation
12329         - V("SpecialChar")
12330         + parsers.unicode.whitespace
12331         - V("EndlineExceptions"))^0
12332     / writer.string
12333     * (
12334         subparsers[""]
12335         * #(-parsers.normalchar
12336             + parsers.unicode.punctuation
12337             + parsers.unicode.whitespace
12338             + parsers.eof)
12339         / writer.acronym)
12340     self.insert_pattern("Inline before Str", Acronym, "Acronym")
12341 end
12342 }
12343 end
12344 %

```

```

12345 ##### Bracketed Spans
12346 %
12347 % The \luamdef{extensions.bracketed_spans} function implements the Pandoc
12348 % bracketed span syntax extension.
12349 %
12350 % \end{markdown}
12351 % \begin{macrocode}
12352 M.extensions.bracketed_spans = function()
12353   return {
12354     name = "built-in bracketed_spans syntax extension",
12355     extend_writer = function(self)

```

Define `writer->span` as a function that will transform an input bracketed span `s` with attributes `attr` to the output format.

```

12356       function self.span(s, attr)
12357         if self.flatten_inlines then return s end
12358         return {"\\markdownRendererBracketedSpanAttributeContextBegin",
12359               self.attributes(attr),
12360               "\\markdownRendererBracketedSpan{" ,s,"}",
12361               "\\markdownRendererBracketedSpanAttributeContextEnd{}}"
12362       end
12363     end, extend_reader = function(self)
12364       local parsers = self.parsers
12365       local writer = self.writer
12366
12367       local span_label = parsers.lbracket
12368                       * (Cs((parsers.alphanumeric~1
12369                             + parsers.inticks
12370                             + parsers.autolink
12371                             + V("InlineHtml")
12372                             + ( parsers.backslash * parsers.backslash)
12373                             + ( parsers.backslash
12374                               * (parsers.lbracket + parsers.rbracket)
12375                               + V("Space") + V("Endline")
12376                               + (parsers.any
12377                                 - ( parsers.newline
12378                                   + parsers.lbracket
12379                                   + parsers.rbracket
12380                                   + parsers.blankline~2))))~1)
12381                       / self.parser_functions.parse_inlines)
12382                       * parsers.rbracket
12383
12384       local Span = span_label
12385                   * Ct(parsers.attributes)
12386                   / writer.span
12387
12388       self.insert_pattern("Inline before LinkAndEmph",

```

```

12389                                     Span, "Span")
12390     end
12391 }
12392 end

```

3.1.7.2 Citations

The `extensions.citations` function implements the Pandoc citation syntax extension. When the `citation_nbsps` parameter is enabled, the syntax extension will replace regular spaces with non-breaking spaces inside the prenotes and postnotes of citations.

```

12393 M.extensions.citations = function(citation_nbsps)
12394   return {
12395     name = "built-in citations syntax extension",
12396     extend_writer = function(self)

```

Define `writer->citations` as a function that will transform an input array of citations `cites` to the output format. If `text_cites` is enabled, the citations should be rendered in-text, when applicable. The `cites` array contains tables with the following keys and values:

- `suppress_author` – If the value of the key is true, then the author of the work should be omitted in the citation, when applicable.
- `prenote` – The value of the key is either `nil` or a rope that should be inserted before the citation.
- `postnote` – The value of the key is either `nil` or a rope that should be inserted after the citation.
- `name` – The value of this key is the citation name.

```

12397   function self.citations(text_cites, cites)
12398     local buffer = {}
12399     if self.flatten_inlines then
12400       for _,cite in ipairs(cites) do
12401         if cite.prenote then
12402           table.insert(buffer, {cite.prenote, " "})
12403         end
12404         table.insert(buffer, cite.name)
12405         if cite.postnote then
12406           table.insert(buffer, {" ", cite.postnote})
12407         end
12408       end
12409     else
12410       table.insert(buffer,
12411         {"\\markdownRenderer",
12412         text_cites and "TextCite" or "Cite",

```

```

12413             "{", #cites, "}")
12414     for _,cite in ipairs(cites) do
12415         table.insert(buffer,
12416             {cite.suppress_author and "-" or "+", "{",
12417               cite.prenote or "", "}{" ,
12418               cite.postnote or "", "}{" , cite.name, "}")
12419     end
12420 end
12421 return buffer
12422 end
12423 end, extend_reader = function(self)
12424     local parsers = self.parsers
12425     local writer = self.writer
12426
12427     local citation_chars
12428         = parsers.alphanumeric
12429         + S("#$%&-+<>~/_")
12430
12431     local citation_name
12432         = Cs(parsers.dash~1) * parsers.at
12433         * Cs(citation_chars
12434             * ((( citation_chars
12435                   + parsers.internal_punctuation
12436                   - parsers.comma - parsers.semicolon)
12437             * -#(( parsers.internal_punctuation
12438                   - parsers.comma
12439                   - parsers.semicolon)^0
12440             * -( citation_chars
12441                   + parsers.internal_punctuation
12442                   - parsers.comma
12443                   - parsers.semicolon)))^0
12444             * citation_chars)^-1)
12445
12446     local citation_body_prenote
12447         = Cs((parsers.alphanumeric^1
12448             + parsers.bracketed
12449             + parsers.inticks
12450             + parsers.autolink
12451             + V("InlineHtml")
12452             + V("Space") + V("EndlineNoSub")
12453             + (parsers.anyescaped
12454               - ( parsers.newline
12455                   + parsers.rbracket
12456                   + parsers.blankline^2))
12457             - ( parsers.spnl
12458               * parsers.dash~1
12459               * parsers.at))^1)

```

```

12460
12461     local citation_body_postnote
12462         = Cs((parsers.alphanumeric^1
12463             + parsers.bracketed
12464             + parsers.inticks
12465             + parsers.autolink
12466             + V("InlineHtml")
12467             + V("Space") + V("EndlineNoSub")
12468             + (parsers.anyescaped
12469                 - ( parsers.newline
12470                     + parsers.rbracket
12471                     + parsers.semicolon
12472                     + parsers.blankline^2))
12473             - (parsers.spnl * parsers.rbracket))^1)
12474
12475     local citation_body_chunk
12476         = ( citation_body_prenote
12477             * parsers.spnlc_sep
12478             + Cc("")
12479             * parsers.spnlc
12480             )
12481         * citation_name
12482         * ( parsers.internal_punctuation
12483             - parsers.semicolon)^-1
12484         * ( parsers.spnlc / function(_) return end
12485             * citation_body_postnote
12486             + Cc("")
12487             * parsers.spnlc
12488             )
12489
12490     local citation_body
12491         = citation_body_chunk
12492         * ( parsers.semicolon
12493             * parsers.spnlc
12494             * citation_body_chunk
12495             )^0
12496
12497     local citation_headless_body_postnote
12498         = Cs((parsers.alphanumeric^1
12499             + parsers.bracketed
12500             + parsers.inticks
12501             + parsers.autolink
12502             + V("InlineHtml")
12503             + V("Space") + V("Endline")
12504             + (parsers.anyescaped
12505                 - ( parsers.newline
12506                     + parsers.rbracket

```

```

12507             + parsers.at
12508             + parsers.semicolon + parsers.blankline^2))
12509         - (parsers.spnl * parsers.rbracket))^0)
12510
12511     local citation_headless_body
12512         = citation_headless_body_postnote
12513         * ( parsers.semicolon
12514           * parsers.spnlc
12515           * citation_body_chunk
12516         )^0
12517
12518     local citations
12519         = function(text_cites, raw_cites)
12520     local function normalize(str)
12521         if str == "" then
12522             str = nil
12523         else
12524             str = (citation_nbsps and
12525                   self.parser_functions.parse_inlines_nbsp or
12526                   self.parser_functions.parse_inlines)(str)
12527         end
12528         return str
12529     end
12530
12531     local cites = {}
12532     for i = 1,#raw_cites,4 do
12533         cites[#cites+1] = {
12534             prenote = normalize(raw_cites[i]),
12535             suppress_author = raw_cites[i+1] == "-",
12536             name = writer.identifier(raw_cites[i+2]),
12537             postnote = normalize(raw_cites[i+3]),
12538         }
12539     end
12540     return writer.citations(text_cites, cites)
12541 end
12542
12543 local TextCitations
12544     = Ct((parsers.spnlc
12545         * Cc("")
12546         * citation_name
12547         * ((parsers.spnlc
12548           * parsers.lbracket
12549           * citation_headless_body
12550           * parsers.rbracket) + Cc("")))^1)
12551 / function(raw_cites)
12552     return citations(true, raw_cites)
12553 end

```

```

12554
12555     local ParenthesizedCitations
12556         = Ct((parsers.spnlc
12557             * parsers.lbracket
12558             * citation_body
12559             * parsers.rbracket)^1)
12560         / function(raw_cites)
12561             return citations(false, raw_cites)
12562         end
12563
12564     local Citations = TextCitations + ParenthesizedCitations
12565
12566     self.insert_pattern("Inline before LinkAndEmph",
12567         Citations, "Citations")
12568
12569     self.add_special_character("@")
12570     self.add_special_character("-")
12571 end
12572 }
12573 end

```

3.1.7.3 Content Blocks

The `extensions.content_blocks` function implements the iA Writer content blocks syntax extension. The `language_map` parameter specifies the filename of the JSON file that maps filename extensions to programming language names.

```

12574 M.extensions.content_blocks = function(language_map)

```

The `languages_json` table maps programming language filename extensions to fence infostrings. All `language_map` files located by the `kpathsea` library are loaded into a chain of tables. `languages_json` corresponds to the first table and is chained with the rest via Lua metatables.

```

12575     local languages_json = (function()
12576         local base, prev, curr
12577         for _, pathname in ipairs(util.find_files(language_map)) do
12578             local file = io.open(pathname, "r")
12579             if not file then goto continue end
12580             local input = assert(file:read("*a"))
12581             assert(file:close())
12582             local json = input:gsub('"[^\\n]-":', '[%1]=')
12583             curr = load("_ENV = {}; return "..json")()
12584             if type(curr) == "table" then
12585                 if base == nil then
12586                     base = curr
12587                 else
12588                     setmetatable(prev, { __index = curr })
12589                 end

```



```

12590         prev = curr
12591     end
12592     ::continue::
12593 end
12594 return base or {}
12595 end()()
12596
12597 return {
12598     name = "built-in content_blocks syntax extension",
12599     extend_writer = function(self)

```

Define `writer->contentblock` as a function that will transform an input iA Writer content block to the output format, where `src` corresponds to the URI prefix, `suf` to the URI extension, `type` to the type of the content block (`localfile` or `onlineimage`), and `tit` to the title of the content block.

```

12600     function self.contentblock(src,suf,type,tit)
12601         if not self.is_writing then return "" end
12602         src = src.." "..suf
12603         suf = suf:lower()
12604         if type == "onlineimage" then
12605             return {"\\markdownRendererContentBlockOnlineImage{" ,suf,""},
12606                 {"",self.string(src),""},
12607                 {"",self.uri(src),""},
12608                 {"",self.string(tit or ""),"}}"
12609         elseif languages_json[suf] then
12610             return {"\\markdownRendererContentBlockCode{" ,suf,""},
12611                 {"",self.string(languages_json[suf]),""},
12612                 {"",self.string(src),""},
12613                 {"",self.uri(src),""},
12614                 {"",self.string(tit or ""),"}}"
12615         else
12616             return {"\\markdownRendererContentBlock{" ,suf,""},
12617                 {"",self.string(src),""},
12618                 {"",self.uri(src),""},
12619                 {"",self.string(tit or ""),"}}"
12620         end
12621     end
12622 end, extend_reader = function(self)
12623     local parsers = self.parsers
12624     local writer = self.writer
12625
12626     local contentblock_tail
12627         = parsers.optionaltitle
12628         * (parsers.newline + parsers.eof)
12629
12630     -- case insensitive online image suffix:
12631     local onlineimagesuffix

```

```

12632         = (function(...)
12633             local parser = nil
12634             for _, suffix in ipairs({...}) do
12635                 local pattern=nil
12636                 for i=1,#suffix do
12637                     local char=suffix:sub(i,i)
12638                     char = S(char:lower()..char:upper())
12639                     if pattern == nil then
12640                         pattern = char
12641                     else
12642                         pattern = pattern * char
12643                     end
12644                 end
12645                 if parser == nil then
12646                     parser = pattern
12647                 else
12648                     parser = parser + pattern
12649                 end
12650             end
12651             return parser
12652         end)("png", "jpg", "jpeg", "gif", "tif", "tiff")
12653
12654         -- online image url for iA Writer content blocks with
12655         -- mandatory suffix, allowing nested brackets:
12656         local onlineimageurl
12657         = (parsers.less
12658             * Cs((parsers.anyescaped
12659                 - parsers.more
12660                 - parsers.spacing
12661                 - #(parsers.period
12662                     * onlineimagesuffix
12663                     * parsers.more
12664                     * contentblock_tail))^0)
12665             * parsers.period
12666             * Cs(onlineimagesuffix)
12667             * parsers.more
12668             + (Cs((parsers.inparens
12669                 + (parsers.anyescaped
12670                     - parsers.spacing
12671                     - parsers.rparent
12672                     - #(parsers.period
12673                         * onlineimagesuffix
12674                         * contentblock_tail))))^0)
12675             * parsers.period
12676             * Cs(onlineimagesuffix))
12677         ) * Cc("onlineimage")
12678

```

```

12679      -- filename for iA Writer content blocks with mandatory suffix:
12680      local localfilepath
12681          = parsers.slash
12682          * Cs((parsers.anyescaped
12683              - parsers.tab
12684              - parsers.newline
12685              - #(parsers.period
12686                  * parsers.alphanumeric^1
12687                  * contentblock_tail))^1)
12688          * parsers.period
12689          * Cs(parsers.alphanumeric^1)
12690          * Cc("localfile")
12691
12692      local ContentBlock
12693          = parsers.check_trail_no_rem
12694          * (localfilepath + onlineimageurl)
12695          * contentblock_tail
12696          / writer.contentblock
12697
12698      self.insert_pattern("Block before Blockquote",
12699                          ContentBlock, "ContentBlock")
12700  end
12701 }
12702 end

```

3.1.7.4 Definition Lists

The `extensions.definition_lists` function implements the Pandoc definition list syntax extension. If the `tight_lists` parameter is `true`, tight lists will produce special right item renderers.

```

12703 M.extensions.definition_lists = function(tight_lists)
12704   return {
12705     name = "built-in definition_lists syntax extension",
12706     extend_writer = function(self)

```

Define `writer->definitionlist` as a function that will transform an input definition list to the output format, where `items` is an array of tables, each of the form `{ term = t, definitions = defs }`, where `t` is a term and `defs` is an array of definitions. `tight` specifies, whether the list is tight or not.

```

12707     local function dlitem(term, defs)
12708       local retVal = {"\\markdownRendererDlItem{",term,""}
12709       for _, def in ipairs(defs) do
12710         retVal[#retVal+1]
12711           = {"\\markdownRendererDlDefinitionBegin ",def,
12712             "\\markdownRendererDlDefinitionEnd "}
12713       end
12714       retVal[#retVal+1] = "\\markdownRendererDlItemEnd "

```

```

12715         return retVal
12716     end
12717
12718     function self.definitionlist(items,tight)
12719         if not self.is_writing then return "" end
12720         local buffer = {}
12721         for _,item in ipairs(items) do
12722             buffer[#buffer + 1] = dlititem(item.term, item.definitions)
12723         end
12724         if tight and tight_lists then
12725             return {"\\markdownRendererDlBeginTight\n", buffer,
12726                 "\n\\markdownRendererDlEndTight"}
12727         else
12728             return {"\\markdownRendererDlBegin\n", buffer,
12729                 "\n\\markdownRendererDlEnd"}
12730         end
12731     end
12732 end, extend_reader = function(self)
12733     local parsers = self.parsers
12734     local writer = self.writer
12735
12736     local defstartchar = S("~:")
12737
12738     local defstart
12739         = parsers.check_trail_length(0) * defstartchar
12740         * #parsers.spacing
12741         * (parsers.tab + parsers.space^-3)
12742         + parsers.check_trail_length(1)
12743         * defstartchar * #parsers.spacing
12744         * (parsers.tab + parsers.space^-2)
12745         + parsers.check_trail_length(2)
12746         * defstartchar * #parsers.spacing
12747         * (parsers.tab + parsers.space^-1)
12748         + parsers.check_trail_length(3)
12749         * defstartchar * #parsers.spacing
12750
12751     local indented_line
12752         = (parsers.check_minimal_indent / "")
12753         * parsers.check_code_trail * parsers.line
12754
12755     local blank
12756         = parsers.check_minimal_blank_indent_and_any_trail
12757         * parsers.optionalspace * parsers.newline
12758
12759     local dlchunk = Cs(parsers.line * (indented_line - blank)^0)
12760
12761     local indented_blocks = function(bl)

```

```

12762         return Cs( bl
12763             * (blank^1 * (parsers.check_minimal_indent / ""))
12764             * parsers.check_code_trail * -parsers.blankline * bl)^0
12765             * (blank^1 + parsers.eof))
12766     end
12767
12768     local function definition_list_item(term, defs, _)
12769         return { term = self.parser_functions.parse_inlines(term),
12770             definitions = defs }
12771     end
12772
12773     local DefinitionListItemLoose
12774     = C(parsers.line) * blank^0
12775     * Ct((parsers.check_minimal_indent * (defstart
12776         * indented_blocks(dlchunk)
12777         / self.parser_functions.parse_blocks_nested))^1)
12778     * Cc(false) / definition_list_item
12779
12780     local DefinitionListItemTight
12781     = C(parsers.line)
12782     * Ct((parsers.check_minimal_indent * (defstart * dlchunk
12783         / self.parser_functions.parse_blocks_nested))^1)
12784     * Cc(true) / definition_list_item
12785
12786     local DefinitionList
12787     = ( Ct(DefinitionListItemLoose^1) * Cc(false)
12788         + Ct(DefinitionListItemTight^1)
12789         * (blank^0
12790             * -DefinitionListItemLoose * Cc(true))
12791         ) / writer.definitionlist
12792
12793     self.insert_pattern("Block after Heading",
12794         DefinitionList, "DefinitionList")
12795 end
12796 }
12797 end

```

3.1.7.5 Fancy Lists

The `extensions.fancy_lists` function implements the Pandoc fancy list syntax extension.

```

12798 M.extensions.fancy_lists = function()
12799     return {
12800         name = "built-in fancy_lists syntax extension",
12801         extend_writer = function(self)
12802             local options = self.options
12803

```

Define `writer->fancylist` as a function that will transform an input ordered list to the output format, where:

- `items` is an array of the list items,
- `tight` specifies, whether the list is tight or not,
- `startnum` is the number of the first list item,
- `numstyle` is the style of the list item labels from among the following:
 - `Decimal` – decimal arabic numbers,
 - `LowerRoman` – lower roman numbers,
 - `UpperRoman` – upper roman numbers,
 - `LowerAlpha` – lower ASCII alphabetic characters, and
 - `UpperAlpha` – upper ASCII alphabetic characters, and
- `numdelim` is the style of delimiters between list item labels and texts from among the following:
 - `Default` – default style,
 - `OneParen` – parentheses, and
 - `Period` – periods.

```

12804     function self.fancylist(items,tight,startnum,numstyle,numdelim)
12805         if not self.is_writing then return "" end
12806         local buffer = {}
12807         local num = startnum
12808         for _,item in ipairs(items) do
12809             if item ~= "" then
12810                 buffer[#buffer + 1] = self.fancyitem(item,num)
12811             end
12812             if num ~= nil and item ~= "" then
12813                 num = num + 1
12814             end
12815         end
12816         local contents = util.intersperse(buffer,"\n")
12817         if tight and options.tightLists then
12818             return {"\\markdownRendererFancy01BeginTight{",
12819                 numstyle,"}{",numdelim,"}",contents,
12820                 "\\n\\markdownRendererFancy01EndTight "}
12821         else
12822             return {"\\markdownRendererFancy01Begin{",
12823                 numstyle,"}{",numdelim,"}",contents,
12824                 "\\n\\markdownRendererFancy01End "}
12825         end
12826     end

```

Define `writer->fancyitem` as a function that will transform an input fancy ordered list item to the output format, where `s` is the text of the list item. If the optional parameter `num` is present, it is the number of the list item.

```

12827     function self.fancyitem(s,num)
12828         if num ~= nil then
12829             return {"\\markdownRendererFancyOliItemWithNumber{" ,num,"} ",s,
12830                 "\\markdownRendererFancyOliItemEnd "}
12831         else
12832             return {"\\markdownRendererFancyOliItem ",s,
12833                 "\\markdownRendererFancyOliItemEnd "}
12834         end
12835     end
12836 end, extend_reader = function(self)
12837     local parsers = self.parsers
12838     local options = self.options
12839     local writer = self.writer
12840
12841     local function combine_markers_and_delims(markers, delims)
12842         local markers_table = {}
12843         for _,marker in ipairs(markers) do
12844             local start_marker
12845             local continuation_marker
12846             if type(marker) == "table" then
12847                 start_marker = marker[1]
12848                 continuation_marker = marker[2]
12849             else
12850                 start_marker = marker
12851                 continuation_marker = marker
12852             end
12853             for _,delim in ipairs(delims) do
12854                 table.insert(markers_table,
12855                     {start_marker, continuation_marker, delim})
12856             end
12857         end
12858         return markers_table
12859     end
12860
12861     local function join_table_with_func(func, markers_table)
12862         local pattern = func(table.unpack(markers_table[1]))
12863         for i = 2, #markers_table do
12864             pattern = pattern + func(table.unpack(markers_table[i]))
12865         end
12866         return pattern
12867     end
12868
12869     local lowercase_letter_marker = R("az")
12870     local uppercase_letter_marker = R("AZ")
12871
12872     local roman_marker = function(chars)
12873         local m, d, c = P(chars[1]), P(chars[2]), P(chars[3])

```

```

12874     local l, x, v, i
12875     = P(chars[4]), P(chars[5]), P(chars[6]), P(chars[7])
12876     return m^-3
12877         * (c*m + c*d + d^-1 * c^-3)
12878         * (x*c + x*l + l^-1 * x^-3)
12879         * (i*x + i*v + v^-1 * i^-3)
12880     end
12881
12882     local lowercase_roman_marker
12883     = roman_marker({"m", "d", "c", "l", "x", "v", "i"})
12884     local uppercase_roman_marker
12885     = roman_marker({"M", "D", "C", "L", "X", "V", "I"})
12886
12887     local lowercase_opening_roman_marker = P("i")
12888     local uppercase_opening_roman_marker = P("I")
12889
12890     local digit_marker = parsers.dig * parsers.dig^-8
12891
12892     local markers = {
12893         {lowercase_opening_roman_marker, lowercase_roman_marker},
12894         {uppercase_opening_roman_marker, uppercase_roman_marker},
12895         lowercase_letter_marker,
12896         uppercase_letter_marker,
12897         lowercase_roman_marker,
12898         uppercase_roman_marker,
12899         digit_marker
12900     }
12901
12902     local delims = {
12903         parsers.period,
12904         parsers.rparent
12905     }
12906
12907     local markers_table = combine_markers_and_delims(markers, delims)
12908
12909     local function enumerator(start_marker, _,
12910                             delimiter_type, interrupting)
12911         local delimiter_range
12912         local allowed_end
12913         if interrupting then
12914             delimiter_range = P("1")
12915             allowed_end = C(parsers.spacechar^1) * #parsers.linechar
12916         else
12917             delimiter_range = start_marker
12918             allowed_end = C(parsers.spacechar^1)
12919                         + #(parsers.newline + parsers.eof)
12920     end

```



```

12921
12922     return parsers.check_trail
12923         * Ct(C(delimiter_range) * C(delimiter_type))
12924         * allowed_end
12925 end
12926
12927 local starter = join_table_with_func(enumerator, markers_table)
12928
12929 local TightListItem = function(starter)
12930     return parsers.add_indent(starter, "li")
12931         * parsers.indented_content_tight
12932 end
12933
12934 local LooseListItem = function(starter)
12935     return parsers.add_indent(starter, "li")
12936         * parsers.indented_content_loose
12937         * remove_indent("li")
12938 end
12939
12940 local function roman2number(roman)
12941     local romans = { ["M"] = 1000, ["D"] = 500, ["C"] = 100,
12942                     ["L"] = 50, ["X"] = 10, ["V"] = 5, ["I"] = 1 }
12943     local numeral = 0
12944
12945     local i = 1
12946     local len = string.len(roman)
12947     while i < len do
12948         local z1, z2 = romans[ string.sub(roman, i, i) ],
12949                         romans[ string.sub(roman, i+1, i+1) ]
12950         if z1 < z2 then
12951             numeral = numeral + (z2 - z1)
12952             i = i + 2
12953         else
12954             numeral = numeral + z1
12955             i = i + 1
12956         end
12957     end
12958     if i <= len then
12959         numeral = numeral + romans[ string.sub(roman,i,i) ]
12960     end
12961     return numeral
12962 end
12963
12964 local function sniffstyle(numstr, delimend)
12965     local numdelim
12966     if delimend == ")" then
12967         numdelim = "OneParen"

```

```

12968 elseif delimend == "." then
12969     numdelim = "Period"
12970 else
12971     numdelim = "Default"
12972 end
12973
12974 local num
12975 num = numstr:match("^([I])$")
12976 if num then
12977     return roman2number(num), "UpperRoman", numdelim
12978 end
12979 num = numstr:match("^([i])$")
12980 if num then
12981     return roman2number(string.upper(num)), "LowerRoman", numdelim
12982 end
12983 num = numstr:match("^([A-Z])$")
12984 if num then
12985     return string.byte(num) - string.byte("A") + 1,
12986         "UpperAlpha", numdelim
12987 end
12988 num = numstr:match("^([a-z])$")
12989 if num then
12990     return string.byte(num) - string.byte("a") + 1,
12991         "LowerAlpha", numdelim
12992 end
12993 num = numstr:match("^([IVXLCDM]+)")
12994 if num then
12995     return roman2number(num), "UpperRoman", numdelim
12996 end
12997 num = numstr:match("^([ivxlc dm]+)")
12998 if num then
12999     return roman2number(string.upper(num)), "LowerRoman", numdelim
13000 end
13001 return math.floor(tonumber(numstr) or 1), "Decimal", numdelim
13002 end
13003
13004 local function fancylist(items,tight,start)
13005     local startnum, numstyle, numdelim
13006     = sniffstyle(start[2][1], start[2][2])
13007     return writer.fancylist(items,tight,
13008         options.startNumber and startnum or 1,
13009         numstyle or "Decimal",
13010         numdelim or "Default")
13011 end
13012
13013 local FancyListOfType
13014 = function(start_marker, continuation_marker, delimiter_type)

```

```

13015         local enumerator_start
13016             = enumerator(start_marker, continuation_marker,
13017                         delimiter_type)
13018         local enumerator_cont
13019             = enumerator(continuation_marker, continuation_marker,
13020                         delimiter_type)
13021         return Cg(enumerator_start, "listtype")
13022             * (Ct( TightListItem(Cb("listtype"))
13023                 * ((parsers.check_minimal_indent / "")
13024                   * TightListItem(enumerator_cont))^0)
13025             * Cc(true)
13026             * -#((parsers.conditionally_indented_blankline^0 / "")
13027                 * parsers.check_minimal_indent * enumerator_cont)
13028             + Ct( LooseListItem(Cb("listtype"))
13029                 * ((parsers.conditionally_indented_blankline^0 / "")
13030                   * (parsers.check_minimal_indent / "")
13031                   * LooseListItem(enumerator_cont))^0)
13032             * Cc(false)
13033             ) * Ct(Cb("listtype")) / fancylist
13034     end
13035
13036     local FancyList
13037         = join_table_with_func(FancyListOfType, markers_table)
13038
13039     local ListStarter = starter
13040
13041     self.update_rule("OrderedList", FancyList)
13042     self.update_rule("ListStarter", ListStarter)
13043 end
13044 }
13045 end

```

3.1.7.6 Fenced Code

The `extensions.fenced_code` function implements the CommonMark fenced code block syntax extension. When the `blank_before_code_fence` parameter is `true`, the syntax extension requires a blank line between a paragraph and the following fenced code block.

When the `allow_attributes` option is `true`, the syntax extension permits attributes following the infostring. When the `allow_raw_blocks` option is `true`, the syntax extension permits the specification of raw blocks using the Pandoc raw attribute syntax extension.

```

13046 M.extensions.fenced_code = function(blank_before_code_fence,
13047                                     allow_attributes,
13048                                     allow_raw_blocks)
13049     return {

```

```

13050     name = "built-in fenced_code syntax extension",
13051     extend_writer = function(self)
13052         local options = self.options
13053

```

Define `writer->fencedCode` as a function that will transform an input fenced code block `s` with the infostring `i` and optional attributes `attr` to the output format.

```

13054     function self.fencedCode(s, i, attr)
13055         if not self.is_writing then return "" end
13056         s = s:gsub("\n$", "")
13057         local buf = {}
13058         if attr ~= nil then
13059             table.insert(buf,
13060                 {"\\markdownRendererFencedCodeAttributeContextBegin",
13061                     self.attributes(attr)})
13062         end
13063         local name = util.cache_verbatim(options.cacheDir, s)
13064         table.insert(buf,
13065             {"\\markdownRendererInputFencedCode{",
13066                 name,"}{",self.string(i),"}{",self.infostring(i),""}})
13067         if attr ~= nil then
13068             table.insert(buf,
13069                 "\\markdownRendererFencedCodeAttributeContextEnd{")
13070         end
13071         return buf
13072     end
13073

```

Define `writer->rawBlock` as a function that will transform an input raw block `s` with the raw attribute `attr` to the output format.

```

13074     if allow_raw_blocks then
13075         function self.rawBlock(s, attr)
13076             if not self.is_writing then return "" end
13077             s = s:gsub("\n$", "")
13078             local name = util.cache_verbatim(options.cacheDir, s)
13079             return {"\\markdownRendererInputRawBlock{",
13080                 name,"}{", self.string(attr),""}}
13081         end
13082     end
13083     end, extend_reader = function(self)
13084         local parsers = self.parsers
13085         local writer = self.writer
13086
13087         local function captures_geq_length(_,i,a,b)
13088             return #a >= #b and i
13089         end
13090
13091         local function strip_enclosing_whitespaces(str)

```

```

13092         return str:gsub("^%s*(.)%s*$", "%1")
13093     end
13094
13095     local tilde_infostring = Cs(Cs((V("HtmlEntity")
13096         + parsers.anyescaped
13097         - parsers.newline)^0)
13098         / strip_enclosing_whitespaces)
13099
13100     local backtick_infostring
13101     = Cs( Cs((V("HtmlEntity")
13102         + ( -(parsers.backslash * parsers.backtick)
13103             * parsers.anyescaped)
13104             - parsers.newline
13105             - parsers.backtick)^0)
13106         / strip_enclosing_whitespaces)
13107
13108     local fenceindent
13109
13110     local function has_trail(indent_table)
13111         return indent_table ~= nil and
13112             indent_table.trail ~= nil and
13113             next(indent_table.trail) ~= nil
13114     end
13115
13116     local function has_indents(indent_table)
13117         return indent_table ~= nil and
13118             indent_table.indents ~= nil and
13119             next(indent_table.indents) ~= nil
13120     end
13121
13122     local function get_last_indent_name(indent_table)
13123         if has_indents(indent_table) then
13124             return indent_table.indents[#indent_table.indents].name
13125         end
13126     end
13127
13128     local count_fenced_start_indent =
13129     function(_, _, indent_table, trail)
13130         local last_indent_name = get_last_indent_name(indent_table)
13131         fenceindent = 0
13132         if last_indent_name ~= "li" then
13133             fenceindent = #trail
13134         end
13135         return true
13136     end
13137
13138     local fencehead = function(char, infostring)

```

```

13139         return Cmt( Cb("indent_info")
13140                     * parsers.check_trail, count_fenced_start_indent)
13141         * Cg(char^3, "fencelength")
13142         * parsers.optionalspace
13143         * infostring
13144         * (parsers.newline + parsers.eof)
13145     end
13146
13147     local fencetail = function(char)
13148         return parsers.check_trail_no_rem
13149             * Cmt(C(char^3) * Cb("fencelength"), captures_geq_length)
13150             * parsers.optionalspace * (parsers.newline + parsers.eof)
13151             + parsers.eof
13152     end
13153
13154     local process_fenced_line =
13155         function(s, i, -- luacheck: ignore s i
13156                 indent_table, line_content, is_blank)
13157         local remainder = ""
13158         if has_trail(indent_table) then
13159             remainder = indent_table.trail.internal_remainder
13160         end
13161
13162         if is_blank
13163             and get_last_indent_name(indent_table) == "li" then
13164             remainder = ""
13165         end
13166
13167         local str = remainder .. line_content
13168         local index = 1
13169         local remaining = fenceindent
13170
13171         while true do
13172             local c = str:sub(index, index)
13173             if c == " " and remaining > 0 then
13174                 remaining = remaining - 1
13175                 index = index + 1
13176             elseif c == "\t" and remaining > 3 then
13177                 remaining = remaining - 4
13178                 index = index + 1
13179             else
13180                 break
13181             end
13182         end
13183
13184         return true, str:sub(index)
13185     end

```

```

13186
13187     local fencedline = function(char)
13188         return Cmt( Cb("indent_info")
13189             * C(parsers.line - fencetail(char))
13190             * Cc(false), process_fenced_line)
13191     end
13192
13193     local blankfencedline
13194         = Cmt( Cb("indent_info")
13195             * C(parsers.blankline)
13196             * Cc(true), process_fenced_line)
13197
13198     local TildeFencedCode
13199         = fencehead(parsers.tilde, tilde_infostring)
13200         * Cs(( parsers.check_minimal_blank_indent / "" )
13201             * blankfencedline
13202             + ( parsers.check_minimal_indent / "" )
13203             * fencedline(parsers.tilde))^0)
13204         * ( (parsers.check_minimal_indent / "" )
13205             * fencetail(parsers.tilde) + parsers.succeed)
13206
13207     local BacktickFencedCode
13208         = fencehead(parsers.backtick, backtick_infostring)
13209         * Cs(( parsers.check_minimal_blank_indent / "" )
13210             * blankfencedline
13211             + (parsers.check_minimal_indent / "" )
13212             * fencedline(parsers.backtick))^0)
13213         * ( (parsers.check_minimal_indent / "" )
13214             * fencetail(parsers.backtick) + parsers.succeed)
13215
13216     local infostring_with_attributes
13217         = Ct(C((parsers.linechar
13218             - ( parsers.optionalspace
13219                 * parsers.attributes))^0)
13220             * parsers.optionalspace
13221             * Ct(parsers.attributes))
13222
13223     local FencedCode
13224         = ((TildeFencedCode + BacktickFencedCode)
13225         / function(infostring, code)
13226             local expanded_code = self.expandtabs(code)
13227
13228             if allow_raw_blocks then
13229                 local raw_attr = lpeg.match(parsers.raw_attribute,
13230                     infostring)
13231
13232                 if raw_attr then
13233                     return writer.rawBlock(expanded_code, raw_attr)

```

```

13233         end
13234     end
13235
13236     local attr = nil
13237     if allow_attributes then
13238         local match = lpeg.match(fostring_with_attributes,
13239                                 fostring)
13240         if match then
13241             fostring, attr = table.unpack(match)
13242         end
13243     end
13244     return writer.fencedCode(expanded_code, fostring, attr)
13245 end)
13246
13247 self.insert_pattern("Block after Verbatim",
13248                    FencedCode, "FencedCode")
13249
13250 local fencestart
13251 if blank_before_code_fence then
13252     fencestart = parsers.fail
13253 else
13254     fencestart = fencehead(parsers.backtick, backtick_fostring)
13255                 + fencehead(parsers.tilde, tilde_fostring)
13256 end
13257
13258 self.update_rule("EndlineExceptions", function(previous_pattern)
13259     if previous_pattern == nil then
13260         previous_pattern = parsers.EndlineExceptions
13261     end
13262     return previous_pattern + fencestart
13263 end)
13264
13265 self.add_special_character("`")
13266 self.add_special_character("~")
13267 end
13268 }
13269 end

```

3.1.7.7 Fenced Divs

The `extensions.fenced_divs` function implements the Pandoc fenced div syntax extension. When the `blank_before_div_fence` parameter is `true`, the syntax extension requires a blank line between a paragraph and the following fenced code block.

```

13270 M.extensions.fenced_divs = function(blank_before_div_fence)
13271     return {
13272         name = "built-in fenced_divs syntax extension",

```



```
13273     extend_writer = function(self)
```

Define `writer->div_begin` as a function that will transform the beginning of an input fenced div with attributes `attributes` to the output format.

```
13274         function self.div_begin(attributes)
13275             local start_output
13276             = {"\\markdownRendererFencedDivAttributeContextBegin\\n",
13277               self.attributes(attributes)}
13278             local end_output
13279             = {"\\markdownRendererFencedDivAttributeContextEnd{}}"
13280             return self.push_attributes(
13281               "div", attributes, start_output, end_output)
13282         end
```

Define `writer->div_end` as a function that will produce the end of a fenced div in the output format.

```
13283         function self.div_end()
13284             return self.pop_attributes("div")
13285         end
13286     end, extend_reader = function(self)
13287         local parsers = self.parsers
13288         local writer = self.writer
```

Define basic patterns for matching the opening and the closing tag of a div.

```
13289         local fenced_div_infostring
13290             = Ct(parsers.attributes)
13291             + (
13292                 Ct( parsers.attribute_classname
13293                   - parsers.colon)^1
13294                 / function (infostring)
13295                     return {"." .. infostring}
13296                 end
13297             )
13298
13299         local fenced_div_begin = parsers.nonindentSPACE
13300             * parsers.colon^3
13301             * parsers.optionalspace
13302             * fenced_div_infostring
13303             * ( parsers.spacechar^1
13304               * parsers.colon^1)^0
13305             * parsers.optionalspace
13306             * (parsers.newline + parsers.eof)
13307
13308         local fenced_div_end = parsers.nonindentSPACE
13309             * parsers.colon^3
13310             * parsers.optionalspace
13311             * (parsers.newline + parsers.eof)
```

Initialize a named group named `fenced_div_level` for tracking how deep we are nested in divs and the named group `fenced_div_num_opening_indents` for tracking the indent of the starting div fence. The former named group is immutable and should roll back properly when we fail to match a fenced div. The latter is mutable and may contain items from unsuccessful matches on top. However, we always know how many items at the head of the latter we can trust by consulting the former.

```

13312     self.initialize_named_group("fenced_div_level", "0")
13313     self.initialize_named_group("fenced_div_num_opening_indents")
13314
13315     local function increment_div_level()
13316         local push_indent_table =
13317             function(s, i, indent_table, -- luacheck: ignore s i
13318                 fenced_div_num_opening_indents, fenced_div_level)
13319             fenced_div_level = tonumber(fenced_div_level) + 1
13320             local num_opening_indents = 0
13321             if indent_table.indents ~= nil then
13322                 num_opening_indents = #indent_table.indents
13323             end
13324             fenced_div_num_opening_indents[fenced_div_level]
13325                 = num_opening_indents
13326             return true, fenced_div_num_opening_indents
13327         end
13328
13329         local increment_level =
13330             function(s, i, fenced_div_level) -- luacheck: ignore s i
13331             fenced_div_level = tonumber(fenced_div_level) + 1
13332             return true, tostring(fenced_div_level)
13333         end
13334
13335         return Cg( Cmt( Cb("indent_info")
13336             * Cb("fenced_div_num_opening_indents")
13337             * Cb("fenced_div_level"), push_indent_table)
13338             , "fenced_div_num_opening_indents")
13339             * Cg( Cmt( Cb("fenced_div_level"), increment_level)
13340             , "fenced_div_level")
13341         end
13342
13343     local function decrement_div_level()
13344         local pop_indent_table =
13345             function(s, i, -- luacheck: ignore s i
13346                 fenced_div_indent_table, fenced_div_level)
13347             fenced_div_level = tonumber(fenced_div_level)
13348             fenced_div_indent_table[fenced_div_level] = nil
13349             return true, tostring(fenced_div_level - 1)
13350         end
13351

```

```

13352         return Cg( Cmt( Cb("fenced_div_num_opening_indents")
13353             * Cb("fenced_div_level"), pop_indent_table)
13354             , "fenced_div_level")
13355     end
13356
13357
13358     local non_fenced_div_block
13359         = parsers.check_minimal_indent * V("Block")
13360         - parsers.check_minimal_indent_and_trail * fenced_div_end
13361
13362     local non_fenced_div_paragraph
13363         = parsers.check_minimal_indent * V("Paragraph")
13364         - parsers.check_minimal_indent_and_trail * fenced_div_end
13365
13366     local blank = parsers.minimally_indented_blank
13367
13368     local block_separated = parsers.block_sep_group(blank)
13369         * non_fenced_div_block
13370
13371     local loop_body_pair
13372         = parsers.create_loop_body_pair(block_separated,
13373             non_fenced_div_paragraph,
13374             parsers.block_sep_group(blank),
13375             parsers.par_sep_group(blank))
13376
13377     local content_loop = ( non_fenced_div_block
13378         * loop_body_pair.block^0
13379         + non_fenced_div_paragraph
13380         * block_separated
13381         * loop_body_pair.block^0
13382         + non_fenced_div_paragraph
13383         * loop_body_pair.par^0)
13384         * blank^0
13385
13386     local FencedDiv = fenced_div_begin
13387         / writer.div_begin
13388         * increment_div_level()
13389         * parsers.skipblanklines
13390         * Ct(content_loop)
13391         * parsers.minimally_indented_blank^0
13392         * parsers.check_minimal_indent_and_trail
13393         * fenced_div_end
13394         * decrement_div_level()
13395         * (Cc("") / writer.div_end)
13396
13397     self.insert_pattern("Block after Verbatim",
13398         FencedDiv, "FencedDiv")

```

```

13399
13400         self.add_special_character(":")
13401

```

If the `blank_before_div_fence` parameter is `false`, we will have the closing div at the beginning of a line break the current paragraph if we are currently nested in a div and the indentation matches the opening div fence.

```

13402         local function is_inside_div()
13403             local check_div_level =
13404                 function(s, i, fenced_div_level) -- luacheck: ignore s i
13405                     fenced_div_level = tonumber(fenced_div_level)
13406                     return fenced_div_level > 0
13407                 end
13408
13409             return Cmt(Cb("fenced_div_level"), check_div_level)
13410         end
13411
13412         local function check_indent()
13413             local compare_indent =
13414                 function(s, i, indent_table, -- luacheck: ignore s i
13415                     fenced_div_num_opening_indents, fenced_div_level)
13416                     fenced_div_level = tonumber(fenced_div_level)
13417                     local num_current_indents
13418                     = ( indent_table.current_line_indents ~= nil and
13419                         #indent_table.current_line_indents) or 0
13420                     local num_opening_indents
13421                     = fenced_div_num_opening_indents[fenced_div_level]
13422                     return num_current_indents == num_opening_indents
13423                 end
13424
13425             return Cmt( Cb("indent_info")
13426                 * Cb("fenced_div_num_opening_indents")
13427                 * Cb("fenced_div_level"), compare_indent)
13428         end
13429
13430         local fencestart = is_inside_div()
13431             * fenced_div_end
13432             * check_indent()
13433
13434         if not blank_before_div_fence then
13435             self.update_rule("EndlineExceptions", function(previous_pattern)
13436                 if previous_pattern == nil then
13437                     previous_pattern = parsers.EndlineExceptions
13438                 end
13439                 return previous_pattern + fencestart
13440             end)
13441         end

```

```

13442     end
13443   }
13444 end

```

3.1.7.8 Header Attributes

The `extensions.header_attributes` function implements the Pandoc header attribute syntax extension.

```

13445 M.extensions.header_attributes = function()
13446   return {
13447     name = "built-in header_attributes syntax extension",
13448     extend_writer = function()
13449       end, extend_reader = function(self)
13450         local parsers = self.parsers
13451         local writer = self.writer
13452
13453         local function strip_atx_end(s)
13454           return s:gsub("%s+##%s*$", "")
13455         end
13456
13457         local AtxHeading = Cg(parsers.heading_start, "level")
13458           * parsers.optionalspace
13459           * (C(((parsers.linechar
13460             - (parsers.attributes
13461               * parsers.optionalspace
13462               * parsers.newline))
13463             * (parsers.linechar
13464               - parsers.lbrace)^0)^1)
13465           / strip_atx_end
13466           / parsers.parse_heading_text)
13467         * Cg(Ct(parsers.newline
13468           + (parsers.attributes
13469             * parsers.optionalspace
13470             * parsers.newline)), "attributes")
13471         * Cb("level")
13472         * Cb("attributes")
13473         / writer.heading
13474
13475         local function strip_trailing_spaces(s)
13476           return s:gsub("%s*$", "")
13477         end
13478
13479         local heading_line = (parsers.linechar
13480           - (parsers.attributes
13481             * parsers.optionalspace
13482             * parsers.newline))^1
13483           - parsers.thematic_break_lines

```

```

13484
13485     local heading_text
13486     = heading_line
13487     * ( (V("Endline") / "\n")
13488     * (heading_line - parsers.heading_level))^0
13489     * parsers.newline^-1
13490
13491     local SettextHeading
13492     = parsers.freeze_trail * parsers.check_trail_no_rem
13493     * #(heading_text
13494     * (parsers.attributes
13495     * parsers.optionalspace
13496     * parsers.newline)^-1
13497     * parsers.check_minimal_indent
13498     * parsers.check_trail
13499     * parsers.heading_level)
13500     * Cs(heading_text) / strip_trailing_spaces
13501     / parsers.parse_heading_text
13502     * Cg(Ct((parsers.attributes
13503     * parsers.optionalspace
13504     * parsers.newline)^-1), "attributes")
13505     * parsers.check_minimal_indent_and_trail * parsers.heading_level
13506     * Cb("attributes")
13507     * parsers.newline
13508     * parsers.unfreeze_trail
13509     / writer.heading
13510
13511     local Heading = AtxHeading + SettextHeading
13512     self.update_rule("Heading", Heading)
13513 end
13514 }
13515 end

```

3.1.7.9 Inline Code Attributes

The `extensions.inline_code_attributes` function implements the Pandoc in-line code attribute syntax extension.

```

13516 M.extensions.inline_code_attributes = function()
13517   return {
13518     name = "built-in inline_code_attributes syntax extension",
13519     extend_writer = function()
13520       end, extend_reader = function(self)
13521         local writer = self.writer
13522
13523         local CodeWithAttributes = parsers.inticks
13524           * Ct(parsers.attributes)
13525           / writer.code

```

```

13526
13527     self.insert_pattern("Inline before Code",
13528                           CodeWithAttributes,
13529                           "CodeWithAttributes")
13530   end
13531 }
13532 end

```

3.1.7.10 Line Blocks

The `extensions.line_blocks` function implements the Pandoc line block syntax extension.

```

13533 M.extensions.line_blocks = function()
13534   return {
13535     name = "built-in line_blocks syntax extension",
13536     extend_writer = function(self)

```

Define `writer->lineblock` as a function that will transform a line block consisted of `lines` to the output format, with all but the last newline rendered as a line break.

```

13537     function self.lineblock(lines)
13538       if not self.is_writing then return "" end
13539       local buffer = {}
13540       for i = 1, #lines - 1 do
13541         buffer[#buffer + 1] = { lines[i], self.hard_line_break }
13542       end
13543       buffer[#buffer + 1] = lines[#lines]
13544
13545       return {"\\markdownRendererLineBlockBegin\\n"
13546             ,buffer,
13547             "\\n\\markdownRendererLineBlockEnd "}
13548     end
13549   end, extend_reader = function(self)
13550     local parsers = self.parsers
13551     local writer = self.writer
13552
13553     local LineBlock
13554     = Ct((Cs(( (parsers.pipe * parsers.space) / ""
13555               * ((parsers.space)/entities.char_entity("nbsp"))^0
13556               * parsers.linechar^0 * (parsers.newline/""))
13557         * (-parsers.pipe
13558           * (parsers.space^1/" ")
13559           * parsers.linechar^1
13560           * (parsers.newline/"")
13561           )^0)
13562       / self.parser_functions.parse_inlines)^1)
13563     / writer.lineblock
13564
13565     self.insert_pattern("Block after Blockquote",

```

```

13566                                     LineBlock, "LineBlock")
13567     end
13568 }
13569 end

```

3.1.7.11 Marked text

The `extensions.mark` function implements the Pandoc mark syntax extension.

```

13570 M.extensions.mark = function()
13571   return {
13572     name = "built-in mark syntax extension",
13573     extend_writer = function(self)

```

Define `writer->mark` as a function that will transform an input marked text `s` to the output format.

```

13574       function self.mark(s)
13575         if self.flatten_inlines then return s end
13576         return {"\\markdownRenderMark{", s, "}"}
13577       end
13578     end, extend_reader = function(self)
13579       local parsers = self.parsers
13580       local writer = self.writer
13581
13582       local doubleequals = P("==")
13583
13584       local Mark
13585         = parsers.between(V("Inline"), doubleequals, doubleequals)
13586         / function (inlines) return writer.mark(inlines) end
13587
13588       self.add_special_character("=")
13589       self.insert_pattern("Inline before LinkAndEmph",
13590                           Mark, "Mark")
13591     end
13592   }
13593 end

```

3.1.7.12 Link Attributes

The `extensions.link_attributes` function implements the Pandoc link attribute syntax extension.

```

13594 M.extensions.link_attributes = function()
13595   return {
13596     name = "built-in link_attributes syntax extension",
13597     extend_writer = function()
13598     end, extend_reader = function(self)
13599       local parsers = self.parsers
13600       local options = self.options
13601

```


The following patterns define link reference definitions with attributes.

```
13602     local define_reference_parser
13603         = (parsers.check_trail / "")
13604         * parsers.link_label
13605         * parsers.colon
13606         * parsers.spnlc * parsers.url
13607         * ( parsers.spnlc_sep * parsers.title
13608           * (parsers.spnlc * Ct(parsers.attributes))
13609           * parsers.only_blank
13610           + parsers.spnlc_sep * parsers.title * parsers.only_blank
13611           + Cc("") * (parsers.spnlc * Ct(parsers.attributes))
13612           * parsers.only_blank
13613           + Cc("") * parsers.only_blank)
13614
13615     local ReferenceWithAttributes = define_reference_parser
13616                                   / self.register_link
13617
13618     self.update_rule("Reference", ReferenceWithAttributes)
13619
```

The following patterns define direct and indirect links with attributes.

```
13620
13621     local LinkWithAttributesAndEmph
13622         = Ct(parsers.link_and_emph_table * Cg(Cc(true),
13623           "match_link_attributes"))
13624         / self.defer_link_and_emphasis_processing
13625
13626     self.update_rule("LinkAndEmph", LinkWithAttributesAndEmph)
13627
```

The following patterns define autolinks with attributes.

```
13628     local AutoLinkUrlWithAttributes
13629         = parsers.auto_link_url
13630         * Ct(parsers.attributes)
13631         / self.auto_link_url
13632
13633     self.insert_pattern("Inline before AutoLinkUrl",
13634                         AutoLinkUrlWithAttributes,
13635                         "AutoLinkUrlWithAttributes")
13636
13637     local AutoLinkEmailWithAttributes
13638         = parsers.auto_link_email
13639         * Ct(parsers.attributes)
13640         / self.auto_link_email
13641
13642     self.insert_pattern("Inline before AutoLinkEmail",
13643                         AutoLinkEmailWithAttributes,
13644                         "AutoLinkEmailWithAttributes")
```

```

13645
13646     if options.relativeReferences then
13647
13648         local AutoLinkRelativeReferenceWithAttributes
13649             = parsers.auto_link_relative_reference
13650             * Ct(parsers.attributes)
13651             / self.auto_link_url
13652
13653         self.insert_pattern(
13654             "Inline before AutoLinkRelativeReference",
13655             AutoLinkRelativeReferenceWithAttributes,
13656             "AutoLinkRelativeReferenceWithAttributes")
13657
13658     end
13659
13660 end
13661 }
13662 end

```

3.1.7.13 Notes

The `extensions.notes` function implements the Pandoc note and inline note syntax extensions. When the `note` parameter is `true`, the Pandoc note syntax extension will be enabled. When the `inline_notes` parameter is `true`, the Pandoc inline note syntax extension will be enabled.

```

13663 M.extensions.notes = function(notes, inline_notes)
13664     assert(notes or inline_notes)
13665     return {
13666         name = "built-in notes syntax extension",
13667         extend_writer = function(self)

```

Define `writer->note` as a function that will transform an input note `s` to the output format.

```

13668         function self.note(s)
13669             if self.flatten_inlines then return "" end
13670             return {"\\markdownRendererNote{",s,""}
13671         end
13672     end, extend_reader = function(self)
13673         local parsers = self.parsers
13674         local writer = self.writer
13675
13676         local rawnotes = parsers.rawnotes
13677
13678         if inline_notes then
13679             local InlineNote
13680                 = parsers.circumflex
13681                 * ( parsers.link_label

```

```

13682         / self.parser_functions.parse_inlines_no_inline_note)
13683     / writer.note
13684
13685     self.insert_pattern("Inline after LinkAndEmph",
13686                        InlineNote, "InlineNote")
13687 end
13688 if notes then
13689     local function strip_first_char(s)
13690         return s:sub(2)
13691     end
13692
13693     local RawNoteRef
13694         = #(parsers.lbracket * parsers.circumflex)
13695         * parsers.link_label / strip_first_char
13696
13697     -- like indirect_link
13698     local function lookup_note(ref)
13699         return writer.defer_call(function()
13700             local found = rawnotes[self.normalize_tag(ref)]
13701             if found then
13702                 return writer.note(
13703                     self.parser_functions.parse_blocks_nested(found))
13704             else
13705                 local text = string.format(
13706                     'Undefined note reference "%s"', ref)
13707                 local more = string.format(
13708                     "Look for the text `[~%s]`.", ref)
13709                 return {writer.warning(text, more), "[" ,
13710                     self.parser_functions.parse_inlines("^" .. ref), "]" }
13711             end
13712         end)
13713     end
13714
13715     local function register_note(ref, rawnote)
13716         local normalized_tag = self.normalize_tag(ref)
13717         if rawnotes[normalized_tag] == nil then
13718             rawnotes[normalized_tag] = rawnote
13719             return ""
13720         else
13721             local text
13722                 = string.format('Multiply defined note reference "%s"',
13723                                ref)
13724             local more
13725                 = string.format("Look for the text `[~%s]: ...`.", ref)
13726             return writer.warning(text, more)
13727         end
13728     end

```

```

13729
13730     local NoteRef = RawNoteRef / lookup_note
13731
13732     local optionally_indented_line
13733         = parsers.check_optional_indent_and_any_trail * parsers.line
13734
13735     local blank
13736         = parsers.check_optional_blank_indent_and_any_trail
13737         * parsers.optionalspace * parsers.newline
13738
13739     local chunk
13740         = Cs(parsers.line
13741             * (optionally_indented_line - blank)^0)
13742
13743     local indented_blocks = function(bl)
13744         return Cs( bl
13745             * ( blank^1 * (parsers.check_optional_indent / "")
13746                 * parsers.check_code_trail
13747                 * -parsers.blankline * bl)^0)
13748     end
13749
13750     local NoteBlock
13751         = parsers.check_trail_no_rem
13752         * RawNoteRef * parsers.colon
13753         * parsers.spnlc * indented_blocks(chunk)
13754         / register_note
13755
13756     self.update_rule("Reference", function(previous_pattern)
13757         if previous_pattern == nil then
13758             previous_pattern = parsers.Reference
13759         end
13760         return NoteBlock + previous_pattern
13761     end)
13762
13763     self.insert_pattern("Inline before LinkAndEmph",
13764                         NoteRef, "NoteRef")
13765 end
13766
13767 self.add_special_character("^")
13768 end
13769 }
13770 end

```

3.1.7.14 Pipe Tables

The `extensions.pipe_table` function implements the PHP Markdown table syntax extension (also known as pipe tables in Pandoc). When the `table_captions`

parameter is `true`, the function also implements the Pandoc table caption syntax extension for table captions. When the `table_attributes` parameter is also `true`, the function also allows attributes to be attached to the (possibly empty) table captions.

```

13771 M.extensions.pipe_tables = function(table_captions, table_attributes)
13772
13773   local function make_pipe_table_rectangular(rows)
13774     local num_columns = #rows[2]
13775     local rectangular_rows = {}
13776     for i = 1, #rows do
13777       local row = rows[i]
13778       local rectangular_row = {}
13779       for j = 1, num_columns do
13780         rectangular_row[j] = row[j] or ""
13781       end
13782       table.insert(rectangular_rows, rectangular_row)
13783     end
13784     return rectangular_rows
13785   end
13786
13787   local function pipe_table_row(allow_empty_first_column
13788                                 , nonempty_column
13789                                 , column_separator
13790                                 , column)
13791     local row_beginning
13792     if allow_empty_first_column then
13793       row_beginning = -- empty first column
13794                       #(parsers.spacechar^4
13795                        * column_separator)
13796                       * parsers.optionalspace
13797                       * column
13798                       * parsers.optionalspace
13799                       -- non-empty first column
13800                       + parsers.nonindentSPACE
13801                       * nonempty_column^-1
13802                       * parsers.optionalspace
13803     else
13804       row_beginning = parsers.nonindentSPACE
13805                       * nonempty_column^-1
13806                       * parsers.optionalspace
13807     end
13808
13809     return Ct(row_beginning
13810              * (-- single column with no leading pipes
13811                #(column_separator
13812                  * parsers.optionalspace

```

```

13813         * parsers.newline)
13814     * column_separator
13815     * parsers.optionalspace
13816     -- single column with leading pipes or
13817     -- more than a single column
13818     + (column_separator
13819         * parsers.optionalspace
13820         * column
13821         * parsers.optionalspace)^1
13822     * (column_separator
13823         * parsers.optionalspace)^-1))
13824 end
13825
13826 return {
13827     name = "built-in pipe_tables syntax extension",
13828     extend_writer = function(self)

```

Define `writer->table` as a function that will transform an input table to the output format, where `rows` is a sequence of columns and a column is a sequence of cell texts.

```

13829     function self.table(rows, caption, attributes)
13830         if not self.is_writing then return "" end
13831         local buffer = {}
13832         if attributes ~= nil then
13833             table.insert(buffer,
13834                 "\\markdownRendererTableAttributeContextBegin\n")
13835             table.insert(buffer, self.attributes(attributes))
13836         end
13837         table.insert(buffer,
13838             {"\\markdownRendererTable{",
13839                 caption or "", "}{" , #rows - 1, "}{" ,
13840                 #rows[1], "}"})
13841         local temp = rows[2] -- put alignments on the first row
13842         rows[2] = rows[1]
13843         rows[1] = temp
13844         for i, row in ipairs(rows) do
13845             table.insert(buffer, "{")
13846             for _, column in ipairs(row) do
13847                 if i > 1 then -- do not use braces for alignments
13848                     table.insert(buffer, "{")
13849                 end
13850                 table.insert(buffer, column)
13851                 if i > 1 then
13852                     table.insert(buffer, "}")
13853                 end
13854             end
13855             table.insert(buffer, "}")
13856         end

```

```

13857         if attributes ~= nil then
13858             table.insert(buffer,
13859                 "\\markdownRendererTableAttributeContextEnd{}")
13860         end
13861         return buffer
13862     end
13863 end, extend_reader = function(self)
13864     local parsers = self.parsers
13865     local writer = self.writer
13866
13867     local table_hline_separator = parsers.pipe + parsers.plus
13868
13869     local table_hline_column = (parsers.dash
13870         - #(parsers.dash
13871             * (parsers.spacechar
13872                 + table_hline_separator
13873                 + parsers.newline)))^1
13874         * (parsers.colon * Cc("r")
13875             + parsers.dash * Cc("d"))
13876         + parsers.colon
13877         * (parsers.dash
13878             - #(parsers.dash
13879                 * (parsers.spacechar
13880                     + table_hline_separator
13881                     + parsers.newline)))^1
13882         * (parsers.colon * Cc("c")
13883             + parsers.dash * Cc("l"))
13884
13885     local table_hline = pipe_table_row(false
13886         , table_hline_column
13887         , table_hline_separator
13888         , table_hline_column)
13889
13890     local table_caption_beginning
13891     = ( parsers.check_minimal_blank_indent_and_any_trail_no_rem
13892         * parsers.optionalspace * parsers.newline)^0
13893         * parsers.check_minimal_indent_and_trail
13894         * (P("Table")^-1 * parsers.colon)
13895         * parsers.optionalspace
13896
13897     local function strip_trailing_spaces(s)
13898         return s:gsub("%s*$", "")
13899     end
13900
13901     local table_row
13902     = pipe_table_row(true
13903         , (C((parsers.linechar - parsers.pipe)^1)

```

```

13904         / strip_trailing_spaces
13905         / self.parser_functions.parse_inlines)
13906     , parsers.pipe
13907     , (C((parsers.linechar - parsers.pipe)^0)
13908       / strip_trailing_spaces
13909       / self.parser_functions.parse_inlines))
13910
13911     local table_caption
13912     if table_captions then
13913         table_caption = #table_caption_beginning
13914             * table_caption_beginning
13915         if table_attributes then
13916             table_caption = table_caption
13917                 * (C((( parsers.linechar
13918                     - (parsers.attributes
13919                       * parsers.optionalspace
13920                       * parsers.newline
13921                       * -( parsers.optionalspace
13922                         * parsers.linechar)))
13923                   + ( parsers.newline
13924                     * #( parsers.optionalspace
13925                       * parsers.linechar)
13926                     * C(parsers.optionalspace)
13927                       / writer.space))
13928                   * (parsers.linechar
13929                     - parsers.lbrace)^0)^1)
13930             / strip_trailing_spaces
13931             / self.parser_functions.parse_inlines)
13932             * (parsers.newline
13933               + ( Ct(parsers.attributes)
13934                 * parsers.optionalspace
13935                 * parsers.newline))
13936         else
13937             table_caption = table_caption
13938                 * C(( parsers.linechar
13939                   + ( parsers.newline
13940                     * #( parsers.optionalspace
13941                       * parsers.linechar)
13942                     * C(parsers.optionalspace)
13943                       / writer.space))^1)
13944             / self.parser_functions.parse_inlines
13945             * parsers.newline
13946         end
13947     else
13948         table_caption = parsers.fail
13949     end
13950

```



```

13951     local PipeTable
13952     = Ct( table_row * parsers.newline
13953         * (parsers.check_minimal_indent_and_trail / {})
13954         * table_hline * parsers.newline
13955         * ( (parsers.check_minimal_indent / {})
13956           * table_row * parsers.newline)^0)
13957     / make_pipe_table_rectangular
13958     * table_caption^-1
13959     / writer.table
13960
13961     self.insert_pattern("Block after Blockquote",
13962                       PipeTable, "PipeTable")
13963   end
13964 }
13965 end

```

3.1.7.15 Raw Attributes

The `extensions.raw_inline` function implements the Pandoc raw attribute syntax extension for inline code spans.

```

13966 M.extensions.raw_inline = function()
13967   return {
13968     name = "built-in raw_inline syntax extension",
13969     extend_writer = function(self)
13970       local options = self.options
13971

```

Define `writer->rawInline` as a function that will transform an input inline raw span `s` with the raw attribute `attr` to the output format.

```

13972     function self.rawInline(s, attr)
13973       if not self.is_writing then return "" end
13974       if self.flatten_inlines then return s end
13975       local name = util.cache_verbatim(options.cacheDir, s)
13976       return {"\\markdownRendererInputRawInline{",
13977             name,"}{" , self.string(attr),"}" }
13978     end
13979   end, extend_reader = function(self)
13980     local writer = self.writer
13981
13982     local RawInline = parsers.inticks
13983                       * parsers.raw_attribute
13984                       / writer.rawInline
13985
13986     self.insert_pattern("Inline before Code",
13987                       RawInline, "RawInline")
13988   end
13989 }
13990 end

```

3.1.7.16 Strike-Through

The `extensions.strike_through` function implements the Pandoc strike-through syntax extension.

```
13991 M.extensions.strike_through = function()
13992   return {
13993     name = "built-in strike_through syntax extension",
13994     extend_writer = function(self)
```

Define `writer->strike_through` as a function that will transform a strike-through span `s` of input text to the output format.

```
13995       function self.strike_through(s)
13996         if self.flatten_inlines then return s end
13997         return {"\\markdownRendererStrikeThrough{" ,s,"}"}
13998       end
13999     end, extend_reader = function(self)
14000       local parsers = self.parsers
14001       local writer = self.writer
14002
14003       local StrikeThrough = (
14004         parsers.between(parsers.Inline, parsers.doubletildes,
14005           parsers.doubletildes)
14006       ) / writer.strike_through
14007
14008       self.insert_pattern("Inline after LinkAndEmph",
14009         StrikeThrough, "StrikeThrough")
14010
14011       self.add_special_character("~")
14012     end
14013   }
14014 end
```

3.1.7.17 Subscripts

The `extensions.subscripts` function implements the Pandoc subscript syntax extension.

```
14015 M.extensions.subscripts = function()
14016   return {
14017     name = "built-in subscripts syntax extension",
14018     extend_writer = function(self)
```

Define `writer->subscript` as a function that will transform a subscript span `s` of input text to the output format.

```
14019       function self.subscript(s, parsed)
14020         if self.flatten_inlines then return s end
14021         return {"\\markdownRendererSubscript{" ,parsed,"}"}
14022       end
14023     end, extend_reader = function(self)
```

```

14024     local parsers = self.parsers
14025     local writer = self.writer
14026
14027     local Subscript = (
14028         parsers.between(parsers.Str, parsers.tilde, parsers.tilde)
14029     ) / function(s)
14030         return writer.subscript(
14031             s, self.parser_functions.parse_inlines_identity(s[1])
14032         )
14033     end
14034
14035     self.insert_pattern("Inline after LinkAndEmph",
14036                         Subscript, "Subscript")
14037
14038     self.add_special_character("~")
14039 end
14040 }
14041 end

```

3.1.7.18 Superscripts

The `extensions.superscripts` function implements the Pandoc superscript syntax extension.

```

14042 M.extensions.superscripts = function()
14043     return {
14044         name = "built-in superscripts syntax extension",
14045         extend_writer = function(self)

```

Define `writer->superscript` as a function that will transform a superscript span `s` of input text to the output format.

```

14046         function self.superscript(s, parsed)
14047             if self.flatten_inlines then return s end
14048             return {"\\markdownRendererSuperscript{" ,parsed,""} }
14049         end
14050     end, extend_reader = function(self)
14051         local parsers = self.parsers
14052         local writer = self.writer
14053
14054         local Superscript = (
14055             parsers.between(parsers.Str, parsers.circumflex,
14056                             parsers.circumflex)
14057         ) / function(s)
14058             return writer.superscript(
14059                 s, self.parser_functions.parse_inlines_identity(s[1])
14060             )
14061         end
14062
14063         self.insert_pattern("Inline after LinkAndEmph",

```

```

14064             Superscript, "Superscript")
14065
14066         self.add_special_character("^")
14067     end
14068 }
14069 end

```

3.1.7.19 T_EX Math

The `extensions.tex_math` function implements the Pandoc math syntax extensions.

```

14070 M.extensions.tex_math = function(tex_math_dollars,
14071                                   tex_math_single_backslash,
14072                                   tex_math_double_backslash)
14073     return {
14074         name = "built-in tex_math syntax extension",
14075         extend_writer = function(self)

```

Define `writer->display_math` as a function that will transform a math span `s` of input text to the output format.

```

14076         function self.display_math(s, parsed)
14077             if self.flatten_inlines then return s end
14078             return {"\\markdownRendererDisplayMath{",parsed,""}
14079         end

```

Define `writer->inline_math` as a function that will transform a math span `s` of input text to the output format.

```

14080         function self.inline_math(s, parsed)
14081             if self.flatten_inlines then return s end
14082             return {"\\markdownRendererInlineMath{",parsed,""}
14083         end
14084     end, extend_reader = function(self)
14085         local parsers = self.parsers
14086         local writer = self.writer
14087
14088         local function between(p, starter, ender)
14089             return (starter * Cs(p * (p - ender)^0) * ender)
14090         end
14091
14092         local function strip_preceding_whitespaces(str)
14093             return str:gsub("^%s*(.-)$", "%1")
14094         end
14095
14096         local allowed_before_closing
14097             = B( parsers.backslash * parsers.any
14098               + parsers.any * (parsers.any - parsers.backslash))
14099
14100         local allowed_before_closing_no_space

```

```

14101         = B( parsers.backslash * parsers.any
14102           + parsers.any * (parsers.nonspacechar - parsers.backslash))
14103

```

The following patterns implement the Pandoc dollar math syntax extension.

```

14104     local dollar_math_content
14105       = (parsers.newline * (parsers.check_optional_indent / "")
14106         + parsers.backslash~1
14107         * parsers.linechar)
14108       - parsers.blankline~2
14109       - parsers.dollar
14110
14111     local inline_math_opening_dollars = parsers.dollar
14112                                       * #(parsers.nonspacechar)
14113
14114     local inline_math_closing_dollars
14115       = allowed_before_closing_no_space
14116       * parsers.dollar
14117       * -#(parsers.digit)
14118
14119     local inline_math_dollars = between(Cs( dollar_math_content),
14120                                         inline_math_opening_dollars,
14121                                         inline_math_closing_dollars)
14122
14123     local display_math_opening_dollars = parsers.dollar
14124                                       * parsers.dollar
14125
14126     local display_math_closing_dollars = parsers.dollar
14127                                       * parsers.dollar
14128
14129     local display_math_dollars = between(Cs( dollar_math_content),
14130                                         display_math_opening_dollars,
14131                                         display_math_closing_dollars)

```

The following patterns implement the Pandoc single and double backslash math syntax extensions.

```

14132     local backslash_math_content
14133       = (parsers.newline * (parsers.check_optional_indent / "")
14134         + parsers.linechar)
14135       - parsers.blankline~2

```

The following patterns implement the Pandoc double backslash math syntax extension.

```

14136     local inline_math_opening_double = parsers.backslash
14137                                       * parsers.backslash
14138                                       * parsers.lparent
14139
14140     local inline_math_closing_double = allowed_before_closing

```

```

14141             * parsers.spacechar~0
14142             * parsers.backslash
14143             * parsers.backslash
14144             * parsers.rparent
14145
14146     local inline_math_double = between(Cs( backslash_math_content),
14147                                       inline_math_opening_double,
14148                                       inline_math_closing_double)
14149                               / strip_preceding_whitespaces
14150
14151     local display_math_opening_double = parsers.backslash
14152                                       * parsers.backslash
14153                                       * parsers.lbracket
14154
14155     local display_math_closing_double = allowed_before_closing
14156                                       * parsers.spacechar~0
14157                                       * parsers.backslash
14158                                       * parsers.backslash
14159                                       * parsers.rbracket
14160
14161     local display_math_double = between(Cs( backslash_math_content),
14162                                       display_math_opening_double,
14163                                       display_math_closing_double)
14164                               / strip_preceding_whitespaces

```

The following patterns implement the Pandoc single backslash math syntax extension.

```

14165     local inline_math_opening_single = parsers.backslash
14166                                       * parsers.lparent
14167
14168     local inline_math_closing_single = allowed_before_closing
14169                                       * parsers.spacechar~0
14170                                       * parsers.backslash
14171                                       * parsers.rparent
14172
14173     local inline_math_single = between(Cs( backslash_math_content),
14174                                       inline_math_opening_single,
14175                                       inline_math_closing_single)
14176                               / strip_preceding_whitespaces
14177
14178     local display_math_opening_single = parsers.backslash
14179                                       * parsers.lbracket
14180
14181     local display_math_closing_single = allowed_before_closing
14182                                       * parsers.spacechar~0
14183                                       * parsers.backslash
14184                                       * parsers.rbracket
14185
14186     local display_math_single = between(Cs( backslash_math_content),

```

```

14187             display_math_opening_single,
14188             display_math_closing_single)
14189         / strip_preceding_whitespace
14190
14191     local display_math = parsers.fail
14192
14193     local inline_math = parsers.fail
14194
14195     if tex_math_dollars then
14196         display_math = display_math + display_math_dollars
14197         inline_math = inline_math + inline_math_dollars
14198     end
14199
14200     if tex_math_double_backslash then
14201         display_math = display_math + display_math_double
14202         inline_math = inline_math + inline_math_double
14203     end
14204
14205     if tex_math_single_backslash then
14206         display_math = display_math + display_math_single
14207         inline_math = inline_math + inline_math_single
14208     end
14209
14210     local TexMath = display_math
14211         / function(s)
14212         return writer.display_math(
14213             s, self.parser_functions.parse_inlines_math(s)
14214         )
14215         end
14216     + inline_math
14217     / function(s)
14218     return writer.inline_math(
14219         s, self.parser_functions.parse_inlines_math(s)
14220     )
14221     end
14222
14223     self.insert_pattern("Inline after LinkAndEmph",
14224         TexMath, "TexMath")
14225
14226     if tex_math_dollars then
14227         self.add_special_character("$")
14228     end
14229
14230     if tex_math_single_backslash or tex_math_double_backslash then
14231         self.add_special_character("\\")
14232         self.add_special_character("[")
14233         self.add_special_character("]")

```

```

14234         self.add_special_character("")
14235         self.add_special_character("")
14236     end
14237 end
14238 }
14239 end

```

3.1.7.20 yaml Metadata

The `extensions.jekyll_data` function implements the Pandoc YAML metadata block syntax extension. When the `expect_jekyll_data` parameter is `true`, then a markdown document may begin directly with YAML metadata and may contain nothing but YAML metadata. When both `expect_jekyll_data` and `ensure_jekyll_data` parameters are `true`, then a a markdown document must begin directly with YAML metadata and must contain nothing but YAML metadata.

```

14240 M.extensions.jekyll_data = function(expect_jekyll_data,
14241                                     ensure_jekyll_data)
14242   return {
14243     name = "built-in jekyll_data syntax extension",
14244     extend_writer = function(self)

```

Define `writer->jekyllData` as a function that will transform an input YAML table `d` to the output format. The table is the value for the key `p` in the parent table; if `p` is nil, then the table has no parent. All scalar keys and values encountered in the table will be cast to a string following YAML serialization rules. String values will also be transformed using the function `t` for the typographic output format used by the `\markdownRendererJekyllDataTypographicString` macro.

```

14245     function self.jekyllData(d, t, p)
14246       if not self.is_writing then return "" end
14247
14248       local buf = {}
14249
14250       local keys = {}
14251       for k, _ in pairs(d) do
14252         table.insert(keys, k)
14253       end

```

For reproducibility, sort the keys. For mixed string-and-numeric keys, sort numeric keys before string keys.

```

14254       table.sort(keys, function(first, second)
14255         if type(first) ~= type(second) then
14256           return type(first) < type(second)
14257         else
14258           return first < second
14259         end
14260       end)
14261

```



```

14262     if not p then
14263         table.insert(buf, "\\markdownRendererJekyllDataBegin")
14264     end
14265
14266     local is_sequence = false
14267     if #d > 0 and #d == #keys then
14268         for i=1, #d do
14269             if d[i] == nil then
14270                 goto not_a_sequence
14271             end
14272         end
14273         is_sequence = true
14274     end
14275     ::not_a_sequence::
14276
14277     if is_sequence then
14278         table.insert(buf,
14279             "\\markdownRendererJekyllDataSequenceBegin{")
14280         table.insert(buf, self.identifier(p or "null"))
14281         table.insert(buf, "}{" )
14282         table.insert(buf, #keys)
14283         table.insert(buf, "}")
14284     else
14285         table.insert(buf, "\\markdownRendererJekyllDataMappingBegin{")
14286         table.insert(buf, self.identifier(p or "null"))
14287         table.insert(buf, "}{" )
14288         table.insert(buf, #keys)
14289         table.insert(buf, "}")
14290     end
14291
14292     for _, k in ipairs(keys) do
14293         local v = d[k]
14294         local typ = type(v)
14295         k = tostring(k or "null")
14296         if typ == "table" and next(v) ~= nil then
14297             table.insert(
14298                 buf,
14299                 self.jekyllData(v, t, k)
14300             )
14301         else
14302             k = self.identifier(k)
14303             v = tostring(v)
14304             if typ == "boolean" then
14305                 table.insert(buf, "\\markdownRendererJekyllDataBoolean{")
14306                 table.insert(buf, k)
14307                 table.insert(buf, "}{" )
14308                 table.insert(buf, v)

```

```

14309         table.insert(buf, "}")
14310     elseif typ == "number" then
14311         table.insert(buf, "\\markdownRendererJekyllDataNumber{")
14312         table.insert(buf, k)
14313         table.insert(buf, "{")
14314         table.insert(buf, v)
14315         table.insert(buf, "}")
14316     elseif typ == "string" then
14317         table.insert(buf,
14318             "\\markdownRendererJekyllDataProgrammaticString{")
14319         table.insert(buf, k)
14320         table.insert(buf, "{")
14321         table.insert(buf, self.identifier(v))
14322         table.insert(buf, "}")
14323         table.insert(buf,
14324             "\\markdownRendererJekyllDataTypographicString{")
14325         table.insert(buf, k)
14326         table.insert(buf, "{")
14327         table.insert(buf, t(v))
14328         table.insert(buf, "}")
14329     elseif typ == "table" then
14330         table.insert(buf, "\\markdownRendererJekyllDataEmpty{")
14331         table.insert(buf, k)
14332         table.insert(buf, "}")
14333     else
14334         local error = self.error(format(
14335             "Unexpected type %s for value of "
14336             .. "YAML key %s.", typ, k))
14337         table.insert(buf, error)
14338     end
14339 end
14340 end
14341
14342 if is_sequence then
14343     table.insert(buf, "\\markdownRendererJekyllDataSequenceEnd")
14344 else
14345     table.insert(buf, "\\markdownRendererJekyllDataMappingEnd")
14346 end
14347
14348 if not p then
14349     table.insert(buf, "\\markdownRendererJekyllDataEnd")
14350 end
14351
14352 return buf
14353 end
14354 end, extend_reader = function(self)
14355     local parsers = self.parsers

```

```

14356     local writer = self.writer
14357
14358     local JekyllData
14359     = Cmt( C((parsers.line - P("----") - P("..."))^0)
14360       , function(s, i, text) -- luacheck: ignore s i
14361         local data
14362         local ran_ok, _ = pcall(function()
14363           local tinyyaml = require("tinyyaml")
14364           data = tinyyaml.parse(text, {timestamps=false})
14365         end)
14366         if ran_ok and data ~= nil then
14367           return true, writer.jekyllData(data, function(s)
14368             return self.parser_functions.parse_blocks_nested(s)
14369           end, nil)
14370         else
14371           return false
14372         end
14373       end
14374     )
14375
14376     local UnexpectedJekyllData
14377     = P("----")
14378     * parsers.blankline / 0
14379     -- if followed by blank, it's thematic break
14380     * #(-parsers.blankline)
14381     * JekyllData
14382     * (P("----") + P("..."))
14383
14384     local ExpectedJekyllData
14385     = ( P("----")
14386       * parsers.blankline / 0
14387       -- if followed by blank, it's thematic break
14388       * #(-parsers.blankline)
14389       )^-1
14390     * JekyllData
14391     * (P("----") + P("..."))^-1
14392
14393     if ensure_jekyll_data then
14394       ExpectedJekyllData = ExpectedJekyllData
14395       * parsers.eof
14396     else
14397       ExpectedJekyllData = ( ExpectedJekyllData
14398         * (V("Blank")^0 / writer.interblocksep)
14399       )^-1
14400     end
14401
14402     self.insert_pattern("Block before Blockquote",

```

```

14403             UnexpectedJekyllData, "UnexpectedJekyllData")
14404         if expect_jekyll_data then
14405             self.update_rule("ExpectedJekyllData", ExpectedJekyllData)
14406         end
14407     end
14408 }
14409 end

```

3.1.8 Conversion from Markdown to Plain T_EX

The `new` function of file `markdown.lua` loads file `markdown-parser.lua` and calls its function `new` unless option `eagerCache` or `finalizeCache` has been enabled and a cached conversion output exists, in which case it is returned without loading file `markdown-parser.lua`.

```

14410 function M.new(options)

```

Make the `options` table inherit from the `defaultOptions` and `experimentalOptions` tables.

```

14411     options = options or {}
14412     setmetatable(options, { __index = function (_, key)
14413         return defaultOptions[key] end })
14414     if options.experimental then
14415         setmetatable(options, { __index = function (_, key)
14416             return experimentalOptions[key] end })
14417     end

```

Return a conversion function that tries to produce a cached conversion output exists. If no cached conversion output exists, we load the file `markdown-parser.lua` and use it to convert the input.

```

14418     local parser_convert = nil
14419     return function(input, include_flat_output)
14420         local function convert(input)
14421             if parser_convert == nil then

```

Lazy-load `markdown-parser.lua` and check that it originates from the same version of the Markdown package.

```

14422             local parser = require("markdown-parser")
14423             if metadata.version ~= parser.metadata.version then
14424                 warn("markdown.lua " .. metadata.version .. " used with " ..
14425                     "markdown-parser.lua " .. parser.metadata.version .. ".")
14426             end
14427             parser_convert = parser.new(options)
14428         end
14429         return parser_convert(input)
14430     end

```

If we cache markdown documents, produce the cache file and transform its filename to plain T_EX output.

When determining the name of the cache file, create salt for the hashing function out of the package version and the passed options recognized by the Lua interface (see Section 2.1.3).

```

14431     local raw_output, flat_output
14432     if options.eagerCache or options.finalizeCache then
14433         local salt = util.salt(options)
14434         local name, result = util.cache(options.cacheDir, input, salt,
14435                                         convert, ".md.tex")
14436         raw_output = [[\input{}} .. name .. [{}\relax]]
14437         flat_output = function()
14438             if result == nil then
14439                 local input_file = assert(io.open(name, "r"),
14440                                           [[Could not open file "]] .. name .. [[" for reading]])
14441                 result = assert(input_file:read("*a"))
14442                 assert(input_file:close())
14443             end
14444             return result
14445         end

```

Otherwise, return the result of the conversion directly.

```

14446     else
14447         raw_output = convert(input)
14448         flat_output = function()
14449             return raw_output
14450         end
14451     end

```

If the `finalizeCache` option is enabled, populate the frozen cache in the file `frozenCacheFileName` with an entry for markdown document number `frozenCacheCounter`.

```

14452     if options.finalizeCache then
14453         local file, mode
14454         if options.frozenCacheCounter > 0 then
14455             mode = "a"
14456         else
14457             mode = "w"
14458         end
14459         file = assert(io.open(options.frozenCacheFileName, mode),
14460                       [[Could not open file "]] .. options.frozenCacheFileName
14461                       .. [[" for writing]])
14462         assert(file:write(
14463             [[\expandafter\global\expandafter\def\csname ]]
14464             .. [[markdownFrozenCache]] .. options.frozenCacheCounter
14465             .. [[\endcsname{}} .. raw_output .. [{}]] .. "\n"))
14466         assert(file:close())
14467     end

```

Besides the canonical output of the conversion, which may contain cached files behind `\input`, also return a function that always produces a flat output regardless of caching as the second return value.

```

14468     if include_flat_output then
14469         return raw_output, flat_output
14470     else
14471         return raw_output
14472     end
14473 end
14474 end

```

The `new` function from file `markdown-parser.lua` returns a conversion function that takes a markdown string and turns it into a plain \TeX output. See Section 2.1.1.

```

14475 function M.new(options)

```

Make the `options` table inherit from the `defaultOptions` and `experimentalOptions` tables.

```

14476     options = options or {}
14477     setmetatable(options, { __index = function (_, key)
14478         return defaultOptions[key] end })
14479     if options.experimental then
14480         setmetatable(options, { __index = function (_, key)
14481             return experimentalOptions[key] end })
14482     end

```

If the singleton cache contains a conversion function for the same `options`, reuse it.

```

14483     if options.singletonCache and singletonCache.convert then
14484         for k, v in pairs(defaultOptions) do
14485             if type(v) == "table" then
14486                 for i = 1, math.max(#singletonCache.options[k], #options[k]) do
14487                     if singletonCache.options[k][i] ~= options[k][i] then
14488                         goto miss
14489                     end
14490                 end

```

The `cacheDir` option is disregarded.

```

14491         elseif k ~= "cacheDir"
14492             and singletonCache.options[k] ~= options[k] then
14493             goto miss
14494         end
14495     end
14496     return singletonCache.convert
14497 end
14498 ::miss::

```

Apply built-in syntax extensions based on `options`.

```

14499     local extensions = {}
14500

```

```

14501 if #options.acronyms > 0 then
14502     local acronyms_extension = M.extensions.acronyms(options.acronyms)
14503     table.insert(extensions, acronyms_extension)
14504 end
14505
14506 if options.bracketedSpans then
14507     local bracketed_spans_extension = M.extensions.bracketed_spans()
14508     table.insert(extensions, bracketed_spans_extension)
14509 end
14510
14511 if options.contentBlocks then
14512     local content_blocks_extension = M.extensions.content_blocks(
14513         options.contentBlocksLanguageMap)
14514     table.insert(extensions, content_blocks_extension)
14515 end
14516
14517 if options.definitionLists then
14518     local definition_lists_extension = M.extensions.definition_lists(
14519         options.tightLists)
14520     table.insert(extensions, definition_lists_extension)
14521 end
14522
14523 if options.fencedCode then
14524     local fenced_code_extension = M.extensions.fenced_code(
14525         options.blankBeforeCodeFence,
14526         options.fencedCodeAttributes,
14527         options.rawAttribute)
14528     table.insert(extensions, fenced_code_extension)
14529 end
14530
14531 if options.fencedDivs then
14532     local fenced_div_extension = M.extensions.fenced_divs(
14533         options.blankBeforeDivFence)
14534     table.insert(extensions, fenced_div_extension)
14535 end
14536
14537 if options.headerAttributes then
14538     local header_attributes_extension = M.extensions.header_attributes()
14539     table.insert(extensions, header_attributes_extension)
14540 end
14541
14542 if options.inlineCodeAttributes then
14543     local inline_code_attributes_extension =
14544         M.extensions.inline_code_attributes()
14545     table.insert(extensions, inline_code_attributes_extension)
14546 end
14547

```

```

14548   if options.jekyllData then
14549       local jekyll_data_extension = M.extensions.jekyll_data(
14550           options.expectJekyllData, options.ensureJekyllData)
14551       table.insert(extensions, jekyll_data_extension)
14552   end
14553
14554   if options.linkAttributes then
14555       local link_attributes_extension =
14556           M.extensions.link_attributes()
14557       table.insert(extensions, link_attributes_extension)
14558   end
14559
14560   if options.lineBlocks then
14561       local line_block_extension = M.extensions.line_blocks()
14562       table.insert(extensions, line_block_extension)
14563   end
14564
14565   if options.mark then
14566       local mark_extension = M.extensions.mark()
14567       table.insert(extensions, mark_extension)
14568   end
14569
14570   if options.pipeTables then
14571       local pipe_tables_extension = M.extensions.pipe_tables(
14572           options.tableCaptions, options.tableAttributes)
14573       table.insert(extensions, pipe_tables_extension)
14574   end
14575
14576   if options.rawAttribute then
14577       local raw_inline_extension = M.extensions.raw_inline()
14578       table.insert(extensions, raw_inline_extension)
14579   end
14580
14581   if options.strikeThrough then
14582       local strike_through_extension = M.extensions.strike_through()
14583       table.insert(extensions, strike_through_extension)
14584   end
14585
14586   if options.subscripts then
14587       local subscript_extension = M.extensions.subscripts()
14588       table.insert(extensions, subscript_extension)
14589   end
14590
14591   if options.superscripts then
14592       local superscript_extension = M.extensions.superscripts()
14593       table.insert(extensions, superscript_extension)
14594   end

```



```

14595
14596 if options.texMathDollars or
14597     options.texMathSingleBackslash or
14598     options.texMathDoubleBackslash then
14599     local tex_math_extension = M.extensions.tex_math(
14600         options.texMathDollars,
14601         options.texMathSingleBackslash,
14602         options.texMathDoubleBackslash)
14603     table.insert(extensions, tex_math_extension)
14604 end
14605
14606 if options.notes or options.inlineNotes then
14607     local notes_extension = M.extensions.notes(
14608         options.notes, options.inlineNotes)
14609     table.insert(extensions, notes_extension)
14610 end
14611
14612 if options.citations then
14613     local citations_extension
14614     = M.extensions.citations(options.citationNbsps)
14615     table.insert(extensions, citations_extension)
14616 end
14617
14618 if options.fancyLists then
14619     local fancy_lists_extension = M.extensions.fancy_lists()
14620     table.insert(extensions, fancy_lists_extension)
14621 end

```

Apply user-defined syntax extensions based on `options.extensions`.

```

14622 for _, user_extension_filename in ipairs(options.extensions) do
14623     local user_extension = (function(filename)

```

First, load and compile the contents of the user-defined syntax extension.

```

14624         local pathname = assert(util.find_file(filename),
14625             [[Could not locate user-defined syntax extension "]]
14626             .. filename)
14627         local input_file = assert(io.open(pathname, "r"),
14628             [[Could not open user-defined syntax extension "]]
14629             .. pathname .. [" for reading]])
14630         local input = assert(input_file:read("*a"))
14631         assert(input_file:close())
14632         local user_extension, err = load([[
14633             local sandbox = {}
14634             setmetatable(sandbox, {__index = _G})
14635             _ENV = sandbox
14636         ]] .. input)()
14637         assert(user_extension,
14638             [[Failed to compile user-defined syntax extension "]]

```

```
14639     .. pathname .. [": "] .. (err or [[]]))
```

Then, validate the user-defined syntax extension.

```
14640     assert(user_extension.api_version ~= nil,
14641           [[User-defined syntax extension "] .. pathname
14642           .. [" does not specify mandatory field "api_version"]])
14643     assert(type(user_extension.api_version) == "number",
14644           [[User-defined syntax extension "] .. pathname
14645           .. [" specifies field "api_version" of type "]
14646           .. type(user_extension.api_version)
14647           .. [" but "number" was expected]])
14648     assert(user_extension.api_version > 0
14649           and user_extension.api_version
14650             <= metadata.user_extension_api_version,
14651           [[User-defined syntax extension "] .. pathname
14652           .. [" uses syntax extension API version "]
14653           .. user_extension.api_version .. [" but markdown.lua "]
14654           .. metadata.version .. [" uses API version "]
14655           .. metadata.user_extension_api_version
14656           .. [", which is incompatible"]])
14657
14658     assert(user_extension.grammar_version ~= nil,
14659           [[User-defined syntax extension "] .. pathname
14660           .. [" does not specify mandatory field "grammar_version"]])
14661     assert(type(user_extension.grammar_version) == "number",
14662           [[User-defined syntax extension "] .. pathname
14663           .. [" specifies field "grammar_version" of type "]
14664           .. type(user_extension.grammar_version)
14665           .. [" but "number" was expected]])
14666     assert(user_extension.grammar_version == metadata.grammar_version,
14667           [[User-defined syntax extension "] .. pathname
14668           .. [" uses grammar version "]
14669           .. user_extension.grammar_version
14670           .. [" but markdown.lua "] .. metadata.version
14671           .. [" uses grammar version "] .. metadata.grammar_version
14672           .. [", which is incompatible"]])
14673
14674     assert(user_extension.finalize_grammar ~= nil,
14675           [[User-defined syntax extension "] .. pathname
14676           .. [" does not specify mandatory "finalize_grammar" field]])
14677     assert(type(user_extension.finalize_grammar) == "function",
14678           [[User-defined syntax extension "] .. pathname
14679           .. [" specifies field "finalize_grammar" of type "]
14680           .. type(user_extension.finalize_grammar)
14681           .. [" but "function" was expected]])
```

Finally, cast the user-defined syntax extension to the internal format of user extensions used by the Markdown package (see Section [3.1.7](#).)

```

14682     local extension = {
14683       name = [[user-defined "]] .. pathname .. [[" syntax extension]],
14684       extend_reader = user_extension.finalize_grammar,
14685       extend_writer = function() end,
14686     }
14687     return extension
14688   end)(user_extension_filename)
14689   table.insert(extensions, user_extension)
14690 end

```

Produce a conversion function from markdown to plain T_EX.

```

14691 local writer = M.writer.new(options)
14692 local reader = M.reader.new(writer, options)
14693 local convert = reader.finalize_grammar(extensions)

```

Force garbage collection to reclaim memory for temporary objects created in `writer.new`, `reader.new`, and `reader->finalize_grammar`.

```

14694 collectgarbage("collect")

```

Update the singleton cache.

```

14695 if options.singletonCache then
14696   local singletonCacheOptions = {}
14697   for k, v in pairs(options) do
14698     singletonCacheOptions[k] = v
14699   end
14700   setmetatable(singletonCacheOptions,
14701     { __index = function (_, key)
14702       return defaultOptions[key] end })
14703   singletonCache.options = singletonCacheOptions
14704   singletonCache.convert = convert
14705 end

```

Return the conversion function from markdown to plain T_EX.

```

14706 return convert
14707 end
14708 return M

```

3.1.9 Command-Line Implementation

The command-line implementation provides the actual conversion routine for the command-line interface described in Section 2.1.7.

```

14709
14710 local input
14711 if input_filename then
14712   local input_file = assert(io.open(input_filename, "r"),
14713     [[Could not open file "]] .. input_filename .. [[" for reading]])
14714   input = assert(input_file:read("*a"))
14715   assert(input_file:close())

```

```

14716 else
14717     input = assert(io.read("*a"))
14718 end
14719

```

First, ensure that the `options.cacheDir` directory exists.

```

14720 local lfs = require("lfs")
14721 if options.cacheDir and not lfs.isdir(options.cacheDir) then
14722     assert(lfs.mkdir(options["cacheDir"]))
14723 end

```

If Kpathsea has not been loaded before or if LuaTeX has not yet been initialized, configure Kpathsea on top of loading it.

```

14724 local kpse
14725 (function()
14726     local should_initialize = package.loaded.kpse == nil
14727                             or tex.initialize ~= nil
14728     kpse = require("kpse")
14729     if should_initialize then
14730         kpse.set_program_name("luatex")
14731     end
14732 end)()
14733 local md = require("markdown")

```

Since we are loading the rest of the Lua implementation dynamically, check that both the `markdown` module and the command line implementation are the same version.

```

14734 if metadata.version ~= md.metadata.version then
14735     warn("markdown-cli.lua " .. metadata.version .. " used with " ..
14736         "markdown.lua " .. md.metadata.version .. ".")
14737 end
14738
14739 local convert = md.new(options)
14740 local raw_output, flat_output = convert(input, true)
14741 local output
14742 if flat_output == nil then
14743     if options.eagerCache then
14744         warn("markdown.lua has not produced flat output, so I am using " ..
14745             "backwards-compatible raw output instead. This may cause " ..
14746             "the conversion result to be hidden behind '\\input'.")
14747     end
14748     output = raw_output
14749 else
14750     output = flat_output()
14751 end
14752
14753 if output_filename then
14754     local output_file = assert(io.open(output_filename, "w"),
14755         [[Could not open file ]] .. output_filename .. [[ for writing]])

```

```

14756  assert(output_file:write(output))
14757  assert(output_file:close())
14758  else
14759    assert(io.write(output))
14760  end

```

Remove the `options.cacheDir` directory if it is empty.

```

14761  if options.cacheDir then
14762    lfs.rmdir(options.cacheDir)
14763  end

```

3.2 Plain T_EX Implementation

The plain T_EX implementation provides macros for the interfacing between T_EX and Lua and for the buffering of input text. These macros are then used to implement the macros for the conversion from markdown to plain T_EX exposed by the plain T_EX interface (see Section 2.2).

3.2.1 Logging Facilities

```

14764  \ExplSyntaxOn
14765  \cs_if_free:NT
14766    \markdownInfo
14767    {
14768      \cs_new_protected:Npn
14769        \markdownInfo #1
14770        {
14771          \msg_info:nne
14772            { markdown }
14773            { generic-message }
14774            { #1 }
14775        }
14776    }
14777  \cs_if_free:NT
14778    \markdownWarning
14779    {
14780      \cs_new_protected:Npn
14781        \markdownWarning #1
14782        {
14783          \msg_warning:nne
14784            { markdown }
14785            { generic-message }
14786            { #1 }
14787        }
14788    }
14789  \cs_if_free:NT
14790    \markdownError

```

```

14791 {
14792   \cs_new_protected:Npn
14793     \markdownError #1 #2
14794     {
14795       \msg_error:nnee
14796         { markdown }
14797         { generic-message-with-help-text }
14798         { #1 }
14799         { #2 }
14800     }
14801 }
14802 \msg_new:nnn
14803 { markdown }
14804 { generic-message }
14805 { #1 }
14806 \msg_new:nnnn
14807 { markdown }
14808 { generic-message-with-help-text }
14809 { #1 }
14810 { #2 }
14811 \cs_generate_variant:Nn
14812   \msg_info:nnn
14813   { nne }
14814 \cs_generate_variant:Nn
14815   \msg_warning:nnn
14816   { nne }
14817 \cs_generate_variant:Nn
14818   \msg_error:nnnn
14819   { nnee }
14820 \ExplSyntaxOff

```

3.2.2 Themes

This section implements the theme-loading mechanism and the built-in themes provided with the Markdown package. Furthermore, this section also implements the built-in plain T_EX themes provided with the Markdown package.

```

14821 \ExplSyntaxOn
14822 \prop_new:N \g_@@_plain_tex_loaded_themes_linenos_prop
14823 \prop_new:N \g_@@_plain_tex_loaded_themes_versions_prop
14824 \cs_new_protected:Nn
14825   \@@_plain_tex_load_theme:nnn
14826   {
14827     \prop_get:NnNTF
14828       \g_@@_plain_tex_loaded_themes_linenos_prop
14829       { #1 }
14830       \l_tmpa_tl
14831       {

```

```

14832 \prop_get:NnN
14833 \g_@@_plain_tex_loaded_themes_versions_prop
14834 { #1 }
14835 \l_tmpb_tl
14836 \str_if_eq:nVTF
14837 { #2 }
14838 \l_tmpb_tl
14839 {
14840 \msg_warning:nnnVn
14841 { markdown }
14842 { repeatedly-loaded-plain-tex-theme }
14843 { #1 }
14844 \l_tmpa_tl
14845 { #2 }
14846 }
14847 {
14848 \msg_error:nnnnVV
14849 { markdown }
14850 { different-versions-of-plain-tex-theme }
14851 { #1 }
14852 { #2 }
14853 \l_tmpb_tl
14854 \l_tmpa_tl
14855 }
14856 }
14857 {
14858 \prop_gput:Nnx
14859 \g_@@_plain_tex_loaded_themes_linenos_prop
14860 { #1 }
14861 { \tex_the:D \tex_inputlineno:D } % noqa: W200
14862 \prop_gput:Nnn
14863 \g_@@_plain_tex_loaded_themes_versions_prop
14864 { #1 }
14865 { #2 }

```

Load built-in plain T_EX themes from the prop `\g_@@_plain_tex_built_in_themes_prop` and from the filesystem otherwise.

```

14866 \prop_if_in:NnTF
14867 \g_@@_plain_tex_built_in_themes_prop
14868 { #1 }
14869 {
14870 \msg_info:nnnn
14871 { markdown }
14872 { loading-built-in-plain-tex-theme }
14873 { #1 }
14874 { #2 }
14875 \prop_item:Nn

```

```

14876         \g_@@_plain_tex_built_in_themes_prop
14877         { #1 }
14878     }
14879     {
14880         \msg_info:nnnn
14881         { markdown }
14882         { loading-plain-tex-theme }
14883         { #1 }
14884         { #2 }
14885         \file_input:n
14886         { markdown theme #3 }
14887     }
14888 }
14889 }
14890 \msg_new:nnn
14891 { markdown }
14892 { loading-plain-tex-theme }
14893 { Loading~version~#2~of~plain~TeX~Markdown~theme~#1 }
14894 \msg_new:nnn
14895 { markdown }
14896 { loading-built-in-plain-tex-theme }
14897 { Loading~version~#2~of~built-in~plain~TeX~Markdown~theme~#1 }
14898 \msg_new:nnn
14899 { markdown }
14900 { repeatedly-loaded-plain-tex-theme }
14901 {
14902     Version~#3~of~plain~TeX~Markdown~theme~#1~was~previously~
14903     loaded~on~line~#2,~not~loading~it~again
14904 }
14905 \msg_new:nnn
14906 { markdown }
14907 { different-versions-of-plain-tex-theme }
14908 {
14909     Tried~to~load~version~#2~of~plain~TeX~Markdown~theme~#1~
14910     but~version~#3~has~already~been~loaded~on~line~#4
14911 }
14912 \cs_generate_variant:Nn
14913 \prop_gput:Nnn
14914 { Nnx }
14915 \cs_gset_eq:NN
14916 \@@_load_theme:nnn
14917 \@@_plain_tex_load_theme:nnn
14918 \cs_generate_variant:Nn
14919 \@@_load_theme:nnn
14920 { VeV }
14921 \cs_generate_variant:Nn
14922 \msg_error:nnnnnn

```



```

14923 { nnnnVV }
14924 \cs_generate_variant:Nn
14925 \msg_warning:nnnnn
14926 { nnnVn }

```

Developers can use the `\markdownLoadPlainTeXTheme` macro to load a corresponding plain TeX theme from within themes for higher-level TeX formats such as L^AT_EX and ConT_EXt.

```

14927 \cs_new_protected:Npn
14928 \markdownLoadPlainTeXTheme
14929 {

```

First, we extract the name of the current theme from the `\g_@@_current_theme_tl` macro.

```

14930 \tl_set:NV
14931 \l_tmpa_tl
14932 \g_@@_current_theme_tl
14933 \tl_reverse:N
14934 \l_tmpa_tl
14935 \tl_set:Ne
14936 \l_tmpb_tl
14937 {
14938 \tl_tail:V
14939 \l_tmpa_tl
14940 }
14941 \tl_reverse:N
14942 \l_tmpb_tl

```

Next, we munge the theme name.

```

14943 \str_set:NV
14944 \l_tmpa_str
14945 \l_tmpb_tl
14946 \str_replace_all:Nnn
14947 \l_tmpa_str
14948 { / }
14949 { _ }

```

Finally, we load the plain TeX theme.

```

14950 \@@_plain_tex_load_theme:VeV
14951 \l_tmpb_tl
14952 { \markdownThemeVersion }
14953 \l_tmpa_str
14954 }
14955 \cs_generate_variant:Nn
14956 \tl_set:Nn
14957 { Ne }
14958 \cs_generate_variant:Nn
14959 \@@_plain_tex_load_theme:nnn
14960 { VeV }

```

The `witiko/dot` theme nags users that they should use the name `witiko/diagrams@v1` instead.

```

14961 \prop_gput:Nnn
14962 \g_@@_plain_tex_built_in_themes_prop
14963 { witiko / dot }
14964 {
14965   \str_if_eq:enF
14966     { \markdownThemeVersion }
14967     { silent }
14968     {
14969       \markdownWarning
14970       {
14971         The~theme~name~"witiko/dot"~has~been~soft-deprecated.
14972         \iow_newline:
14973         Consider~changing~the~name~to~"witiko/diagrams@v1".
14974       }
14975     }

```

We enable the `fencedCode` Lua option.

```

14976 \markdownSetup { fencedCode }

```

We store the previous definition of the fenced code token renderer prototype:

```

14977 \cs_set_eq:NN
14978 \@@_dot_previous_definition:nnn
14979 \markdownRendererInputFencedCodePrototype

```

If the infostring starts with `dot ...`, we redefine the fenced code block token renderer prototype, so that it typesets the code block via Graphviz tools if and only if the `frozenCache` plain T_EX option is disabled and the code block has not been previously typeset:

```

14980 \regex_const:Nn
14981 \c_@@_dot_infostring_regex
14982 { ^dot(\s+(.+)?)? }
14983 \seq_new:N
14984 \l_@@_dot_matches_seq
14985 \markdownSetup {
14986   rendererPrototypes = {
14987     inputFencedCode = {
14988       \regex_extract_once:NnNTF
14989       \c_@@_dot_infostring_regex
14990       { #2 }
14991       \l_@@_dot_matches_seq
14992       {
14993         \@@_if_option:nF
14994         { frozenCache }
14995         {
14996           \sys_shell_now:n
14997           {

```

```

14998         if~!~test~-e~#1.pdf.source~
14999         ||~!~diff~#1~#1.pdf.source;
15000         then~
15001             dot~-Tpdf~-o~#1.pdf~#1;
15002             cp~#1~#1.pdf.source;
15003         fi
15004     }
15005 }

```

We include the typeset image using the image token renderer:

```

15006     \exp_args:NNne
15007     \exp_last_unbraced:No
15008     \markdownRendererImage
15009     {
15010         { Graphviz~image }
15011         { #1.pdf }
15012         { #1.pdf }
15013     }
15014     {
15015         \seq_item:Nn
15016         \l_@@_dot_matches_seq
15017         { 3 }
15018     }
15019 }

```

If the infostring does not start with `dot ...`, we use the previous definition of the fenced code token renderer prototype:

```

15020     {
15021         \@@_dot_previous_definition:nnn
15022         { #1 }
15023         { #2 }
15024         { #3 }
15025     }
15026 },
15027 },
15028 }
15029 }

```

The theme `witiko/diagrams` loads either the theme `witiko/dot` for version `v1` or the theme `witiko/diagrams/v2` for version `v2`.

```

15030 \prop_gput:Nnn
15031 \g_@@_plain_tex_built_in_themes_prop
15032 { witiko / diagrams }
15033 {
15034     \str_case:enF
15035     { \markdownThemeVersion }
15036     {
15037         { latest }

```

```

15038     {
15039         \msg_warning:nnnn
15040         { markdown }
15041         { pin-theme-version }
15042         { witiko/diagrams }
15043         { v2 }
15044         \markdownSetup
15045         {
15046             import = witiko/diagrams/v2,
15047         }
15048     }
15049 { v2 }
15050 {
15051     \markdownSetup
15052     {
15053         import = witiko/diagrams/v2,
15054     }
15055 }
15056 { v1 }
15057 {
15058     \markdownSetup
15059     {
15060         import = witiko/dot@silent,
15061     }
15062 }
15063 }
15064 {
15065     \msg_error:nnnen
15066     { markdown }
15067     { unknown-theme-version }
15068     { witiko/diagrams }
15069     { \markdownThemeVersion }
15070     { v1~and~v2 }
15071 }
15072 }
15073 \cs_generate_variant:Nn
15074 \msg_error:nnnnn
15075 { nnnen }
15076 \msg_new:nnn
15077 { markdown }
15078 { pin-theme-version }
15079 {
15080     Write~"#1@#2"~to~pin-version~"#2"~of~the~theme~"#1".
15081     This~will~keep~your~documents~from~suddenly~breaking
15082     when~we~have~released~future~versions~of~the~theme
15083     with~backwards-incompatible~syntax~and~behavior.
15084 }

```

```

15085 \msg_new:nnnn
15086 { markdown }
15087 { unknown-theme-version }
15088 { Unknown~version~"#2"~of~theme~"#1"~has~been~requested. }
15089 { Known~versions~are:~#3 }

```

Next, we implement the theme [witiko/diagrams/v2](#).

```

15090 \prop_gput:Nnn
15091 \g_@@_plain_tex_built_in_themes_prop
15092 { witiko / diagrams / v2 }
15093 {

```

We enable the [fencedCode](#) and [fencedCodeAttributes](#) Lua option.

```

15094 \@@_setup:n
15095 {
15096     fencedCode = true,
15097     fencedCodeAttributes = true,
15098 }

```

Store the previous fenced code token renderer prototype.

```

15099 \cs_set_eq:NN
15100 \@@_diagrams_previous_fenced_code:nnn
15101 \markdownRendererInputFencedCodePrototype

```

Store the caption, the desired format, and the command to produce the diagram.

```

15102 \tl_new:N
15103 \l_@@_diagrams_caption_tl
15104 \tl_new:N
15105 \l_@@_diagrams_format_tl
15106 \tl_set:Nn
15107 \l_@@_diagrams_format_tl
15108 { pdf }
15109 \tl_new:N
15110 \l_@@_diagrams_command_tl
15111 \@@_setup:n
15112 {
15113     rendererPrototypes = {

```

Route attributes on fenced code blocks to the image attribute renderer prototypes.

```

15114     fencedCodeAttributeContextBegin = {
15115         \group_begin:
15116         \markdownRendererImageAttributeContextBegin
15117         \cs_set_eq:NN
15118         \@@_diagrams_previous_key_value:nn
15119         \markdownRendererAttributeKeyValuePrototype
15120         \@@_setup:n
15121         {
15122             rendererPrototypes = {
15123                 attributeKeyValue = {

```

```

15124         \str_case:nnF
15125         { ##1 }
15126         {
15127             { caption }
15128             {
15129                 \tl_set:Nn
15130                 \l_@@_diagrams_caption_tl
15131                 { ##2 }
15132             }
15133             { format }
15134             {
15135                 \tl_set:Nn
15136                 \l_@@_diagrams_format_tl
15137                 { ##2 }
15138             }
15139             { command }
15140             {
15141                 \tl_set:Nn
15142                 \l_@@_diagrams_command_tl
15143                 { ##2 }
15144             }
15145         }
15146         {
15147             \@@_diagrams_previous_key_value:nn
15148             { ##1 }
15149             { ##2 }
15150         }
15151     },
15152 },
15153 }
15154 },
15155 fencedCodeAttributeContextEnd = {
15156     \markdownRendererImageAttributeContextEnd
15157     \group_end:
15158 },
15159 },
15160 }
15161 \cs_new:Nn
15162 \@@_diagrams_render_diagram:nnnn
15163 {
15164     \@@_if_option:nF
15165     { frozenCache }
15166     {
15167         \sys_shell_now:n
15168         {
15169             if~!~test~-e~#2.source~
15170             ||~!~diff~#1~#2.source;

```

```

15171         then~
15172         (#3);
15173         cp~#1~#2.source;
15174     fi
15175 }
15176 \exp_args:NNnV
15177 \exp_last_unbraced:No
15178 \markdownRendererImage
15179 {
15180     { #4 }
15181     { #2 }
15182     { #2 }
15183 }
15184 \l_@@_diagrams_caption_tl
15185 }
15186 }

```

Use the prop `\g_markdown_diagrams_infostrings_prop` to determine how the code with a given infostring should be processed and routed to the token renderer prototype(s) for images.

```

15187 \prop_new:N
15188 \g_markdown_diagrams_infostrings_prop

```

If we know a processing function for a given infostring, use it.

```

15189 \@@_setup:n
15190 {
15191     rendererPrototypes = {
15192         inputFencedCode = {
15193             \prop_get:NnNTF
15194             \g_markdown_diagrams_infostrings_prop
15195             { #2 }
15196             \l_tmpa_tl
15197             {
15198                 \cs_set:NV
15199                 \@@_diagrams_infostrings_current:n
15200                 \l_tmpa_tl
15201                 \@@_diagrams_infostrings_current:n
15202                 { #1 }
15203             }
15204         }
15205     }
15206 }

```

Otherwise, use the previous fenced code token renderer prototype.

```

15204 {
15205     \@@_diagrams_previous_fenced_code:nnn
15206     { #1 }
15207     { #2 }
15208     { #3 }
15209 }
15210 },

```

```

15211     },
15212     }
15213     \cs_generate_variant:Nn
15214     \cs_set:Nn
15215     { NV }

```

Typeset fenced code with infostring `dot` using the command `dot` from the package Graphviz.

```

15216     \cs_set:Nn
15217     \@@_diagrams_infostrings_current:n
15218     {
15219         \tl_set:Nn
15220         \l_tmpb_tl
15221         { dot~T }
15222         \tl_put_right:NV
15223         \l_tmpb_tl
15224         \l_@@_diagrams_format_tl
15225         \tl_put_right:Nn
15226         \l_tmpb_tl
15227         { ~-o~#1. }
15228         \tl_put_right:NV
15229         \l_tmpb_tl
15230         \l_@@_diagrams_format_tl
15231         \tl_put_right:Nn
15232         \l_tmpb_tl
15233         { ~#1 }

```

For the SVG format, use Inkscape to convert the resulting image to PDF.

```

15234     \str_if_eq:VnT
15235     \l_@@_diagrams_format_tl
15236     { svg }
15237     {
15238         \tl_put_right:Nn
15239         \l_tmpb_tl
15240         { ;~inkscape~#1. }
15241         \tl_put_right:NV
15242         \l_tmpb_tl
15243         \l_@@_diagrams_format_tl
15244         \tl_put_right:Nn
15245         \l_tmpb_tl
15246         { ~---export-area-drawing---export-dpi=300~-o~#1.pdf }
15247     }
15248     \@@_diagrams_render_diagram:nnVn
15249     { #1 }
15250     { #1.pdf }
15251     \l_tmpb_tl
15252     { Graphviz~image }
15253 }

```



```

15254 \cs_generate_variant:Nn
15255 \@@_diagrams_render_diagram:nnnn
15256 { nnVn }
15257 \@@_tl_set_from_cs:NNn
15258 \l_tmpa_tl
15259 \@@_diagrams_infostrings_current:n
15260 { 1 }
15261 \prop_gput:NnV
15262 \g_markdown_diagrams_infostrings_prop
15263 { dot }
15264 \l_tmpa_tl

```

Typeset fenced code with infostring `mermaid` using the command `mmdc` from the npm package `@mermaid-js/mermaid-cli`. The exact command can be configured by redefining or appending to the `\g_@@_diagrams_mmdc_command_tl` token list, by redefining the `\mmdcCommand` macro, or using the HTML attribute `command` on the fenced code.

Unlike the token list, the macro can be redefined even before loading the Markdown package. Unlike the token list and the macro, the HTML attribute is local to a single fenced code.

```

15265 \tl_new:N
15266 \g_@@_diagrams_mmdc_command_tl
15267 \tl_gset:Nn
15268 \g_@@_diagrams_mmdc_command_tl
15269 {
15270   \tl_if_empty:NTF
15271     \l_@@_diagrams_command_tl
15272     { mmdc }
15273     {
15274       \tl_use:N
15275       \l_@@_diagrams_command_tl
15276     }
15277 }
15278 \cs_if_free:NT
15279 \mmdcCommand
15280 {
15281   \cs_new:Npn
15282     \mmdcCommand
15283     {
15284       \tl_use:N
15285       \g_@@_diagrams_mmdc_command_tl
15286     }
15287 }
15288 \cs_set:Nn
15289 \@@_diagrams_infostrings_current:n
15290 {
15291   \tl_set:Nx

```

```

15292         \l_tmpb_tl
15293         { \mmdcCommand }
15294     \tl_put_right:Nn
15295         \l_tmpb_tl
15296         { ---pdfFit~i~#1~o~#1.pdf }
15297     \@@_diagrams_render_diagram:nnVn
15298         { #1 }
15299         { #1.pdf }
15300     \l_tmpb_tl
15301     { Mermaid~image }
15302 }
15303 \@@_tl_set_from_cs:NNn
15304     \l_tmpa_tl
15305     \@@_diagrams_infostrings_current:n
15306     { 1 }
15307 \prop_gput:NnV
15308     \g_markdown_diagrams_infostrings_prop
15309     { mermaid }
15310     \l_tmpa_tl

```

Typeset fenced code with infostring `plantuml` using the command `plantuml` from the package PlantUML.

```

15311     \regex_const:Nn
15312         \c_@@_diagrams_filename_suffix_regex
15313         { \.[^\.]*$ }
15314     \cs_set:Nn
15315         \@@_diagrams_infostrings_current:n
15316         {

```

Use the output format provided by the user.

```

15317     \tl_set:Nn
15318         \l_tmpa_tl
15319         { #1 }
15320     \regex_replace_once:NxN
15321         \c_@@_diagrams_filename_suffix_regex
15322         {
15323             .
15324             \tl_use:N
15325                 \l_@@_diagrams_format_tl
15326         }
15327     \l_tmpa_tl
15328     \tl_set:Nn
15329         \l_tmpb_tl
15330         { plantuml~-t }
15331     \tl_put_right:NV
15332         \l_tmpb_tl
15333         \l__markdown_diagrams_format_tl
15334     \tl_put_right:Nn

```

```

15335         \l_tmpb_tl
15336         { ~#1 }

```

For the SVG format, use Inkscape to convert the resulting image to PDF.

```

15337     \str_if_eq:VnT
15338     \l_@@_diagrams_format_tl
15339     { svg }
15340     {
15341         \tl_put_right:Nn
15342         \l_tmpb_tl
15343         { ;~inkscape~ }
15344         \tl_put_right:NV
15345         \l_tmpb_tl
15346         \l_tmpa_tl
15347         \tl_put_right:Nn
15348         \l_tmpb_tl
15349         { ~---export-area-drawing---export-dpi=300~-o~ }
15350         \tl_set:Nn
15351         \l_tmpa_tl
15352         { #1 }
15353         \regex_replace_once:NnN
15354         \c_@@_diagrams_filename_suffix_regex
15355         { .pdf }
15356         \l_tmpa_tl
15357         \tl_put_right:NV
15358         \l_tmpb_tl
15359         \l_tmpa_tl
15360     }
15361     \@@_diagrams_render_diagram:nVVn
15362     { #1 }
15363     \l_tmpa_tl
15364     \l_tmpb_tl
15365     { PlantUML~image }
15366 }
15367 \cs_generate_variant:Nn
15368   \@@_diagrams_render_diagram:nnnn
15369   { nVVn }
15370 \cs_generate_variant:Nn
15371   \regex_replace_once:NnN
15372   { NxN }
15373 \@@_tl_set_from_cs:NNn
15374   \l_tmpa_tl
15375   \@@_diagrams_infostrings_current:n
15376   { 1 }
15377 \prop_gput:NnV
15378   \g_markdown_diagrams_infostrings_prop
15379   { plantuml }
15380   \l_tmpa_tl

```

```
15381 }
```

We locally change the category code of percent signs, so that we can use them in the shell code:

```
15382 \group_begin:
15383 \char_set_catcode_other:N \%
```

The [witiko/graphicx/http](#) theme stores the previous definition of the image token renderer prototype:

```
15384 \prop_gput:Nnn
15385 \g_@@_plain_tex_built_in_themes_prop
15386 { witiko / graphicx / http }
15387 {
15388   \cs_set_eq:NN
15389     \@@_graphicx_http_previous_definition:nnnn
15390     \markdownRendererImagePrototype
```

We define variables and functions to enumerate the images for caching and to store the pathname of the file containing the pathname of the downloaded image file.

```
15391   \int_new:N
15392     \g_@@_graphicx_http_image_number_int
15393   \int_gset:Nn
15394     \g_@@_graphicx_http_image_number_int
15395     { 0 }
15396   \cs_new:Nn
15397     \@@_graphicx_http_filename:
15398     {
15399       \markdownOptionCacheDir
15400       / witiko_graphicx_http .
15401       \int_use:N
15402         \g_@@_graphicx_http_image_number_int
15403     }
```

We define a function that will receive two arguments that correspond to the URL of the online image and to the pathname, where the online image should be downloaded. The function produces a shell command that tries to download the online image to the pathname.

```
15404   \cs_new:Nn
15405     \@@_graphicx_http_download:nn
15406     {
15407       wget~-0~#2~#1~
15408       ||~curl~--location~-o~#2~#1~
15409       ||~rm~-f~#2
15410     }
```

We redefine the image token renderer prototype, so that it tries to download an online image.

```
15411   \str_new:N
```

```

15412     \l_@@_graphicx_http_filename_str
15413     \ior_new:N
15414     \g_@@_graphicx_http_filename_ior
15415     \markdownSetup {
15416         rendererPrototypes = {
15417             image = {
15418                 \@@_if_option:nF
15419                 { frozenCache }
15420             }

```

The image will be downloaded only if the image URL has the http or https protocols and the `frozenCache` plain T_EX option is disabled:

```

15421         \sys_shell_now:e
15422         {
15423             mkdir~~p~" \markdownOptionCacheDir ";
15424             if~printf~'%s'~"#3"~|~grep~-q~-E~'^https?:';
15425             then~

```

The image will be downloaded to the pathname `cacheDir/⟨the MD5 digest of the image URL⟩.⟨the suffix of the image URL⟩`:

```

15426             OUTPUT_PREFIX=" \markdownOptionCacheDir ";
15427             OUTPUT_BODY="$(printf~'%s'~'#3'
15428                 |~md5sum~|~cut~-d~'~'~-f1)";
15429             OUTPUT_SUFFIX="$(printf~'%s'~'#3'
15430                 |~sed~'s/.*[.]//')";
15431             OUTPUT="$OUTPUT_PREFIX/$OUTPUT_BODY.$OUTPUT_SUFFIX";

```

The image will be downloaded only if it has not already been downloaded:

```

15432             if~!~[~-e~"$OUTPUT"~];
15433             then~
15434                 \@@_graphicx_http_download:nn
15435                 { '#3' }
15436                 { "$OUTPUT" } ;
15437                 printf~'%s'~"$OUTPUT"~
15438                 >~" \@@_graphicx_http_filename: ";
15439             fi;

```

If the image does not have the http or https protocols or the image has already been downloaded, the URL will be stored as-is:

```

15440             else~
15441                 printf~'%s'~'#3'~
15442                 >~" \@@_graphicx_http_filename: ";
15443             fi
15444         }
15445     }

```

We load the pathname of the downloaded image and we typeset the image using the previous definition of the image renderer prototype:

```

15446     \ior_open:Ne

```

```

15447         \g_@@_graphicx_http_filename_ior
15448         { \@@_graphicx_http_filename: }
15449     \ior_str_get:NN
15450     \g_@@_graphicx_http_filename_ior
15451     \l_@@_graphicx_http_filename_str
15452     \ior_close:N
15453     \g_@@_graphicx_http_filename_ior
15454     \@@_graphicx_http_previous_definition:nnVn
15455     { #1 }
15456     { #2 }
15457     \l_@@_graphicx_http_filename_str
15458     { #4 }
15459     \int_gincr:N
15460     \g_@@_graphicx_http_image_number_int
15461 }
15462 }
15463 }
15464 \cs_generate_variant:Nn
15465   \ior_open:Nn
15466   { Ne }
15467 \cs_generate_variant:Nn
15468   \@@_graphicx_http_previous_definition:nnnn
15469   { nnVn }
15470 }
15471 \group_end:

```

The [witiko/tilde](#) theme redefines the tilde token renderer prototype, so that it expands to a non-breaking space:

```

15472 \prop_gput:Nnn
15473   \g_@@_plain_tex_built_in_themes_prop
15474   { witiko / tilde }
15475   {
15476     \markdownSetup {
15477       rendererPrototypes = {
15478         tilde = {~},
15479       },
15480     }
15481   }

```

The themes [witiko/example/foo](#) and [witiko/example/bar](#) are supposed to be used in code examples. They don't do anything.

```

15482 \clist_map_inline:nn
15483   { foo, bar }
15484   {
15485     \prop_gput:Nnn
15486     \g_@@_plain_tex_built_in_themes_prop
15487     { witiko / example / #1 }
15488     {

```

```

15489     \markdownWarning
15490     {
15491         The~theme~witiko/example/#1~is~supposed~to~be~used~in~code~
15492         examples.~Using~it~in~actual~code~has~no~effect,~except~
15493         this~warning~message,~and~is~usually~a~mistake.
15494     }
15495 }
15496 }
15497 \ExplSyntaxOff

```

The `witiko/markdown/defaults` plain TeX theme provides default definitions for token renderer prototypes. See Section 3.2.3 for the actual definitions.

3.2.3 Token Renderer Prototypes

The following definitions should be considered placeholder.

```

15498 \def\markdownRendererInterblockSeparatorPrototype{\par}%
15499 \def\markdownRendererParagraphSeparatorPrototype{%
15500     \markdownRendererInterblockSeparator}%
15501 \def\markdownRendererHardLineBreakPrototype{\hfil\break}%
15502 \def\markdownRendererSoftLineBreakPrototype{ }%
15503 \let\markdownRendererEllipsisPrototype\dots
15504 \def\markdownRendererNbspPrototype{~}%
15505 \def\markdownRendererLeftBracePrototype{\char`\{}%
15506 \def\markdownRendererRightBracePrototype{\char`\}%
15507 \def\markdownRendererDollarSignPrototype{\char`$}%
15508 \def\markdownRendererPercentSignPrototype{\char`\}%
15509 \def\markdownRendererAmpersandPrototype{\&}%
15510 \def\markdownRendererUnderscorePrototype{\char`_}%
15511 \def\markdownRendererHashPrototype{\char`\#}%
15512 \def\markdownRendererCircumflexPrototype{\char`^}%
15513 \def\markdownRendererBackslashPrototype{\char`\}%
15514 \def\markdownRendererTildePrototype{\char`~}%
15515 \def\markdownRendererPipePrototype{|}%
15516 \def\markdownRendererCodeSpanPrototype#1{{\tt#1}}%
15517 \def\markdownRendererLinkPrototype#1#2#3#4{#2}%
15518 \def\markdownRendererContentBlockPrototype#1#2#3#4{%
15519     \markdownInput{#3}}%
15520 \def\markdownRendererContentBlockOnlineImagePrototype{%
15521     \markdownRendererImage}%
15522 \def\markdownRendererContentBlockCodePrototype#1#2#3#4#5{%
15523     \markdownRendererInputFencedCode{#3}{#2}{#2}}%
15524 \def\markdownRendererImagePrototype#1#2#3#4{#2}%
15525 \def\markdownRendererUlBeginPrototype{}%
15526 \def\markdownRendererUlBeginTightPrototype{}%
15527 \def\markdownRendererUlItemPrototype{}%
15528 \def\markdownRendererUlItemEndPrototype{}%

```

```

15529 \def\markdownRendererU1EndPrototype{}%
15530 \def\markdownRendererU1EndTightPrototype{}%
15531 \def\markdownRendererO1BeginPrototype{}%
15532 \def\markdownRendererO1BeginTightPrototype{}%
15533 \def\markdownRendererFancyO1BeginPrototype#1#2{%
15534     \markdownRendererO1Begin}%
15535 \def\markdownRendererFancyO1BeginTightPrototype#1#2{%
15536     \markdownRendererO1BeginTight}%
15537 \def\markdownRendererO1ItemPrototype{}%
15538 \def\markdownRendererO1ItemWithNumberPrototype#1{}%
15539 \def\markdownRendererO1ItemEndPrototype{}%
15540 \def\markdownRendererFancyO1ItemPrototype{\markdownRendererO1Item}%
15541 \def\markdownRendererFancyO1ItemWithNumberPrototype{%
15542     \markdownRendererO1ItemWithNumber}%
15543 \def\markdownRendererFancyO1ItemEndPrototype{}%
15544 \def\markdownRendererO1EndPrototype{}%
15545 \def\markdownRendererO1EndTightPrototype{}%
15546 \def\markdownRendererFancyO1EndPrototype{\markdownRendererO1End}%
15547 \def\markdownRendererFancyO1EndTightPrototype{%
15548     \markdownRendererO1EndTight}%
15549 \def\markdownRendererD1BeginPrototype{}%
15550 \def\markdownRendererD1BeginTightPrototype{}%
15551 \def\markdownRendererD1ItemPrototype#1{#1}%
15552 \def\markdownRendererD1ItemEndPrototype{}%
15553 \def\markdownRendererD1DefinitionBeginPrototype{}%
15554 \def\markdownRendererD1DefinitionEndPrototype{\par}%
15555 \def\markdownRendererD1EndPrototype{}%
15556 \def\markdownRendererD1EndTightPrototype{}%
15557 \def\markdownRendererEmphasisPrototype#1{{\it#1}}%
15558 \def\markdownRendererStrongEmphasisPrototype#1{{\bf#1}}%
15559 \def\markdownRendererBlockQuoteBeginPrototype{\begingroup\it}%
15560 \def\markdownRendererBlockQuoteEndPrototype{\endgroup\par}%
15561 \def\markdownRendererLineBlockBeginPrototype{\begingroup\parindent=0pt}%
15562 \def\markdownRendererLineBlockEndPrototype{\endgroup}%
15563 \def\markdownRendererInputVerbatimPrototype#1{%
15564     \par{\tt\input#1\relax{}}\par}%
15565 \def\markdownRendererInputFencedCodePrototype#1#2#3{%
15566     \markdownRendererInputVerbatim{#1}}%
15567 \def\markdownRendererHeadingOnePrototype#1{#1}%
15568 \def\markdownRendererHeadingTwoPrototype#1{#1}%
15569 \def\markdownRendererHeadingThreePrototype#1{#1}%
15570 \def\markdownRendererHeadingFourPrototype#1{#1}%
15571 \def\markdownRendererHeadingFivePrototype#1{#1}%
15572 \def\markdownRendererHeadingSixPrototype#1{#1}%
15573 \def\markdownRendererThematicBreakPrototype{}%
15574 \def\markdownRendererNotePrototype#1{#1}%
15575 \def\markdownRendererCitePrototype#1{}%

```



```

15576 \def\markdownRendererTextCitePrototype#1{%
15577 \def\markdownRendererTickedBoxPrototype{[X]}%
15578 \def\markdownRendererHalfTickedBoxPrototype{[/]}%
15579 \def\markdownRendererUntickedBoxPrototype{[ ]}%
15580 \def\markdownRendererStrikeThroughPrototype#1{#1}%
15581 \def\markdownRendererSuperscriptPrototype#1{#1}%
15582 \def\markdownRendererSubscriptPrototype#1{#1}%
15583 \def\markdownRendererDisplayMathPrototype#1{$$#1$$}%
15584 \def\markdownRendererInlineMathPrototype#1{$#1$}%
15585 \ExplSyntaxOn
15586 \cs_gset_protected:Npn
15587   \markdownRendererHeaderAttributeContextBeginPrototype
15588   {
15589     \group_begin:
15590     \color_group_begin:
15591   }
15592 \cs_gset_protected:Npn
15593   \markdownRendererHeaderAttributeContextEndPrototype
15594   {
15595     \color_group_end:
15596     \group_end:
15597   }
15598 \cs_gset_eq:NN
15599   \markdownRendererBracketedSpanAttributeContextBeginPrototype
15600   \markdownRendererHeaderAttributeContextBeginPrototype
15601 \cs_gset_eq:NN
15602   \markdownRendererBracketedSpanAttributeContextEndPrototype
15603   \markdownRendererHeaderAttributeContextEndPrototype
15604 \cs_gset_eq:NN
15605   \markdownRendererFencedDivAttributeContextBeginPrototype
15606   \markdownRendererHeaderAttributeContextBeginPrototype
15607 \cs_gset_eq:NN
15608   \markdownRendererFencedDivAttributeContextEndPrototype
15609   \markdownRendererHeaderAttributeContextEndPrototype
15610 \cs_gset_eq:NN
15611   \markdownRendererFencedCodeAttributeContextBeginPrototype
15612   \markdownRendererHeaderAttributeContextBeginPrototype
15613 \cs_gset_eq:NN
15614   \markdownRendererFencedCodeAttributeContextEndPrototype
15615   \markdownRendererHeaderAttributeContextEndPrototype
15616 \cs_gset:Npn
15617   \markdownRendererReplacementCharacterPrototype
15618   { \codepoint_str_generate:n { fffd } }
15619 \ExplSyntaxOff
15620 \def\markdownRendererSectionBeginPrototype{%
15621 \def\markdownRendererSectionEndPrototype{%
15622 \ExplSyntaxOn

```

```

15623 \cs_gset_protected:Npn
15624   \markdownRendererWarningPrototype
15625   #1#2#3#4
15626   {
15627     \tl_set:Nn
15628       \l_tmpa_tl
15629       { #2 }
15630     \tl_if_empty:nF
15631       { #4 }
15632     {
15633       \tl_put_right:Nn
15634         \l_tmpa_tl
15635         { \iow_newline: #4 }
15636     }
15637     \exp_args:NV
15638       \markdownWarning
15639       \l_tmpa_tl
15640   }
15641 \ExplSyntaxOff
15642 \def\markdownRendererErrorPrototype#1#2#3#4{%
15643   \markdownError{#2}{#4}}%
15644 \def\markdownRendererBracketedSpanPrototype#1{#1}%

```

3.2.3.1 CommonMark Raw html Renderers

The CommonMark raw HTML renderer prototypes (see Section 2.2.5.13) fall back onto the renderer for generic inline HTML tags.

```

15645 \def\markdownRendererInlineHtmlProcessingInstructionPrototype{%
15646   \markdownRendererInlineHtmlTagPrototype}%
15647 \def\markdownRendererInlineHtmlDeclarationPrototype{%
15648   \markdownRendererInlineHtmlTagPrototype}%
15649 \def\markdownRendererInlineHtmlCdataSectionPrototype{%
15650   \markdownRendererInlineHtmlTagPrototype}%
15651 \def\markdownRendererInlineHtmlOpenTagPrototype{%
15652   \markdownRendererInlineHtmlTagPrototype}%
15653 \def\markdownRendererInlineHtmlCloseTagPrototype{%
15654   \markdownRendererInlineHtmlTagPrototype}%
15655 \def\markdownRendererInlineHtmlEmptyTagPrototype{%
15656   \markdownRendererInlineHtmlTagPrototype}%

```

3.2.3.2 CommonMark Block html Renderers

Most CommonMark block HTML renderer prototypes (see Section 2.2.5.12) fall back onto the renderer prototype for generic block HTML elements.

```

15657 \def\markdownRendererInputBlockHtmlCdataElementPrototype{%
15658   \markdownRendererInputBlockHtmlElementPrototype}%
15659 \def\markdownRendererInputBlockHtmlProcessingInstructionPrototype{%

```

```

15660 \markdownRendererInputBlockHtmlElementPrototype}%
15661 \def\markdownRendererInputBlockHtmlDeclarationPrototype{%
15662 \markdownRendererInputBlockHtmlElementPrototype}%
15663 \def\markdownRendererInputBlockHtmlCdataSectionPrototype{%
15664 \markdownRendererInputBlockHtmlElementPrototype}%
15665 \def\markdownRendererInputBlockHtmlPcdataElementPrototype{%
15666 \markdownRendererInputBlockHtmlElementPrototype}%

```

The block comment HTML renderer (type 2) falls back on the renderer prototype for inline HTML elements.

```

15667 \def\markdownRendererBlockHtmlCommentPrototype{%
15668 \markdownRendererInlineHtmlCommentPrototype}%

```

The standalone HTML tag renderer (type 7) falls back on the renderer prototype for generic inline HTML tags.

```

15669 \def\markdownRendererBlockHtmlStandaloneTagPrototype{%
15670 \markdownRendererInlineHtmlTagPrototype}%

```

3.2.3.3 Raw Attributes

In the raw block and inline raw span renderer prototypes, execute the content with TeX when the raw attribute is `tex`, display the content as markdown when the raw attribute is `md`, and ignore the content otherwise.

```

15671 \ExplSyntaxOn
15672 \cs_new:Nn
15673 \@@_plain_tex_default_input_raw_inline:nn
15674 {
15675 \str_case:nn
15676 { #2 }
15677 {
15678 { md } { \markdownInput{#1} }
15679 { tex } { \markdownEscape{#1} \unskip }
15680 }
15681 }
15682 \cs_new:Nn
15683 \@@_plain_tex_default_input_raw_block:nn
15684 {
15685 \str_case:nn
15686 { #2 }
15687 {
15688 { md } { \markdownInput{#1} }
15689 { tex } { \markdownEscape{#1} }
15690 }
15691 }
15692 \cs_gset:Npn
15693 \markdownRendererInputRawInlinePrototype#1#2
15694 {
15695 \@@_plain_tex_default_input_raw_inline:nn

```

```

15696      { #1 }
15697      { #2 }
15698    }
15699 \cs_gset:Npn
15700   \markdownRendererInputRawBlockPrototype#1#2
15701   {
15702     \@@_plain_tex_default_input_raw_block:nn
15703     { #1 }
15704     { #2 }
15705   }
15706 \ExplSyntaxOff

```

3.2.3.4 Simple yaml Metadata Renderer Prototypes

In this section, we implement the simple high-level interface for processing simple YAML metadata using the key-value [markdown/jekyllData](#). See also Section 2.2.6.1.

To keep track of the current type of structure we inhabit when we are traversing a YAML document, we will maintain the `\g_@@_jekyll_data_datatypes_seq` stack. At every step of the traversal, the stack will contain one of the following constants at any position p :

`\c_@@_jekyll_data_sequence_tl` The currently traversed branch of the YAML document contains a sequence at depth p .

`\c_@@_jekyll_data_mapping_tl` The currently traversed branch of the YAML document contains a mapping at depth p .

`\c_@@_jekyll_data_scalar_tl` The currently traversed branch of the YAML document contains a scalar value at depth p .

```

15707 \ExplSyntaxOn
15708 \seq_new:N \g_@@_jekyll_data_datatypes_seq
15709 \tl_const:Nn \c_@@_jekyll_data_sequence_tl { sequence }
15710 \tl_const:Nn \c_@@_jekyll_data_mapping_tl   { mapping   }
15711 \tl_const:Nn \c_@@_jekyll_data_scalar_tl    { scalar    }

```

To keep track of our current place when we are traversing a YAML document, we will maintain the `\g_@@_jekyll_data_wildcard_absolute_address_seq` stack of keys using the `\@@_jekyll_data_push_address_segment:n` macro.

```

15712 \seq_new:N \g_@@_jekyll_data_wildcard_absolute_address_seq
15713 \cs_new:Nn \@@_jekyll_data_push_address_segment:n
15714   {
15715     \seq_if_empty:NF
15716       \g_@@_jekyll_data_datatypes_seq
15717       {
15718         \seq_get_right:NN
15719         \g_@@_jekyll_data_datatypes_seq
15720         \l_tmpa_tl

```

If we are currently in a sequence, we will put an asterisk (*) instead of a key into `\g_@@_jekyll_data_wildcard_absolute_address_seq` to make it represent a *wildcard*. Keeping a wildcard instead of a precise address makes it easy for the users to react to *any* item of a sequence regardless of how many there are, which can often be useful.

```

15721     \str_if_eq:NNTF
15722         \l_tmpa_tl
15723         \c_@@_jekyll_data_sequence_tl
15724     {
15725         \seq_put_right:Nn
15726             \g_@@_jekyll_data_wildcard_absolute_address_seq
15727             { * }
15728     }
15729     {
15730         \seq_put_right:Nn
15731             \g_@@_jekyll_data_wildcard_absolute_address_seq
15732             { #1 }
15733     }
15734 }
15735 }

```

Out of `\g_@@_jekyll_data_wildcard_absolute_address_seq`, we will construct the following two token lists:

`\g_@@_jekyll_data_wildcard_absolute_address_tl` An *absolute wildcard*: The wildcard from the root of the document prefixed with a slash (/) with individual keys and asterisks also delimited by slashes. Allows the users to react to complex context-sensitive structures with ease.

For example, the `name` key in the following YAML document would correspond to the `/*/person/name` absolute wildcard:

```
[{person: {name: Elon, surname: Musk}}]
```

`\g_@@_jekyll_data_wildcard_relative_address_tl` A *relative wildcard*: The rightmost segment of the wildcard. Allows the users to react to simple context-free structures.

For example, the `name` key in the following YAML document would correspond to the `name` relative wildcard:

```
[{person: {name: Elon, surname: Musk}}]
```

We will construct `\g_@@_jekyll_data_wildcard_absolute_address_tl` using the `\@@_jekyll_data_concatenate_address:NN` macro and we will construct both token lists using the `\@@_jekyll_data_update_address_tls:` macro.

```

15736 \tl_new:N \g_@@_jekyll_data_wildcard_absolute_address_tl
15737 \tl_new:N \g_@@_jekyll_data_wildcard_relative_address_tl
15738 \cs_new_protected:Nn \@@_jekyll_data_concatenate_address:NN
15739 {
15740     \seq_pop_left:NN #1 \l_tmpa_tl
15741     \tl_set:Nx #2 { / \seq_use:Nn #1 { / } }
15742     \seq_put_left:NV #1 \l_tmpa_tl
15743 }
15744 \cs_new_protected:Nn \@@_jekyll_data_update_address_tls:
15745 {
15746     \@@_jekyll_data_concatenate_address:NN
15747     \g_@@_jekyll_data_wildcard_absolute_address_seq
15748     \g_@@_jekyll_data_wildcard_absolute_address_tl
15749     \seq_get_right:NN
15750     \g_@@_jekyll_data_wildcard_absolute_address_seq
15751     \g_@@_jekyll_data_wildcard_relative_address_tl
15752 }

```

To make sure that the stacks and token lists stay in sync, we will use the `\@@_jekyll_data_push:nN` and `\@@_jekyll_data_pop:` macros.

```

15753 \cs_new_protected:Nn \@@_jekyll_data_push:nN
15754 {
15755     \@@_jekyll_data_push_address_segment:n
15756     { #1 }
15757     \seq_put_right:NV
15758     \g_@@_jekyll_data_datatypes_seq
15759     #2
15760     \@@_jekyll_data_update_address_tls:
15761 }
15762 \cs_new_protected:Nn \@@_jekyll_data_pop:
15763 {
15764     \seq_pop_right:NN
15765     \g_@@_jekyll_data_wildcard_absolute_address_seq
15766     \l_tmpa_tl
15767     \seq_pop_right:NN
15768     \g_@@_jekyll_data_datatypes_seq
15769     \l_tmpa_tl
15770     \@@_jekyll_data_update_address_tls:
15771 }

```

To set a single key–value, we will use the `\@@_jekyll_data_set_keyval_known:nn` macro, ignoring unknown keys. To set key–values for both absolute and relative wildcards, we will use the `\@@_jekyll_data_set_keyvals_known:nn` macro.

```

15772 \cs_new_protected:Nn \@@_jekyll_data_set_keyval_known:nn
15773 {
15774     \keys_set_known:nn
15775     { markdown/jekyllData }
15776     { { #1 } = { #2 } }

```

```

15777     }
15778 \cs_generate_variant:Nn
15779   \@@_jekyll_data_set_keyval_known:nn
15780   { Vn }
15781 \cs_new_protected:Nn \@@_jekyll_data_set_keyvals_known:nn
15782 {
15783   \@@_jekyll_data_push:nN
15784     { #1 }
15785     \c_@@_jekyll_data_scalar_tl
15786     \@@_jekyll_data_set_keyval_known:Vn
15787     \g_@@_jekyll_data_wildcard_absolute_address_tl
15788     { #2 }
15789     \@@_jekyll_data_set_keyval_known:Vn
15790     \g_@@_jekyll_data_wildcard_relative_address_tl
15791     { #2 }
15792     \@@_jekyll_data_pop:
15793 }

```

Finally, we will register our macros as token renderer prototypes to be able to react to the traversal of a YAML document.

```

15794 \cs_gset_protected:Npn
15795   \markdownRendererJekyllDataSequenceBeginPrototype #1#2
15796 {
15797   \@@_jekyll_data_push:nN
15798     { #1 }
15799     \c_@@_jekyll_data_sequence_tl
15800 }
15801 \cs_gset_protected:Npn
15802   \markdownRendererJekyllDataMappingBeginPrototype #1#2
15803 {
15804   \@@_jekyll_data_push:nN
15805     { #1 }
15806     \c_@@_jekyll_data_mapping_tl
15807 }
15808 \cs_gset_protected:Npn
15809   \markdownRendererJekyllDataSequenceEndPrototype
15810 {
15811   \@@_jekyll_data_pop:
15812 }
15813 \cs_gset_protected:Npn
15814   \markdownRendererJekyllDataMappingEndPrototype
15815 {
15816   \@@_jekyll_data_pop:
15817 }
15818 \cs_gset_protected:Npn
15819   \markdownRendererJekyllDataBooleanPrototype #1#2
15820 {

```

```

15821     \@@_jekyll_data_set_keyvals_known:nn
15822     { #1 }
15823     { #2 }
15824   }
15825 \def\markdownRendererJekyllDataEmptyPrototype#1{}
15826 \cs_gset_protected:Npn
15827   \markdownRendererJekyllDataNumberPrototype #1#2
15828   {
15829     \@@_jekyll_data_set_keyvals_known:nn
15830     { #1 }
15831     { #2 }
15832   }

```

We will process all string scalar values assuming that they may contain markdown markup and are intended for typesetting.

```

15833 \def\markdownRendererJekyllDataProgrammaticStringPrototype#1#2{}
15834 \cs_gset_protected:Npn
15835   \markdownRendererJekyllDataTypographicStringPrototype #1#2
15836   {
15837     \@@_jekyll_data_set_keyvals_known:nn
15838     { #1 }
15839     { #2 }
15840   }
15841 \ExplSyntaxOff

```

3.2.3.5 Complex yaml Metadata Renderer Prototypes

In this section, we implement the high-level interface for routing complex YAML metadata to expl3 key-values using the option `jekyllDataKeyValue=<module>`. See also Section 2.2.6.1.

```

15842 \ExplSyntaxOn
15843 \@@_with_various_cases:nn
15844 { jekyllDataKeyValue }
15845 {
15846   \keys_define:nn
15847     { markdown/options }
15848     {
15849       #1 .code:n = {
15850         \@@_route_jekyll_data_to_key_values:n
15851         { ##1 }
15852       },

```

When no `<module>` has been provided, assume that the YAML metadata specify absolute paths to key-values.

```

15853       #1 .value_required:n = { false },
15854       #1 .default:n = { },
15855     }
15856   }

```



```

15857 \seq_new:N
15858   \l_@@_jekyll_data_current_position_seq
15859 \tl_new:N
15860   \l_@@_jekyll_data_current_position_tl
15861 \cs_new_protected:Nn
15862   \@@_route_jekyll_data_to_key_values:n
15863   {
15864     \markdownSetup
15865     {
15866       renderers = {
15867         jekyllData(Sequence|Mapping)Begin = {
15868           \bool_lazy_and:nnTF
15869           {
15870             \seq_if_empty_p:N
15871             \l_@@_jekyll_data_current_position_seq
15872           }
15873           {
15874             \str_if_eq_p:nn
15875             { ##1 }
15876             { null }
15877           }
15878         }
15879         \tl_if_empty:nF
15880         { #1 }
15881         {
15882           \seq_put_right:Nn
15883           \l_@@_jekyll_data_current_position_seq
15884           { #1 }
15885         }
15886       }
15887       {
15888         \seq_put_right:Nn
15889         \l_@@_jekyll_data_current_position_seq
15890         { ##1 }
15891       }
15892     },
15893     jekyllData(Sequence|Mapping)End = {
15894       \seq_pop_right:NN
15895       \l_@@_jekyll_data_current_position_seq
15896       \l_tmpa_tl
15897     },

```

For every YAML key `path.to.<key>` with a value of type *<non-string type>*, set the key *<non-string type>* of the key-value *<module>/path/to/<key>* if it is known and the key *<key>* of the key-value *<module>/path/to* otherwise. *<Non-string type>* is one of `boolean`, `number`, and `empty`.

```

15898     jekyllDataBoolean = {

```

```

15899      \tl_set:Nx
15900      \l_@@_jekyll_data_current_position_tl
15901      {
15902        \seq_use:Nn
15903        \l_@@_jekyll_data_current_position_seq
15904        { / }
15905      }
15906      \keys_if_exist:VnTF
15907      \l_@@_jekyll_data_current_position_tl
15908      { ##1 / boolean }
15909      {
15910        \@@_keys_set:xn
15911        {
15912          \tl_use:N
15913          \l_@@_jekyll_data_current_position_tl
15914          / ##1 / boolean
15915        }
15916        { ##2 }
15917      }
15918      {
15919        \@@_keys_set:xn
15920        {
15921          \tl_use:N
15922          \l_@@_jekyll_data_current_position_tl
15923          / ##1
15924        }
15925        { ##2 }
15926      }
15927    },
15928    jekyllDataNumber = {
15929      \tl_set:Nx
15930      \l_@@_jekyll_data_current_position_tl
15931      {
15932        \seq_use:Nn
15933        \l_@@_jekyll_data_current_position_seq
15934        { / }
15935      }
15936      \keys_if_exist:VnTF
15937      \l_@@_jekyll_data_current_position_tl
15938      { ##1 / number }
15939      {
15940        \@@_keys_set:xn
15941        {
15942          \tl_use:N
15943          \l_@@_jekyll_data_current_position_tl
15944          / ##1 / number
15945        }

```

```

15946         { ##2 }
15947     }
15948     {
15949         \@@_keys_set:xn
15950         {
15951             \tl_use:N
15952             \l_@@_jekyll_data_current_position_tl
15953             / ##1
15954         }
15955         { ##2 }
15956     }
15957 },

```

For the $\langle non-string\ type \rangle$ of `empty`, no value is passed to the key–value. Therefore, a default value should always be defined for nullable keys using the key property `.default:n`.

```

15958 jekyllDataEmpty = {
15959     \tl_set:Nx
15960     \l_@@_jekyll_data_current_position_tl
15961     {
15962         \seq_use:Nn
15963         \l_@@_jekyll_data_current_position_seq
15964         { / }
15965     }
15966     \keys_if_exist:VnTF
15967     \l_@@_jekyll_data_current_position_tl
15968     { ##1 / empty }
15969     {
15970         \keys_set:xn
15971         {
15972             \tl_use:N
15973             \l_@@_jekyll_data_current_position_tl
15974             / ##1
15975         }
15976         { empty }
15977     }
15978     {
15979         \keys_set:Vn
15980         \l_@@_jekyll_data_current_position_tl
15981         { ##1 }
15982     }
15983 },

```

For every YAML key `path.to.<key>` with a value of type `string`, set the keys `typographicString` and `programmaticString` of the key–value $\langle module \rangle / \text{path/to} / \langle key \rangle$ if they are known with the typographic and programmatic strings of the value, respectively. Furthermore, set the key $\langle key \rangle$ of the

key–value $\langle module \rangle / \text{path/to}$ with the typographic string of the value unless the key `typographicString` is known. If the key `programmaticString` is known, only set the key $\langle key \rangle$ if it is known. In contrast, if neither `typographicString` nor `programmaticString` are known, set $\langle key \rangle$ normally, i.e. regardless of whether it is known or unknown.

```

15984         jekyllDataTypographicString = {
15985             \tl_set:Nx
15986                 \l_@@_jekyll_data_current_position_tl
15987             {
15988                 \seq_use:Nn
15989                     \l_@@_jekyll_data_current_position_seq
15990                 { / }
15991             }
15992         \keys_if_exist:VnTF
15993             \l_@@_jekyll_data_current_position_tl
15994         { ##1 / typographicString }
15995         {
15996             \@@_keys_set:xn
15997             {
15998                 \tl_use:N
15999                     \l_@@_jekyll_data_current_position_tl
16000                 / ##1 / typographicString
16001             }
16002             { ##2 }
16003         }
16004         {
16005             \keys_if_exist:VnTF
16006                 \l_@@_jekyll_data_current_position_tl
16007             { ##1 / programmaticString }
16008             {
16009                 \@@_keys_set_known:xn
16010                 {
16011                     \tl_use:N
16012                         \l_@@_jekyll_data_current_position_tl
16013                     / ##1
16014                 }
16015                 { ##2 }
16016             }
16017             {
16018                 \@@_keys_set:xn
16019                 {
16020                     \tl_use:N
16021                         \l_@@_jekyll_data_current_position_tl
16022                     / ##1
16023                 }
16024                 { ##2 }

```

```

16025         }
16026     }
16027 },
16028 jekyllDataProgrammaticString = {
16029     \tl_set:Nx
16030     \l_@@_jekyll_data_current_position_tl
16031     {
16032         \seq_use:Nn
16033         \l_@@_jekyll_data_current_position_seq
16034         { / }
16035     }
16036     \keys_if_exist:VnT
16037     \l_@@_jekyll_data_current_position_tl
16038     { ##1 / programmaticString }
16039     {
16040         \@@_keys_set:xn
16041         {
16042             \tl_use:N
16043             \l_@@_jekyll_data_current_position_tl
16044             / ##1 / programmaticString
16045         }
16046         { ##2 }
16047     }
16048 },
16049 },
16050 }
16051 }
16052 \cs_new_protected:Nn
16053 \@@_keys_set:nn
16054 {
16055     \keys_set:nn
16056     { }
16057     { { #1 } = { #2 } }
16058 }
16059 \cs_new_protected:Nn
16060 \@@_keys_set_known:nn
16061 {
16062     \keys_set_known:nn
16063     { }
16064     { { #1 } = { #2 } }
16065 }
16066 \cs_generate_variant:Nn
16067 \@@_keys_set:nn
16068 { xn }
16069 \cs_generate_variant:Nn
16070 \@@_keys_set_known:nn
16071 { xn }

```

```

16072 \cs_generate_variant:Nn
16073   \keys_set:nn
16074   { xn, Vn }
16075 \prg_generate_conditional_variant:Nnn
16076   \keys_if_exist:nn
16077   { Vn }
16078   { T, TF }
16079 \ExplSyntaxOff

```

If plain T_EX is the top layer, we load the [witiko/markdown/defaults](#) plain T_EX theme with the default definitions for token renderer prototypes unless the option [noDefaults](#) has been enabled (see Section 2.2.2.3).

```

16080 \ExplSyntaxOn
16081 \str_if_eq:VVT
16082   \c_@@_top_layer_tl
16083   \c_@@_option_layer_plain_tex_tl
16084   {
16085     \use:c
16086       { ExplSyntaxOff }
16087     \@@_if_option:nF
16088       { noDefaults }
16089     {
16090       \@@_if_option:nTF
16091         { experimental }
16092         {
16093           \@@_setup:n
16094             { theme = witiko/markdown/defaults@experimental }
16095         }
16096         {
16097           \@@_setup:n
16098             { theme = witiko/markdown/defaults }
16099         }
16100     }
16101     \use:c
16102       { ExplSyntaxOn }
16103   }
16104 \ExplSyntaxOff

```

3.2.4 Lua Snippets

After the [\markdownPrepareLuaOptions](#) macro has been fully expanded, the [\markdownLuaOptions](#) macro will expand to a Lua table that contains the plain T_EX options (see Section 2.2.2) in a format recognized by Lua (see Section 2.1.3).

```

16105 \ExplSyntaxOn
16106 \tl_new:N \g_@@_formatted_lua_options_tl
16107 \cs_new_protected:Nn \@@_format_lua_options:
16108   {

```

```

16109     \tl_gclear:N
16110     \g_@@_formatted_lua_options_tl
16111     \seq_map_function:NN
16112     \g_@@_lua_options_seq
16113     \@@_format_lua_option:n
16114   }
16115 \cs_new_protected:Nn \@@_format_lua_option:n
16116 {
16117   \@@_typecheck_option:n
16118   { #1 }
16119   \@@_get_option_type:nN
16120   { #1 }
16121   \l_tmpa_tl
16122   \bool_case_true:nF
16123   {
16124     {
16125       \str_if_eq_p:VV
16126       \l_tmpa_tl
16127       \c_@@_option_type_boolean_tl ||
16128       \str_if_eq_p:VV
16129       \l_tmpa_tl
16130       \c_@@_option_type_number_tl ||
16131       \str_if_eq_p:VV
16132       \l_tmpa_tl
16133       \c_@@_option_type_counter_tl
16134     }
16135     {
16136       \@@_get_option_value:nN
16137       { #1 }
16138       \l_tmpa_tl
16139       \tl_gput_right:Nx
16140       \g_@@_formatted_lua_options_tl
16141       { #1~~~ \l_tmpa_tl ,~ }
16142     }
16143   }
16144   \str_if_eq_p:VV
16145   \l_tmpa_tl
16146   \c_@@_option_type_clist_tl
16147 }
16148 {
16149   \@@_get_option_value:nN
16150   { #1 }
16151   \l_tmpa_tl
16152   \tl_gput_right:Nx
16153   \g_@@_formatted_lua_options_tl
16154   { #1~~~\c_left_brace_str }
16155   \clist_map_inline:Vn

```

```

16156         \l_tmpa_tl
16157     {
16158         \@@_lua_escape:xN
16159         { ##1 }
16160         \l_tmpb_tl
16161         \tl_gput_right:Nn
16162         \g_@@_formatted_lua_options_tl
16163         { " }
16164         \tl_gput_right:NV
16165         \g_@@_formatted_lua_options_tl
16166         \l_tmpb_tl
16167         \tl_gput_right:Nn
16168         \g_@@_formatted_lua_options_tl
16169         { " ,~ }
16170     }
16171     \tl_gput_right:Nx
16172     \g_@@_formatted_lua_options_tl
16173     { \c_right_brace_str ,~ }
16174 }
16175 }
16176 {
16177     \@@_get_option_value:nN
16178     { #1 }
16179     \l_tmpa_tl
16180     \@@_lua_escape:xN
16181     { \l_tmpa_tl }
16182     \l_tmpb_tl
16183     \tl_gput_right:Nn
16184     \g_@@_formatted_lua_options_tl
16185     { #1~~ " }
16186     \tl_gput_right:NV
16187     \g_@@_formatted_lua_options_tl
16188     \l_tmpb_tl
16189     \tl_gput_right:Nn
16190     \g_@@_formatted_lua_options_tl
16191     { " ,~ }
16192 }
16193 }
16194 \cs_generate_variant:Nn
16195 \clist_map_inline:nn
16196 { Vn }
16197 \let
16198 \markdownPrepareLuaOptions
16199 \@@_format_lua_options:
16200 \def
16201 \markdownLuaOptions
16202 {

```



```

16203     {
16204     \g_@@_formatted_lua_options_tl
16205     }
16206   }
16207 \sys_if_engine luatex:TF
16208 {
16209   \cs_new_protected:Nn
16210     \@@_lua_escape:nN
16211     {
16212       \tl_set:Nx
16213         #2
16214         {
16215           \lua_escape:n
16216             { #1 }
16217         }
16218     }
16219   }
16220   {
16221     \regex_const:Nn
16222       \c_@@_lua_escape_regex
16223       { [\\"' ] }
16224     \cs_new_protected:Nn
16225       \@@_lua_escape:nN
16226       {
16227         \tl_set:Nn
16228           #2
16229           { #1 }
16230         \regex_replace_all:NnN
16231           \c_@@_lua_escape_regex
16232           { \u { c_backslash_str } \0 }
16233         #2
16234       }
16235     }
16236 \cs_generate_variant:Nn
16237   \@@_lua_escape:nN
16238   { xN }

```

After the `\markdownPrepareInputFilename` macro has been fully expanded, the `\markdownInputFilename` macro will expand to a Lua string that contains the input filename passed as the first argument.

```

16239 \tl_new:N
16240   \markdownInputFilename
16241 \cs_new_protected:Npn
16242   \markdownPrepareInputFilename
16243   #1
16244   {
16245     \@@_lua_escape:xN

```

```

16246      { #1 }
16247      \markdownInputFilename
16248      \tl_gset:Nx
16249      \markdownInputFilename
16250      { " \markdownInputFilename " }
16251  }

```

The `\markdownPrepare` macro contains the Lua code that is executed prior to any conversion from markdown to plain T_EX. It exposes the `convert` function for the use by any further Lua code.

```

16252 \cs_new:Npn
16253 \markdownPrepare
16254 {

```

First, ensure that the `cacheDir` directory exists.

```

16255     local~lfs = require("lfs")
16256     local~options = \markdownLuaOptions
16257     if~not~lfs.isdir(options.cacheDir) then~
16258         assert(lfs.mkdir(options.cacheDir))
16259     end~

```

Next, load the `markdown` module and create a converter function using the plain T_EX options, which were serialized to a Lua table via the `\markdownLuaOptions` macro.

```

16260     local~md = require("markdown")
16261     local~convert = md.new(options)
16262 }

```

The `\markdownConvert` macro contains the Lua code that is executed during the conversion from markdown to plain T_EX. It opens the input file, converts it, and prints the conversion result.

```

16263 \cs_new:Npn
16264 \markdownConvert
16265 {
16266     local~filename = \markdownInputFilename
16267     local~file = assert(io.open(filename, "r"),
16268         [[Could~not~open~file~]] .. filename .. [[~for~reading]])
16269     local~input = assert(file:read("*a"))
16270     assert(file:close())
16271     print(convert(input))
16272 }
16273 \ExplSyntaxOff

```

The `\markdownCleanup` macro contains the Lua code that is executed after any conversion from markdown to plain T_EX.

```

16274 \def\markdownCleanup{%

```

Remove the `options.cacheDir` directory if it is empty.

```

16275     if options.cacheDir then
16276         lfs.rmdir(options.cacheDir)

```

```

16277   end
16278 }%

```

3.2.5 Buffering Block-Level Markdown Input

The macros `\markdownInputFileStream` and `\markdownOutputFileStream` contain the number of the input and output file streams that will be used for the IO operations of the package.

```

16279 \csname newread\endcsname\markdownInputFileStream
16280 \csname newwrite\endcsname\markdownOutputFileStream

```

The `\markdownReadAndConvertTab` macro contains the tab character literal.

```

16281 \begingroup
16282   \catcode\^^I=12%
16283   \gdef\markdownReadAndConvertTab{^^I}%
16284 \endgroup

```

The `\markdownReadAndConvert` macro is largely a rewrite of the $\text{\LaTeX 2}_{\epsilon}$ `\filecontents` macro to plain \TeX .

```

16285 \begingroup

```

Make the newline and tab characters active and swap the character codes of the backslash symbol (`\`) and the pipe symbol (`|`), so that we can use the backslash as an ordinary character inside the macro definition. Likewise, swap the character codes of the percent sign (`%`) and the ampersand (`@`), so that we can remove percent signs from the beginning of lines when `stripPercentSigns` is enabled.

```

16286   \catcode\^^M=13%
16287   \catcode\^^I=13%
16288   \catcode|=0%
16289   \catcode\=12%
16290   |catcode@=14%
16291   |catcode|=12@
16292   |gdef|markdownReadAndConvert#1#2{@
16293     |begingroup@

```

If we are not reading markdown documents from the frozen cache, open the `inputTempFileName` file for writing.

```

16294     |markdownIfOption{frozenCache}{@}{@
16295       |immediate|openout|markdownOutputFileStream@
16296       |markdownOptionInputTempFileName|relax@
16297     |markdownInfo{@
16298       Buffering block-level markdown input into the temporary @
16299       input file "|markdownOptionInputTempFileName" and scanning @
16300       for the closing token sequence "#1"}@
16301   }@

```

Locally change the category of the special plain T_EX characters to *other* in order to prevent unwanted interpretation of the input. Change also the category of the space character, so that we can retrieve it unaltered.

```
16302      |def|do##1{|catcode`##1=12}|dospecials@
16303      |catcode`| =12@
16304      |markdownMakeOther@
```

The `\markdownReadAndConvertStripPercentSigns` macro will process the individual lines of output, stripping away leading percent signs (%) when `stripPercentSigns` is enabled. Notice the use of the comments (@) to ensure that the entire macro is at a single line and therefore no (active) newline symbols (`^^M`) are produced.

```
16305      |def|markdownReadAndConvertStripPercentSign##1{@
16306          |markdownIfOption{stripPercentSigns}{@
16307              |if##1%@
16308                  |expandafter|expandafter|expandafter@
16309                  |markdownReadAndConvertProcessLine@
16310              |else@
16311                  |expandafter|expandafter|expandafter@
16312                  |markdownReadAndConvertProcessLine@
16313                  |expandafter|expandafter|expandafter##1@
16314              |fi@
16315          }{@
16316              |expandafter@
16317              |markdownReadAndConvertProcessLine@
16318              |expandafter##1@
16319          }@
16320      }@
```

The `\markdownReadAndConvertProcessLine` macro will process the individual lines of output. Notice the use of the comments (@) to ensure that the entire macro is at a single line and therefore no (active) newline symbols (`^^M`) are produced.

```
16321      |def|markdownReadAndConvertProcessLine##1##2##3|relax{@
```

If we are not reading markdown documents from the frozen cache and the ending token sequence does not appear in the line, store the line in the `inputTempFileName` file. If we are reading markdown documents from the frozen cache and the ending token sequence does not appear in the line, gobble the line.

```
16322          |ifx|relax##3|relax@
16323          |markdownIfOption{frozenCache}{@}{@
16324              |immediate|write|markdownOutputFileStream{##1}@
16325          }@
16326          |else@
```

When the ending token sequence appears in the line, make the next newline character close the `inputTempFileName` file, return the character categories back to the former state, convert the `inputTempFileName` file from markdown to plain T_EX, `\input` the result of the conversion, and expand the ending control sequence.

```

16327         |def^^M{@
16328             |markdownInfo{The ending token sequence was found}@
16329             |markdownIfOption{frozenCache}{-}{@
16330                 |immediate|closeout|markdownOutputFileStream@
16331             }@
16332         |endgroup@
16333         |markdownInput{@
16334             |markdownOptionOutputDir@
16335             /|markdownOptionInputTempFileName@
16336         }@
16337         #2}@
16338     |fi@

```

Repeat with the next line.

```

16339         ^^M}@

```

Make the tab character active at expansion time and make it expand to a literal tab character.

```

16340         |catcode`|^~I=13@
16341         |def^^I{|markdownReadAndConvertTab}@

```

Make the newline character active at expansion time and make it consume the rest of the line on expansion. Throw away the rest of the first line and pass the second line to the `\markdownReadAndConvertProcessLine` macro.

```

16342         |catcode`|^~M=13@
16343         |def^^M##1^^M{@
16344             |def^^M###1^^M{@
16345                 |markdownReadAndConvertStripPercentSign####1#1#1|relax}@
16346             ^^M}@
16347         ^^M}@

```

Reset the character categories back to the former state.

```

16348 |endgroup

```

Use the `lt3luabridge` library to define the `\markdownLuaExecute` macro, which takes in a Lua scripts and expands to the standard output produced by its execution.

```

16349 \ExplSyntaxOn
16350 \cs_new_protected:Npn
16351   \markdownLuaExecute
16352   #1
16353   {
16354     \int_compare:nNtT
16355       { \g_luabridge_method_int }
16356       =
16357       { \c_luabridge_method_shell_int }
16358       {
16359         \sys_if_shell_unrestricted:F
16360         {
16361           \sys_if_shell:TF

```

```

16362         {
16363             \msg_error:nn
16364             { markdown }
16365             { restricted-shell-access }
16366         }
16367         {
16368             \msg_error:nn
16369             { markdown }
16370             { disabled-shell-access }
16371         }
16372     }
16373 }
16374 \str_gset:NV
16375   \g_luabridge_output_dirname_str
16376   \markdownOptionOutputDir
16377 \luabridge_now:e
16378   { #1 }
16379 }
16380 \cs_generate_variant:Nn
16381   \msg_new:nnnn
16382   { nnnV }
16383 \tl_set:Nn
16384   \l_tmpa_tl
16385   {
16386     You~may~need~to~run~TeX~with~the~---shell-escape~or~the~
16387     --enable-write18~flag,~or~write~shell_escape=t~in~the~
16388     texmf.cnf~file.
16389   }
16390 \msg_new:nnnV
16391   { markdown }
16392   { restricted-shell-access }
16393   { Shell~escape~is~restricted }
16394   \l_tmpa_tl
16395 \msg_new:nnnV
16396   { markdown }
16397   { disabled-shell-access }
16398   { Shell~escape~is~disabled }
16399   \l_tmpa_tl
16400 \ExplSyntaxOff

```

3.2.6 Buffering Inline Markdown Input

This section describes the implementation of the macro `\markinline`.

```

16401 \ExplSyntaxOn
16402 \tl_new:N
16403   \g_@@_after_markinline_tl
16404 \tl_gset:Nn

```

```

16405 \g_@@_after_markinline_tl
16406 { \unskip }
16407 \cs_new_protected:Npn
16408 \markinline
16409 {

```

Locally change the category of the special plain T_EX characters to *other* in order to prevent unwanted interpretation of the input markdown text as T_EX code.

```

16410 \group_begin:
16411 \cctab_select:N
16412 \c_other_cctab

```

Unless we are reading markdown documents from the frozen cache, open the file `inputTempFileName` for writing.

```

16413 \@@_if_option:nF
16414 { frozenCache }
16415 {
16416 \immediate
16417 \openout
16418 \markdownOutputFileStream
16419 \markdownOptionInputTempFileName
16420 \relax
16421 \msg_info:nne
16422 { markdown }
16423 { buffering-markinline }
16424 { \markdownOptionInputTempFileName }
16425 }

```

Peek ahead and extract the inline markdown text.

```

16426 \peek_regex_replace_once:nnF
16427 { { (.*) } }
16428 {

```

Unless we are reading markdown documents from the frozen cache, store the text in the file `inputTempFileName` and close it.

```

16429 \c { @@_if_option:nF }
16430 \cB { frozenCache \cE }
16431 \cB {
16432 \c { immediate }
16433 \c { write }
16434 \c { markdownOutputFileStream }
16435 \cB { \1 \cE }
16436 \c { immediate }
16437 \c { closeout }
16438 \c { markdownOutputFileStream }
16439 \cE }

```

Reset the category codes and `\input` the result of the conversion.

```

16440 \c { group_end: }

```

```

16441 \c { group_begin: }
16442 \c { @@_setup:n }
16443 \cB { contentLevel = inline \cE }
16444 \c { markdownInput }
16445 \cB {
16446 \c { markdownOptionOutputDir } /
16447 \c { markdownOptionInputTempFileName }
16448 \cE }
16449 \c { group_end: }
16450 \c { tl_use:N }
16451 \c { g_@@_after_markinline_tl }
16452 }
16453 {
16454 \msg_error:nn
16455 { markdown }
16456 { markinline-peek-failure }
16457 \group_end:
16458 \tl_use:N
16459 \g_@@_after_markinline_tl
16460 }
16461 }
16462 \msg_new:nnn
16463 { markdown }
16464 { buffering-markinline }
16465 { Buffering~inline~markdown~input~into~
16466 the~temporary~input~file~"#1". }
16467 \msg_new:nnnn
16468 { markdown }
16469 { markinline-peek-failure }
16470 { Use~of~\iow_char:N \ markinline~doesn't~match~its~definition }
16471 { The~macro~should~be~followed~by~inline~
16472 markdown~text~in~curly~braces }
16473 \ExplSyntaxOff

```

3.2.7 Typesetting Markdown

The `\markdownInput` macro uses an implementation of the `\markdownLuaExecute` macro to convert the contents of the file whose filename it has received as its single argument from markdown to plain T_EX.

```

16474 \ExplSyntaxOn
16475 \cs_new_protected:Npn
16476 \markdownInput
16477 #1
16478 {
16479 \@@_if_option:nTF
16480 { frozenCache }

```



```

16481     {
16482         \markdownInputRaw
16483         { #1 }
16484     }
16485     {

```

If the file does not exist in the current directory, we will search for it in the directories specified in `\l_file_search_path_seq`. On \LaTeX , this also includes the directories specified in `\input@path`.

```

16486         \tl_set:Nx
16487         \l_tmpa_tl
16488         { #1 }
16489         \file_get_full_name:VNTF
16490         \l_tmpa_tl
16491         \l_tmpb_tl
16492         {
16493             \exp_args:NV
16494             \markdownInputRaw
16495             \l_tmpb_tl
16496         }
16497         {
16498             \msg_error:nnV
16499             { markdown }
16500             { markdown-file-does-not-exist }
16501             \l_tmpa_tl
16502         }
16503     }
16504 }
16505 \msg_new:nnn
16506 { markdown }
16507 { markdown-file-does-not-exist }
16508 {
16509     Markdown~file~#1~does~not~exist
16510 }
16511 \ExplSyntaxOff
16512 \begingroup

```

Swap the category code of the backslash symbol and the pipe symbol, so that we may use the backslash symbol freely inside the Lua code. Furthermore, use the ampersand symbol to specify parameters.

```

16513 \catcode`\=0%
16514 \catcode`\=12%
16515 \catcode`\&=6%
16516 \gdef|markdownInputRaw#1{%

```

Change the category code of the percent sign (%) to other, so that a user of the `hybrid` Lua option or a malevolent actor can't produce TeX comments in the plain TeX output of the Markdown package.

```

16517     |begingroup
16518     |catcode`|# =12

```

Furthermore, also change the category code of the hash sign (#) to other, so that it's safe to tokenize the plain TeX output without mistaking hash signs with TeX's parameter numbers.

```

16519     |catcode`|# =12

```

If we are reading from the frozen cache, input it, expand the corresponding `\markdownFrozenCache<number>` macro, and increment `frozenCacheCounter`.

```

16520     |markdownIfOption{frozenCache}{%
16521         |ifnum|markdownOptionFrozenCacheCounter=0|relax
16522         |markdownInfo{Reading frozen cache from
16523             "|markdownOptionFrozenCacheFileName"}%
16524         |input|markdownOptionFrozenCacheFileName|relax
16525     |fi
16526     |markdownInfo{Including markdown document number
16527         "|the|markdownOptionFrozenCacheCounter" from frozen cache}%
16528     |csname markdownFrozenCache%
16529         |the|markdownOptionFrozenCacheCounter|endcsname
16530     |global|advance|markdownOptionFrozenCacheCounter by 1|relax
16531 }{%
16532     |markdownInfo{Including markdown document "&1"}%

```

Attempt to open the markdown document to record it in the `.log` and `.fls` files. This allows external programs such as L^AT_EX Mk to track changes to the markdown document.

```

16533     |openin|markdownInputFileStream{&1}%
16534     |closein|markdownInputFileStream
16535     |markdownPrepareLuaOptions
16536     |markdownPrepareInputFilename{&1}%
16537     |markdownLuaExecute{%
16538         |markdownPrepare
16539         |markdownConvert
16540         |markdownCleanup}%

```

If we are finalizing the frozen cache, increment `frozenCacheCounter`.

```

16541     |markdownIfOption{finalizeCache}{%
16542         |global|advance|markdownOptionFrozenCacheCounter by 1|relax}{}%
16543     }%
16544     |endgroup
16545 }%
16546 |endgroup

```

The `\markdownEscape` macro resets the category codes of the percent sign and the hash sign back to comment and parameter, respectively, before using the `\input` built-in of T_EX to execute a T_EX document in the middle of a markdown document fragment.

```

16547 \gdef\markdownEscape#1{%
16548   \catcode`\%=14\relax
16549   \catcode`\#=6\relax
16550   \input #1\relax
16551   \catcode`\%=12\relax
16552   \catcode`\#=12\relax
16553 }%

```

3.3 L^AT_EX Implementation

The L^AT_EX implementation makes use of the fact that, apart from some subtle differences, L^AT_EX implements the majority of the plain T_EX format [19, Section 9]. As a consequence, we can directly reuse the existing plain T_EX implementation.

```

16554 \def\markdownVersionSpace{ }%
16555 \ProvidesPackage{markdown}[\markdownLastModified\markdownVersionSpace v%
16556   \markdownVersion\markdownVersionSpace markdown renderer]%

```

3.3.1 Typesetting Markdown

The `\markinlinePlainTeX` macro is used to store the original plain T_EX implementation of the `\markinline` macro. The `\markinline` macro is then redefined to accept an optional argument with options recognized by the L^AT_EX interface (see Section 2.3.3).

```

16557 \ExplSyntaxOn
16558 \cs_gset_eq:NN
16559   \markinlinePlainTeX
16560   \markinline
16561 \cs_gset_protected:Npn
16562   \markinline
16563   {
16564     \peek_regex_replace_once:nn
16565       { ( \[ (.*) \] ) ? }
16566       {

```

Apply the options locally.

```

16567       \c { group_begin: }
16568       \c { @@_setup:n }
16569       \cB { \2 \cE }
16570       \c { tl_put_right:Nn }
16571       \c { g_@@_after_markinline_tl }
16572       \cB { \c { group_end: } \cE }
16573       \c { markinlinePlainTeX }
16574     }
16575   }
16576 \ExplSyntaxOff

```

The `\markdownInputPlainTeX` macro is used to store the original plain TeX implementation of the `\yamlInput` macro. The `\markdownInput` and `\yamlInput` macros are then redefined to accept an optional argument with options recognized by the L^AT_EX interface (see Section 2.3.3).

```

16577 \let\markdownInputPlainTeX\markdownInput
16578 \renewcommand\markdownInput[2][]{%
16579   \begingroup
16580     \markdownSetup{#1}%
16581     \markdownInputPlainTeX{#2}%
16582   \endgroup}%
16583 \renewcommand\yamlInput[2][]{%
16584   \begingroup
16585     \yamlSetup{jekyllData, expectJekyllData, ensureJekyllData, #1}%
16586     \markdownInputPlainTeX{#2}%
16587   \endgroup}%

```

The `markdown`, `markdown*`, and `yaml` L^AT_EX environments are implemented using the `\markdownReadAndConvert` macro.

```

16588 \ExplSyntaxOn
16589 \renewenvironment
16590   { markdown }
16591   {

```

In our implementation of the `markdown` L^AT_EX environment, we want to distinguish between the following two cases:

<pre> \begin{markdown} [smartEllipses] % This is an optional argument ~ % ... \end{markdown} </pre>	<pre> \begin{markdown} [smartEllipses] % ~ This is link \end{markdown} </pre>
---	---

Therefore, we cannot use the built-in L^AT_EX support for environments with optional arguments or packages such as `xparse`. Instead, we must read the optional argument manually and prevent reading past the end of a line.

To prevent reading past the end of a line when looking for the optional argument of the `markdown` L^AT_EX environment and accidentally tokenizing markdown text, we change the category code of carriage return (`\r`, ASCII character 13 in decimal) from 5 (end of line).

While any category code other than 5 (end of line) would work, we switch to the category 13 (active), which is also used by the `\markdownReadAndConvert` macro. This is necessary if we read until the end of a line, because then the carriage return character will be produced by TeX via the `\endlinechar` plain TeX macro and it needs to have the correct category code, so that `\markdownReadAndConvert` processes it correctly.

```

16592     \group_begin:
16593     \char_set_catcode_active:n { 13 }

```

To prevent doubling the hash signs (`#`, ASCII code 35 in decimal), we switch its category from 6 (parameter) to 11 (letter).

```

16594     \char_set_catcode_letter:n { 35 }

```

After we have matched the opening `[` that begins the optional argument, we accept carriage returns as well.

```

16595     \peek_regex_replace_once:nnF
16596     { \ *\[r*([~]*)\[^[^r]* }
16597     {

```

After we have matched the optional argument, we switch back the category code of carriage returns and hash signs and we retokenize the content. This will cause single new lines to produce a space token and multiple new lines to produce `\par` tokens. Furthermore, this will cause hash signs followed by a number to be recognized as parameter numbers, which is necessary when we use the optional argument to redefine token renderers and token renderer prototypes.

```

16598         \c { group_end: }
16599         \c { tl_set_rescan:Nnn } \c { l_tmpa_tl } { } { \1 }

```

Then, we pass the retokenized content to the `\markdownSetup` macro.

```

16600         \c { @@_setup:V } \c { l_tmpa_tl }

```

Finally, regardless of whether or not we have matched the optional argument, we let the `\markdownReadAndConvert` macro process the rest of the `LATEX` environment.

We also make provision for using the `\markdown` command as a part of a different `LATEX` environment as follows:

```

\newenvironment{foo}%
  {code before \markdown[some, options]}%
  {\markdownEnd code after}

```

```

16601         \c { exp_args:NV }
16602         \c { markdownReadAndConvert@ }
16603         \c { @currenvir }
16604     }
16605     {
16606         \group_end:
16607         \exp_args:NV
16608         \markdownReadAndConvert@
16609         \@currenvir
16610     }
16611 }
16612 { \markdownEnd }
16613 \renewenvironment

```

```

16614 { markdown* }
16615 [ 1 ]
16616 {
16617   \@@_if_option:nTF
16618     { experimental }
16619     {
16620       \msg_error:nn
16621         { markdown }
16622         { latex-markdown-star-deprecated }
16623     }
16624     {
16625       \msg_warning:nn
16626         { markdown }
16627         { latex-markdown-star-deprecated }
16628     }
16629   \@@_setup:n
16630     { #1 }
16631   \markdownReadAndConvert@
16632     { markdown* }
16633 }
16634 { \markdownEnd }
16635 \renewenvironment
16636 { yaml }
16637 {
16638   \group_begin:
16639   \yamlSetup
16640     { jekyllData, expectJekyllData, ensureJekyllData }
16641   \markdown
16642 }
16643 { \yamlEnd }
16644 \msg_new:nnn
16645 { markdown }
16646 { latex-markdown-star-deprecated }
16647 {
16648   The~markdown*~LaTeX~environment~has~been~deprecated~and~will~
16649   be~removed~in~the~next~major~version~of~the~Markdown~package.
16650 }
16651 \cs_generate_variant:Nn % noqa: w402
16652 \@@_setup:n
16653 { V }
16654 \ExplSyntaxOff
16655 \begingroup

```

Locally swap the category code of the backslash symbol with the pipe symbol, and of the left (`{`) and right brace (`}`) with the less-than (`<`) and greater-than (`>`) signs. This is required in order that all the special symbols that appear in the first argument of the `markdownReadAndConvert` macro have the category code *other*.

```

16656 \catcode`\|=0\catcode`\<=1\catcode`\>=2%
16657 \catcode`\|=12\catcode`\{=12\catcode`\}=12%
16658 |gdef|markdownReadAndConvert@#1<%
16659 |markdownReadAndConvert<\end{#1}>%
16660 <|end<#1>>%
16661 |endgroup

```

3.3.2 Themes

This section overrides the plain \TeX implementation of the theme-loading mechanism from Section 3.2.2. Furthermore, this section also implements the built-in \LaTeX themes provided with the Markdown package.

```

16662 \ExplSyntaxOn
16663 \prop_new:N \g_@@_latex_loaded_themes_linenos_prop
16664 \prop_new:N \g_@@_latex_loaded_themes_versions_prop
16665 \cs_gset_protected:Nn
16666 \@@_load_theme:nnn
16667 {

```

If the Markdown package has not yet been loaded, determine whether either this is a built-in theme according to the prop `\g_@@_latex_built_in_themes_prop` or a file named `markdowntheme<munged theme name>.sty` exists and whether we are still in the preamble.

```

16668 \ifmarkdownLaTeXLoaded
16669 \ifx\@onlypreamble\@notprerr

```

If both conditions are true, end with an error, since we cannot load \LaTeX themes after the preamble.

```

16670 \bool_if:nTF
16671 {
16672 \bool_lazy_or_p:nn
16673 {
16674 \prop_if_in_p:Nn
16675 \g_@@_latex_built_in_themes_prop
16676 { #1 }
16677 }
16678 {
16679 \file_if_exist_p:n
16680 { markdown theme #3.sty }
16681 }
16682 }
16683 {
16684 \msg_error:nn
16685 { markdown }
16686 { latex-theme-after-preamble }
16687 }

```

Otherwise, try loading a plain T_EX theme instead.

```

16688     {
16689         \@_plain_tex_load_theme:nnn
16690         { #1 }
16691         { #2 }
16692         { #3 }
16693     }
16694 \else

```

If the Markdown package has already been loaded but we are still in the preamble, load a L^AT_EX theme if it exists or load a plain T_EX theme otherwise.

```

16695     \bool_if:nTF
16696     {
16697         \bool_lazy_or_p:nn
16698         {
16699             \prop_if_in_p:Nn
16700             \g_@@_latex_built_in_themes_prop
16701             { #1 }
16702         }
16703         {
16704             \file_if_exist_p:n
16705             { markdown theme #3.sty }
16706         }
16707     }
16708     {
16709         \prop_get:NnNTF
16710         \g_@@_latex_loaded_themes_linenos_prop
16711         { #1 }
16712         \l_tmpa_tl
16713         {
16714             \prop_get:NnN
16715             \g_@@_latex_loaded_themes_versions_prop
16716             { #1 }
16717             \l_tmpb_tl
16718             \str_if_eq:nVTF
16719             { #2 }
16720             \l_tmpb_tl
16721             {
16722                 \msg_warning:nnnVn
16723                 { markdown }
16724                 { repeatedly-loaded-latex-theme }
16725                 { #1 }
16726                 \l_tmpa_tl
16727                 { #2 }
16728             }
16729             {
16730                 \msg_error:nnnnVV

```



```

16731         { markdown }
16732         { different-versions-of-latex-theme }
16733         { #1 }
16734         { #2 }
16735         \l_tmpb_tl
16736         \l_tmpa_tl
16737     }
16738 }
16739 {
16740     \prop_gput:Nnx
16741     \g_@@_latex_loaded_themes_linenos_prop
16742     { #1 }
16743     { \tex_the:D \tex_inputlineno:D } % noqa: W200
16744     \prop_gput:Nnn
16745     \g_@@_latex_loaded_themes_versions_prop
16746     { #1 }
16747     { #2 }

```

Load built-in plain TeX themes from the prop `\g_@@_latex_built_in_themes_prop` and from the filesystem otherwise.

```

16748     \prop_if_in:NnTF
16749     \g_@@_latex_built_in_themes_prop
16750     { #1 }
16751     {
16752         \msg_info:nnnn
16753         { markdown }
16754         { loading-built-in-latex-theme }
16755         { #1 }
16756         { #2 }
16757         \prop_item:Nn
16758         \g_@@_latex_built_in_themes_prop
16759         { #1 }
16760     }
16761     {
16762         \msg_info:nnnn
16763         { markdown }
16764         { loading-latex-theme }
16765         { #1 }
16766         { #2 }
16767         \RequirePackage
16768         { markdown theme #3 }
16769     }
16770 }
16771 }
16772 {
16773     \@@_plain_tex_load_theme:nnn
16774     { #1 }

```

```

16775         { #2 }
16776         { #3 }
16777     }
16778     \fi
16779     \else

```

If the Markdown package has not yet been loaded, postpone the loading until the Markdown package has finished loading.

```

16780     \msg_info:nnnn
16781     { markdown }
16782     { theme-loading-postponed }
16783     { #1 }
16784     { #2 }
16785     \AtEndOfPackage
16786     {
16787         \@@_set_theme:n
16788         { #1 @ #2 }
16789     }
16790     \fi
16791 }
16792 \msg_new:nnn
16793 { markdown }
16794 { theme-loading-postponed }
16795 {
16796     Postponing~loading~version~#2~of~Markdown~theme~#1~until~
16797     Markdown~package~has~finished~loading
16798 }
16799 \msg_new:nnn
16800 { markdown }
16801 { loading-built-in-latex-theme }
16802 { Loading~version~#2~of~built-in~LaTeX~Markdown~theme~#1 }
16803 \msg_new:nnn
16804 { markdown }
16805 { loading-latex-theme }
16806 { Loading~version~#2~of~LaTeX~Markdown~theme~#1 }
16807 \msg_new:nnn
16808 { markdown }
16809 { repeatedly-loaded-latex-theme }
16810 {
16811     Version~#3~of~LaTeX~Markdown~theme~#1~was~previously~
16812     loaded~on~line~#2,~not~loading~it~again
16813 }
16814 \msg_new:nnn
16815 { markdown }
16816 { different-versions-of-latex-theme }
16817 {
16818     Tried~to~load~version~#2~of~LaTeX~Markdown~theme~#1~

```

```

16819     but~version~#3~has~already~been~loaded~on~line~#4
16820   }
16821   \cs_generate_variant:Nn
16822     \msg_new:nnnn
16823     { nnVV }
16824   \tl_set:Nn
16825     \l_tmpa_tl
16826     { Cannot~load~LaTeX~Markdown~theme~#1~after~ }
16827   \tl_put_right:NV
16828     \l_tmpa_tl
16829     \c_backslash_str
16830   \tl_put_right:Nn
16831     \l_tmpa_tl
16832     { begin { document } }
16833   \tl_set:Nn
16834     \l_tmpb_tl
16835     { Load~Markdown~theme~#1~before~ }
16836   \tl_put_right:NV
16837     \l_tmpb_tl
16838     \c_backslash_str
16839   \tl_put_right:Nn
16840     \l_tmpb_tl
16841     { begin { document } }
16842   \msg_new:nnVV
16843     { markdown }
16844     { latex-theme-after-preamble }
16845     \l_tmpa_tl
16846     \l_tmpb_tl

```

The [witiko/dot](#) and [witiko/graphicx/http](#) L^AT_EX themes load the package `graphicx`, see also Section 1.1.3. Then, they load the corresponding plain T_EX themes.

```

16847   \tl_set:Nn
16848     \l_tmpa_tl
16849     {
16850       \RequirePackage
16851         { graphicx }
16852       \markdownLoadPlainTeXTheme
16853     }
16854   \prop_gput:NnV
16855     \g_@@_latex_built_in_themes_prop
16856     { witiko / dot }
16857     \l_tmpa_tl
16858   \prop_gput:NnV
16859     \g_@@_latex_built_in_themes_prop
16860     { witiko / graphicx / http }
16861     \l_tmpa_tl

```

The `witiko/glossaries` theme first checks that the version is either `v1` or `latest`, issuing a warning for the latter.

```

16862 \prop_gput:Nnn
16863   \g_@@_latex_built_in_themes_prop
16864   { witiko / glossaries }
16865   {
16866     \str_case:enF
16867     { \markdownThemeVersion }
16868     {
16869       { latest }
16870       {
16871         \msg_warning:nnnn
16872         { markdown }
16873         { pin-theme-version }
16874         { witiko/glossaries }
16875         { v1 }
16876       }
16877       { v1 }
16878       { }
16879     }
16880     {
16881       \msg_error:nnnen
16882       { markdown }
16883       { unknown-theme-version }
16884       { witiko/glossaries }
16885       { \markdownThemeVersion }
16886       { v1 }
16887     }
16888   }
16889 \ExplSyntaxOff

```

In Section 3.3.3, we'll continue the implementation of the theme by defining the snippet `witiko/glossaries/import-acronyms`. The `witiko/markdown/defaults` L^AT_EX theme also loads the corresponding plain T_EX theme.

```

16890 \markdownLoadPlainTeXTheme

```

Next, the L^AT_EX theme overrides some of the plain T_EX definitions. See Section 3.3.5 for the actual definitions.

3.3.3 Snippets

This section defines the built-in L^AT_EX snippet `witiko/glossaries/import-acronyms`.

```

16891 \ExplSyntaxOn
16892 \prop_get:NnN
16893   \g_@@_latex_built_in_themes_prop
16894   { witiko / glossaries }
16895   \l_tmpa_tl

```

```

16896 \tl_put_right:Nn
16897   \l_tmpa_tl
16898   {
16899     \cs_new:Nn
16900       \@@_register_acronym:n
16901       {
16902         \@@_setup:n
16903         {

```

When we register an acronym with the `acronyms` option, enclose it in an extra set of braces in case the acronym contained a comma.

```

16904             acronyms += {{ #1 }},
16905         }
16906     }
16907   \cs_generate_variant:Nn
16908     \@@_register_acronym:n
16909     { V }
16910   \prop_new:N
16911     \g_@@_acronyms_to_labels_prop
16912   \tl_new:N
16913     \l_@@_acronym_short_tl

```

When we import an acronym from the glossaries package, we receive a $\langle label \rangle$, which doesn't correspond to an acronym. Therefore, we register the short form of the corresponding acronym instead and keep a mapping from these short forms back to the labels when we need to display an acronym in the markdown text.

```

16914   \cs_new:Nn
16915     \@@_register_acronym_label:n
16916     {
16917       \tl_set:Nx
16918         \l_@@_acronym_short_tl
16919         { \glsentryshort { #1 } }

```

Be idempotent and only import each acronym once.

```

16920   \prop_if_in:NVF
16921     \g_@@_acronyms_to_labels_prop
16922     \l_@@_acronym_short_tl
16923   {
16924     \@@_register_acronym:V
16925       \l_@@_acronym_short_tl
16926     \prop_gput:NVn
16927       \g_@@_acronyms_to_labels_prop
16928       \l_@@_acronym_short_tl
16929       { #1 }
16930   }
16931 }
16932 \cs_generate_variant:Nn
16933   \@@_register_acronym_label:n

```

```
16934 { V }
```

When we need to display an acronym in the markdown text, first consult our mapping to see if it has been imported from the glossaries package.

```
16935 \tl_new:N
16936 \l_@@_acronym_label_tl
16937 \cs_new:Nn
16938 \@@_print_acronym:n
16939 {
16940   \prop_get:NnNTF
16941   \g_@@_acronyms_to_labels_prop
16942   { #1 }
16943   \l_@@_acronym_label_tl
16944   {
```

If it has, retrieve the $\langle label \rangle$ and display the acronym using the glossaries package, linking it to the corresponding glossary entry.

```
16945   \group_begin:
16946     \cs_set_eq:NN
16947     \acronymfont
16948     \markdownRendererAcronymPrototype
16949     \exp_args:NV
16950     \acrshort
16951     \l_@@_acronym_label_tl
16952   \group_end:
16953 }
16954 {
```

Otherwise, just format the acronym using the current renderer prototype.

```
16955   \markdownRendererAcronymPrototype
16956   { #1 }
16957 }
16958 }
16959 \cs_generate_variant:Nn
16960 \@@_print_acronym:n
16961 { x }
```

In the snippet [witiko/glossaries/import-acronyms](#), first import all acronyms from the glossaries package and register them with the [acronyms](#) option.

```
16962 \markdownSetupSnippet
16963 { import-acronyms }
16964 {
16965   code = {
16966     \forlseqentries
16967     [ acronym ]
16968     \l_@@_acronym_label_tl
16969     {
16970       \@@_register_acronym_label:V
```

```

16971         \l_@@_acronym_label_tl
16972     }

```

Then, redefine the corresponding token renderers to format acronyms that appear in the markdown text.

```

16973     \@@_setup:n
16974     {
16975         renderers = {
16976         acronym = {

```

Fold nested acronyms.

```

16977         \group_begin:
16978         \markdownSetup {
16979             unprotectedRenderers = {
16980                 acronym = { ##1 },
16981             }
16982         }
16983         \@@_print_acronym:x
16984         { #1 }
16985     \group_end:
16986     }
16987 }
16988 }
16989 }
16990 }
16991 }
16992 \prop_gput:NnV
16993 \g_@@_latex_built_in_themes_prop
16994 { witiko / glossaries }
16995 \l_tmpa_tl
16996 \ExplSyntaxOff

```

3.3.4 Options

The supplied package options are processed using the `\markdownSetup` macro.

```

16997 \DeclareOption*{%
16998     \expandafter\markdownSetup\expandafter{\CurrentOption}}%
16999 \ProcessOptions\relax

```

3.3.5 Token Renderer Prototypes

The following configuration should be considered placeholder. If the option `plain` has been enabled (see Section 2.2.2.3), none of the definitions will take effect.

```

17000 \markdownIfOption{plain}{\iffalse}{\iftrue}

```

3.3.5.1 Acronyms

If the `acronyms` option is non-empty, render acronyms, initialisms, and other all-caps sequences using small caps.

```
17001 \ExplSyntaxOn
17002 \prop_new_linked:N
17003   \g_@@_recorded_acronyms_prop
17004 \bool_new:N
17005   \g_@@_record_acronyms_bool
17006 \bool_gset_false:N
17007   \g_@@_record_acronyms_bool
17008 \cs_new_protected:Nn
17009   \@@_record_acronym:n
17010   {
```

For explicitly listed acronyms using the HTML class `acronym` that only contain simple text and not control sequences after cleaning up any potential nested acronyms, record them in the auxiliary file, so that they are applied throughout the document in the next compilation run.

```
17011   \bool_if:NT
17012     \g_@@_record_acronyms_bool
17013   {
17014     \tl_set:Nn
17015       \l_tmpa_tl
17016       { #1 }
17017     \regex_replace_all:nnN
17018       { \c { markdownRendererAcronym } | \cB\{ | \cE\} }
17019       { }
17020     \l_tmpa_tl
17021     \prop_if_in:NVF
17022       \g_@@_recorded_acronyms_prop
17023       \l_tmpa_tl
17024     {
17025       \regex_if_match:nVF
17026         { \cC. }
17027         \l_tmpa_tl
17028       {
17029         \prop_gput:NVn
17030           \g_@@_recorded_acronyms_prop
17031           \l_tmpa_tl
17032           { true }
17033         \tl_gput_right:Nx
17034           \markdownOptionAcronyms
17035           { , { \tl_use:N \l_tmpa_tl } }
17036         \tl_set:Nn
17037           \l_tmpb_tl
17038           {
17039             \ExplSyntaxOn
```



```

17040             \tl_gput_right:Nn
17041             \markdownOptionAcronyms
17042         }
17043     \tl_gput_right:Nx
17044     \l_tmpb_tl
17045     { { , { \tl_use:N \l_tmpa_tl } } }
17046 \tl_gput_right:Nx
17047 \l_tmpb_tl
17048 { \ExplSyntaxOff }
17049 \iow_now:NV
17050 \@auxout
17051 \l_tmpb_tl
17052 }
17053 }
17054 }
17055 }
17056 \int_new:N
17057 \g_@@_heading_nesting_depth_int
17058 \markdownSetup {
17059     rendererPrototypes = {
17060         acronym = {

```

Prevent acronyms in headings.

```

17061     \int_if_zero:nTF
17062     { \g_@@_heading_nesting_depth_int }
17063     {

```

Prevent nested acronyms.

```

17064     \group_begin:
17065     \markdownSetup {
17066         unprotectedRenderers = {
17067             acronym = { ##1 },
17068         }
17069     }
17070     \@@_record_acronym:n
17071     { #1 }
17072     \tl_set:Nn
17073     \l_tmpa_tl
17074     { #1 }

```

Render all characters that are neither digits nor ASCII lower case characters in small caps. Ideally, we would also be able to exclude Unicode lower-case characters but that doesn't seem possible with expl3 at the moment [20, Chapter 34 (The l3unicode module)].

```

17075     \regex_replace_all:nnN
17076     { [^\d a-z]+ }
17077     {
17078         \c{ textsc } \cB\{

```

```

17079         \c{ MakeLowercase } \cB\{ \0 \cE\}
17080         \cE\}
17081     }
17082     \l_tmpa_tl

```

Furthermore, if the current typeface supports it, render all digits using old-style numerals.

```

17083     \cs_if_exist:NT
17084     \oldstylenums
17085     {
17086         \regex_replace_all:nnN
17087         { \d+ }
17088         { \c{ oldstylenums } \cB\{ \0 \cE\} }
17089         \l_tmpa_tl
17090     }

```

If the package `microtype` is loaded, letter-space the small caps.

```

17091     \@ifpackageloaded
17092     { microtype }
17093     {
17094         \textls
17095         {
17096             \tl_use:N
17097             \l_tmpa_tl
17098         }
17099     }
17100     {
17101         \tl_use:N
17102         \l_tmpa_tl
17103     }
17104     \group_end:
17105 }

```

Prevent acronyms in headings.

```

17106     { #1 }
17107 },
17108 },
17109 }

```

If the package `glossaries` is loaded with the option `acronym`, use the built-in snippet `LATEX witiko/glossaries/import-acronyms`.

```

17110 \@ifpackageloaded
17111 { glossaries }
17112 {
17113     \cs_if_exist:NT
17114     \@gls@do@acronymsdef
17115     {
17116         \markdownSetup {

```

```

17117         import = /witiko/glossaries@v1,
17118         snippet = /witiko/glossaries/import-acronyms,
17119     }
17120 }
17121 }
17122 { }

```

3.3.5.2 Lists

If either the `tightLists` or the `fancyLists` option is enabled and the current document class is not beamer, use a package that provides support for tight and fancy lists.

If either the package `paralist` or the package `enumitem` have already been loaded, use them. Otherwise, if the option `experimental` or the command `\DocumentMetadata` have been used, use the package `enumitem`. Otherwise, use the package `paralist`.

```

17123 \bool_new:N
17124   \g_@@_tight_or_fancy_lists_bool
17125 \bool_gset_false:N
17126   \g_@@_tight_or_fancy_lists_bool
17127 \@@_if_option:nTF
17128   { tightLists }
17129   {
17130     \bool_gset_true:N
17131     \g_@@_tight_or_fancy_lists_bool
17132   }
17133   {
17134     \@@_if_option:nT
17135     { fancyLists }
17136     {
17137       \bool_gset_true:N
17138       \g_@@_tight_or_fancy_lists_bool
17139     }
17140   }
17141 \bool_new:N
17142   \g_@@_beamer_paralist_or_enumitem_bool
17143 \bool_gset_true:N
17144   \g_@@_beamer_paralist_or_enumitem_bool
17145 \@ifclassloaded
17146   { beamer }
17147   { }
17148   {
17149     \@ifpackageloaded
17150     { paralist }
17151     { }
17152     {
17153       \@ifpackageloaded
17154       { enumitem }

```

```

17155         { }
17156     {
17157         \bool_gset_false:N
17158         \g_@@_beamer_paralist_or_enumitem_bool
17159     }
17160 }
17161 }
17162 \bool_if:nT
17163 {
17164     \g_@@_tight_or_fancy_lists_bool &&
17165     ! \g_@@_beamer_paralist_or_enumitem_bool
17166 }
17167 {
17168     \str_if_eq:enTF
17169     { \markdownThemeVersion }
17170     { experimental }
17171     {
17172         \RequirePackage
17173         { enumitem }
17174     }
17175     {
17176         \IfDocumentMetadataTF
17177         {
17178             \RequirePackage
17179             { enumitem }
17180         }
17181         {
17182             \RequirePackage
17183             { paralist }
17184         }
17185     }
17186 }
17187 \ExplSyntaxOff

```

If we loaded the enumitem package, define the tight and fancy list renderer prototypes to make use of the capabilities of the package.

```

17188 \ExplSyntaxOn
17189 \cs_new:Nn
17190 \@@_latex_fancy_list_item_label_number:nn
17191 {
17192     \str_case:nn
17193     { #1 }
17194     {
17195         { Decimal } { #2 }
17196         { LowerRoman } { \int_to_roman:n { #2 } }
17197         { UpperRoman } { \int_to_Roman:n { #2 } }
17198         { LowerAlpha } { \int_to_alph:n { #2 } }

```

```

17199         { UpperAlpha } { \int_to_Alph:n { #2 } }
17200     }
17201 }
17202 \cs_new:Nn
17203   \@@_latex_fancy_list_item_label_delimiter:n
17204 {
17205     \str_case:nn
17206       { #1 }
17207       {
17208         { Default } { . }
17209         { OneParen } { ) }
17210         { Period } { . }
17211       }
17212 }
17213 \cs_new:Nn
17214   \@@_latex_fancy_list_item_label:nnn
17215 {
17216     \@@_latex_fancy_list_item_label_number:nn
17217       { #1 }
17218       { #3 }
17219     \@@_latex_fancy_list_item_label_delimiter:n
17220       { #2 }
17221 }
17222 \cs_generate_variant:Nn
17223   \@@_latex_fancy_list_item_label:nnn
17224   { VVn }
17225 \tl_new:N
17226   \l_@@_latex_fancy_list_item_label_number_style_tl
17227 \tl_new:N
17228   \l_@@_latex_fancy_list_item_label_delimiter_style_tl
17229 \@ifpackageloaded { enumitem } {
17230   \markdownSetup { rendererPrototypes = {

```

First, let's define the tight list item renderer prototypes.

```

17231     ulBeginTight = {
17232       \begin
17233         { itemize }
17234         [ noitemsep ]
17235     },
17236     ulEndTight = {
17237       \end
17238         { itemize }
17239     },
17240     olBeginTight = {
17241       \begin
17242         { enumerate }
17243         [ noitemsep ]
17244     },

```

```

17245     olEndTight = {
17246         \end
17247         { enumerate }
17248     },
17249     dlBeginTight = {
17250         \begin
17251         { description }
17252         [ noitemsep ]
17253     },
17254     dlEndTight = {
17255         \end
17256         { description }
17257     },

```

Second, let's define the fancy list item renderer prototypes.

```

17258     fancyOlBegin = {
17259         \group_begin:
17260         \tl_set:Nn
17261             \l_@@_latex_fancy_list_item_label_number_style_tl
17262             { #1 }
17263         \tl_set:Nn
17264             \l_@@_latex_fancy_list_item_label_delimiter_style_tl
17265             { #2 }
17266         \begin
17267             { enumerate }
17268     },
17269     fancyOlBeginTight = {
17270         \group_begin:
17271         \tl_set:Nn
17272             \l_@@_latex_fancy_list_item_label_number_style_tl
17273             { #1 }
17274         \tl_set:Nn
17275             \l_@@_latex_fancy_list_item_label_delimiter_style_tl
17276             { #2 }
17277         \begin
17278             { enumerate }
17279             [ noitemsep ]
17280     },
17281     fancyOlEnd(|Tight) = {
17282         \end { enumerate }
17283         \group_end:
17284     },
17285     fancyOlItemWithNumber = {
17286         \item
17287         [
17288             \@@_latex_fancy_list_item_label:VVn
17289             \l_@@_latex_fancy_list_item_label_number_style_tl
17290             \l_@@_latex_fancy_list_item_label_delimiter_style_tl

```

```

17291         { #1 }
17292     ]
17293 },
17294 } }

```

Otherwise, if we loaded the paralist package, define the tight and fancy list renderer prototypes to make use of the capabilities of the package.

```

17295 }
17296 { \@ifpackageloaded { paralist } {
17297     \markdownSetup { rendererPrototypes = {

```

Make tight bullet lists a little less compact by adding extra vertical space above and below them.

```

17298     ulBeginTight = {
17299         \group_begin:
17300         \pltopsep=\topsep
17301         \plpartopsep=\partopsep
17302         \begin { compactitem }
17303     },
17304     ulEndTight = {
17305         \end { compactitem }
17306         \group_end:
17307     },
17308     fancyOlBegin = {
17309         \group_begin:
17310         \tl_set:Nn
17311             \l_@@_latex_fancy_list_item_label_number_style_tl
17312             { #1 }
17313         \tl_set:Nn
17314             \l_@@_latex_fancy_list_item_label_delimiter_style_tl
17315             { #2 }
17316         \begin { enumerate }
17317     },
17318     fancyOlEnd = {
17319         \end { enumerate }
17320         \group_end:
17321     },

```

Make tight ordered lists a little less compact by adding extra vertical space above and below them.

```

17322     olBeginTight = {
17323         \group_begin:
17324         \plpartopsep=\partopsep
17325         \pltopsep=\topsep
17326         \begin { compactenum }
17327     },
17328     olEndTight = {
17329         \end { compactenum }

```

```

17330     \group_end:
17331   },
17332   fancyOlBeginTight = {
17333     \group_begin:
17334     \tl_set:Nn
17335       \l_@@_latex_fancy_list_item_label_number_style_tl
17336       { #1 }
17337     \tl_set:Nn
17338       \l_@@_latex_fancy_list_item_label_delimiter_style_tl
17339       { #2 }
17340     \plpartopsep=\partopsep
17341     \pltopsep=\topsep
17342     \begin { compactenum }
17343   },
17344   fancyOlEndTight = {
17345     \end { compactenum }
17346     \group_end:
17347   },
17348   fancyOlItemWithNumber = {
17349     \item
17350     [
17351       \@@_latex_fancy_list_item_label:VVn
17352       \l_@@_latex_fancy_list_item_label_number_style_tl
17353       \l_@@_latex_fancy_list_item_label_delimiter_style_tl
17354       { #1 }
17355     ]
17356   },

```

Make tight definition lists a little less compact by adding extra vertical space above and below them.

```

17357   dlBeginTight = {
17358     \group_begin:
17359     \plpartopsep=\partopsep
17360     \pltopsep=\topsep
17361     \begin { compactdesc }
17362   },
17363   dlEndTight = {
17364     \end { compactdesc }
17365     \group_end:
17366   }
17367 } }
17368 }
17369 {

```

Otherwise, if we loaded neither the enumitem package nor the paralist package, define the tight and fancy list renderer prototypes to fall back on the corresponding renderers for the non-tight lists.

```

17370   \markdownSetup

```



```

17371 {
17372   rendererPrototypes = {
17373     ulBeginTight = \markdownRendererUlBegin,
17374     ulEndTight = \markdownRendererUlEnd,
17375     fancyOlBegin = \markdownRendererOlBegin,
17376     fancyOlEnd = \markdownRendererOlEnd,
17377     olBeginTight = \markdownRendererOlBegin,
17378     olEndTight = \markdownRendererOlEnd,
17379     fancyOlBeginTight = \markdownRendererOlBegin,
17380     fancyOlEndTight = \markdownRendererOlEnd,
17381     dlBeginTight = \markdownRendererDlBegin,
17382     dlEndTight = \markdownRendererDlEnd,
17383   },
17384 }
17385 } }
17386 \ExplSyntaxOff
17387 \RequirePackage{amsmath}

```

Unless the unicode-math package has been loaded, load the amssymb package with symbols to be used for tickboxes.

```

17388 \@ifpackageloaded{unicode-math}{
17389   \markdownSetup{rendererPrototypes={
17390     untickedBox = {\$ \mdlgwhtsquare$},
17391   }}
17392 }{
17393   \RequirePackage{amssymb}
17394   \markdownSetup{rendererPrototypes={
17395     untickedBox = {\$ \square$},
17396   }}
17397 }
17398 \RequirePackage{csvsimple}
17399 \RequirePackage{fancyvrb}
17400 \RequirePackage{graphicx}
17401 \markdownSetup{rendererPrototypes={
17402   hardLineBreak = {\},
17403   leftBrace = {\textbraceleft},
17404   rightBrace = {\textbraceright},
17405   dollarSign = {\textdollar},
17406   underscore = {\textunderscore},
17407   circumflex = {\textasciicircum},
17408   backslash = {\textbackslash},
17409   tilde = {\textasciitilde},
17410   pipe = {\textbar},

```

We can capitalize on the fact that the expansion of renderers is performed by \TeX during the typesetting. Therefore, even if we don't know whether a span of text is

part of math formula or not when we are parsing markdown,⁴¹ we can reliably detect math mode inside the renderer.

Here, we will redefine the code span renderer prototype to typeset upright text in math formulae and typewriter text outside math formulae.

```

17411 codeSpan = {%
17412   \ifmmode
17413     \text{#1}%
17414   \else
17415     \texttt{#1}%
17416   \fi
17417 }}}
```

3.3.5.3 Content Blocks

In content block renderer prototypes, display the content as a table using the package `csvsimple` when the raw attribute is `csv`, display the content using the default templates of the package `luaxml` when the raw attribute is `html`, execute the content with TeX when the raw attribute is `tex`, and display the content as markdown otherwise.

```

17418 \ExplSyntaxOn
17419 \markdownSetup{
17420   rendererPrototypes = {
17421     contentBlock = {
17422       \str_case:nnF
17423         { #1 }
17424         {
17425           { csv }
17426           {
17427             \begin { table }
17428               \begin { center }
17429                 \csvautotabular { #3 }
17430               \end { center }
17431             \tl_if_empty:nF
17432               { #4 }
17433               { \caption { #4 } }
17434             \end { table }
17435           }
17436           { html }
17437           {
```

If we are using `TeX4ht`⁴², we will pass HTML elements to the output HTML document unchanged.

⁴¹This property may actually be undecidable. Suppose a span of text is a part of a macro definition. Then, whether the span of text is part of a math formula or not depends on where the macro is later used, which may easily be *both* inside and outside a math formula.

⁴²See <https://tug.org/tex4ht/>.

```

17438         \cs_if_exist:NTF
17439         \HCode
17440         {
17441             \if_mode_vertical:
17442             \IgnorePar
17443             \fi:
17444             \EndP
17445             \special
17446             { t4ht* < #3 }
17447             \par
17448             \ShowPar
17449         }
17450         {
17451             \@@_luaxml_print_html:n
17452             { #3 }
17453         }
17454     }
17455     { tex }
17456     {
17457         \markdownEscape
17458         { #3 }
17459     }
17460 }
17461 {
17462     \markdownInput
17463     { #3 }
17464 }
17465 },
17466 },
17467 }
17468 \ExplSyntaxOff
17469 \markdownSetup{rendererPrototypes={
17470     ulBegin = {\begin{itemize}},
17471     ulEnd = {\end{itemize}},
17472     olBegin = {\begin{enumerate}},
17473     olItem = {\item{}},
17474     olItemWithNumber = {\item[#1.]},
17475     olEnd = {\end{enumerate}},
17476     dlBegin = {\begin{description}},
17477     dlItem = {\item[#1]},
17478     dlEnd = {\end{description}},
17479     emphasis = {\emph{#1}},
17480     tickedTextBox = {\$\boxtimes$},
17481     halfTickedTextBox = {\$\boxdot$}}

```

If HTML identifiers appear after a heading, we make them produce `\label` macros.

```

17482 \ExplSyntaxOn
17483 \seq_new:N

```

```

17484 \g_@@_header_identifiers_seq
17485 \markdownSetup
17486 {
17487     rendererPrototypes = {
17488         headerAttributeContextBegin = {
17489             \markdownSetup
17490             {
17491                 rendererPrototypes = {
17492                     attributeIdentifier = {
17493                         \seq_gput_right:Nn
17494                         \g_@@_header_identifiers_seq
17495                         { ##1 }
17496                     },
17497                 },
17498             }
17499         },
17500         headerAttributeContextEnd = {
17501             \seq_map_inline:Nn
17502             \g_@@_header_identifiers_seq
17503             { \label { ##1 } }
17504             \seq_gclear:N
17505             \g_@@_header_identifiers_seq
17506         },
17507     },
17508 }

```

If the `unnumbered` HTML class (or the `{-}` shorthand) appears after a heading the heading and all its subheadings will be unnumbered.

```

17509 \bool_new:N
17510 \l_@@_header_unnumbered_bool
17511 \markdownSetup
17512 {
17513     rendererPrototypes = {
17514         headerAttributeContextBegin += {
17515             \markdownSetup
17516             {
17517                 rendererPrototypes = {
17518                     attributeClassName = {
17519                         \bool_if:nT
17520                         {
17521                             \str_if_eq_p:nn
17522                             { ##1 }
17523                             { unnumbered } &&
17524                             ! \l_@@_header_unnumbered_bool
17525                         }
17526                     {
17527                         \group_begin:

```

```

17528         \bool_set_true:N
17529         \l_@@_header_unnumbered_bool
17530         \c@secnumdepth = -2
17531         \markdownSetup
17532         {
17533             rendererPrototypes = {
17534                 sectionBegin = {
17535                     \group_begin:
17536                 },
17537                 sectionEnd = {
17538                     \group_end:
17539                 },
17540             },
17541         }
17542     },
17543 },
17544 },
17545 },
17546 },
17547 },
17548 }
17549 \ExplSyntaxOff
17550 \markdownSetup{rendererPrototypes={
17551     superscript = {\textsuperscript{#1}},
17552     subscript = {\textsubscript{#1}},
17553     blockQuoteBegin = {\begin{quotation}},
17554     blockQuoteEnd = {\end{quotation}},
17555     inputVerbatim = {\VerbatimInput{#1}},
17556     thematicBreak = {\noindent\rule[0.5ex]{\linewidth}{1pt}},
17557     note = {\footnote{#1}}}}

```

3.3.5.4 Fenced Code

When no infostring has been specified, default to the indented code block renderer.

```

17558 \RequirePackage{ltxcmds}
17559 \ExplSyntaxOn
17560 \cs_gset_protected:Npn
17561     \markdownRendererInputFencedCodePrototype#1#2#3
17562     {
17563         \tl_if_empty:nTF
17564             { #2 }
17565             { \markdownRendererInputVerbatim{#1} }

```

Otherwise, extract the first word of the infostring and treat it as the name of the programming language in which the code block is written.

```

17566     {
17567         \regex_extract_once:nnN
17568         { \w* }

```

```

17569      { #2 }
17570      \l_tmpa_seq
17571      \seq_pop_left:NN
17572      \l_tmpa_seq
17573      \l_tmpa_tl

```

When the minted package is loaded, use it for syntax highlighting.

```

17574      \ltx@ifpackageloaded
17575      { minted }
17576      {
17577          \catcode`\%=14\relax
17578          \catcode`\#=6\relax
17579          \exp_args:NV
17580          \inputminted
17581          \l_tmpa_tl
17582          { #1 }
17583          \catcode`\%=12\relax
17584          \catcode`\#=12\relax
17585      }
17586      {

```

When the listings package is loaded, use it for syntax highlighting.

```

17587      \ltx@ifpackageloaded
17588      { listings }
17589      { \lstinputlisting [ language = \l_tmpa_tl ] { #1 } }

```

When neither the listings package nor the minted package is loaded, act as though no infostring were given.

```

17590      { \markdownRendererInputFencedCode { #1 } { } { } }
17591      }
17592      }
17593      }
17594      \ExplSyntaxOff

```

Support the nesting of strong emphasis.

```

17595      \ExplSyntaxOn
17596      \cs_new_protected:Npn
17597      \markdownLATEXStrongEmphasis #1
17598      {
17599          \str_if_in:NnTF
17600          \f@series
17601          { b }
17602          { \textnormal{#1} }
17603          { \textbf{#1} }
17604      }
17605      \ExplSyntaxOff
17606      \markdownSetup{rendererPrototypes={strongEmphasis={%
17607          \protect\markdownLATEXStrongEmphasis{#1}}}}

```

Support L^AT_EX document classes that do not provide chapters.

```
17608 \@ifundefined{chapter}{%
17609   \markdownSetup{rendererPrototypes = {
17610     headingOne = {\section{#1}},
17611     headingTwo = {\subsection{#1}},
17612     headingThree = {\subsubsection{#1}},
17613     headingFour = {\paragraph{#1}},
17614     headingFive = {\subparagraph{#1}}}}
17615 }{%
17616   \markdownSetup{rendererPrototypes = {
17617     headingOne = {\chapter{#1}},
17618     headingTwo = {\section{#1}},
17619     headingThree = {\subsection{#1}},
17620     headingFour = {\subsubsection{#1}},
17621     headingFive = {\paragraph{#1}},
17622     headingSix = {\subparagraph{#1}}}}
17623 }%
```

Prevent acronyms in headings.

```
17624 \ExplSyntaxOn
17625 \markdownSetup {
17626   rendererPrototypes = {
17627     heading* ^ = {
17628       \int_gincr:N
17629       \g_@@_heading_nesting_depth_int
17630     },
17631     heading* $ = {
17632       \int_gdecr:N
17633       \g_@@_heading_nesting_depth_int
17634     }
17635   }
17636 }
17637 \ExplSyntaxOff
```

3.3.5.5 Tickboxes

If the `taskLists` option is enabled, we will hide bullets in unordered list items with tickboxes.

```
17638 \markdownSetup{
17639   rendererPrototypes = {
17640     ulItem = {%
17641       \futurelet\markdownLaTeXCheckbox\markdownLaTeXUListItem
17642     },
17643   },
17644 }
17645 \def\markdownLaTeXUListItem{%
17646   \ifx\markdownLaTeXCheckbox\markdownRendererTickedBox
```

```

17647     \item[\markdownLaTeXCheckbox]%
17648     \expandafter\@gobble
17649   \else
17650     \ifx\markdownLaTeXCheckbox\markdownRendererHalfTickedBox
17651       \item[\markdownLaTeXCheckbox]%
17652       \expandafter\expandafter\expandafter\@gobble
17653     \else
17654       \ifx\markdownLaTeXCheckbox\markdownRendererUntickedBox
17655         \item[\markdownLaTeXCheckbox]%
17656         \expandafter\expandafter\expandafter\expandafter
17657         \expandafter\expandafter\expandafter\@gobble
17658       \else
17659         \item{}%
17660       \fi
17661     \fi
17662   \fi
17663 }

```

3.3.5.6 html elements

If the `html` option is enabled and we are using `TeX4ht`⁴³, we will pass HTML elements to the output HTML document unchanged.

```

17664 \@ifundefined{HCode}{}{
17665   \markdownSetup{
17666     rendererPrototypes = {
17667       inlineHtmlTag = {%
17668         \ifvmode
17669           \IgnorePar
17670         \EndP
17671         \fi
17672         \HCode{#1}%
17673       },
17674       inputBlockHtmlElement = {%
17675         \ifvmode
17676           \IgnorePar
17677         \fi
17678         \EndP
17679         \special{t4ht*<#1}%
17680         \par
17681         \ShowPar
17682       },
17683     },
17684   }
17685 }

```

⁴³See <https://tug.org/tex4ht/>.

3.3.5.7 Citations

Here is a basic implementation for citations that uses the L^AT_EX `\cite` macro. There are also implementations that use the natbib `\citep`, and `\citet` macros, and the BibL^AT_EX `\autocites` and `\textcites` macros. These implementations will be used, when the respective packages are loaded.

```
17686 \newcount\markdownLaTeXCitationsCounter
17687
17688 % Basic implementation
17689 \long\def\@gobblethree#1#2#3{}%
17690 \def\markdownLaTeXBasicCitations#1#2#3#4#5#6{%
17691   \advance\markdownLaTeXCitationsCounter by 1\relax
17692   \ifx\relax#4\relax
17693     \ifx\relax#5\relax
17694       \ifnum\markdownLaTeXCitationsCounter>\markdownLaTeXCitationsTotal
17695         \relax
17696         \cite{#1#2#6}% No prenotes/postnotes, just accumulate cites
17697         \expandafter\expandafter\expandafter
17698         \expandafter\expandafter\expandafter\expandafter
17699         \@gobblethree
17700       \fi
17701     \else% Before a postnote (#5), dump the accumulator
17702       \ifx\relax#1\relax\else
17703         \cite{#1}%
17704       \fi
17705       \cite[#5]{#6}%
17706       \ifnum\markdownLaTeXCitationsCounter>\markdownLaTeXCitationsTotal
17707         \relax
17708       \else
17709         \expandafter\expandafter\expandafter
17710         \expandafter\expandafter\expandafter\expandafter
17711         \expandafter\expandafter\expandafter
17712         \expandafter\expandafter\expandafter\expandafter
17713         \markdownLaTeXBasicCitations
17714       \fi
17715       \expandafter\expandafter\expandafter
17716       \expandafter\expandafter\expandafter\expandafter{%
17717       \expandafter\expandafter\expandafter
17718       \expandafter\expandafter\expandafter\expandafter}%
17719       \expandafter\expandafter\expandafter
17720       \expandafter\expandafter\expandafter\expandafter{%
17721       \expandafter\expandafter\expandafter
17722       \expandafter\expandafter\expandafter\expandafter}%
17723       \expandafter\expandafter\expandafter
17724       \@gobblethree
17725     \fi
17726   \else% Before a prenote (#4), dump the accumulator
```

```

17727 \ifx\relax#1\relax\else
17728 \cite{#1}%
17729 \fi
17730 \ifnum\markdownLaTeXCitationsCounter>1\relax
17731 \space % Insert a space before the prenote in later citations
17732 \fi
17733 #4~\expandafter\cite\ifx\relax#5\relax{#6}\else[#5]{#6}\fi
17734 \ifnum\markdownLaTeXCitationsCounter>\markdownLaTeXCitationsTotal
17735 \relax
17736 \else
17737 \expandafter\expandafter\expandafter
17738 \expandafter\expandafter\expandafter\expandafter
17739 \markdownLaTeXBasicCitations
17740 \fi
17741 \expandafter\expandafter\expandafter{%
17742 \expandafter\expandafter\expandafter}%
17743 \expandafter\expandafter\expandafter{%
17744 \expandafter\expandafter\expandafter}%
17745 \expandafter
17746 \@gobblethree
17747 \fi\markdownLaTeXBasicCitations{#1#2#6},}
17748 \let\markdownLaTeXBasicTextCitations\markdownLaTeXBasicCitations
17749
17750 % Natbib implementation
17751 \def\markdownLaTeXNatbibCitations#1#2#3#4#5{%
17752 \advance\markdownLaTeXCitationsCounter by 1\relax
17753 \ifx\relax#3\relax
17754 \ifx\relax#4\relax
17755 \ifnum\markdownLaTeXCitationsCounter>\markdownLaTeXCitationsTotal
17756 \relax
17757 \citep{#1,#5}% No prenotes/postnotes, just accumulate cites
17758 \expandafter\expandafter\expandafter
17759 \expandafter\expandafter\expandafter\expandafter
17760 \@gobbletwo
17761 \fi
17762 \else% Before a postnote (#4), dump the accumulator
17763 \ifx\relax#1\relax\else
17764 \citep{#1}%
17765 \fi
17766 \citep[] [#4]{#5}%
17767 \ifnum\markdownLaTeXCitationsCounter>\markdownLaTeXCitationsTotal
17768 \relax
17769 \else
17770 \expandafter\expandafter\expandafter
17771 \expandafter\expandafter\expandafter\expandafter
17772 \expandafter\expandafter\expandafter
17773 \expandafter\expandafter\expandafter\expandafter

```

```

17774         \markdownLaTeXNatbibCitations
17775     \fi
17776     \expandafter\expandafter\expandafter
17777     \expandafter\expandafter\expandafter\expandafter{%
17778     \expandafter\expandafter\expandafter
17779     \expandafter\expandafter\expandafter\expandafter}%
17780     \expandafter\expandafter\expandafter
17781     \@gobbletwo
17782 \fi
17783 \else% Before a prenote (#3), dump the accumulator
17784     \ifx\relax#1\relax\relax\else
17785         \citep{#1}%
17786     \fi
17787     \citep[#3][#4]{#5}%
17788     \ifnum\markdownLaTeXCitationsCounter>\markdownLaTeXCitationsTotal
17789     \relax
17790     \else
17791         \expandafter\expandafter\expandafter
17792         \expandafter\expandafter\expandafter\expandafter
17793         \markdownLaTeXNatbibCitations
17794     \fi
17795     \expandafter\expandafter\expandafter{%
17796     \expandafter\expandafter\expandafter}%
17797     \expandafter
17798     \@gobbletwo
17799 \fi\markdownLaTeXNatbibCitations{#1,#5}}
17800 \def\markdownLaTeXNatbibTextCitations#1#2#3#4#5{%
17801     \advance\markdownLaTeXCitationsCounter by 1\relax
17802     \ifx\relax#3\relax
17803         \ifx\relax#4\relax
17804             \ifnum\markdownLaTeXCitationsCounter>\markdownLaTeXCitationsTotal
17805             \relax
17806             \citet{#1,#5}% No prenotes/postnotes, just accumulate cites
17807             \expandafter\expandafter\expandafter
17808             \expandafter\expandafter\expandafter\expandafter
17809             \@gobbletwo
17810         \fi
17811     \else% After a prenote or a postnote, dump the accumulator
17812         \ifx\relax#1\relax\else
17813             \citet{#1}%
17814         \fi
17815         , \citet[#3][#4]{#5}%
17816         \ifnum\markdownLaTeXCitationsCounter<\markdownLaTeXCitationsTotal
17817         \relax
17818         ,
17819     \else
17820         \ifnum

```

```

17821         \markdownLaTeXCitationsCounter=\markdownLaTeXCitationsTotal
17822         \relax
17823         ,
17824         \fi
17825     \fi
17826     \expandafter\expandafter\expandafter
17827     \expandafter\expandafter\expandafter\expandafter
17828     \markdownLaTeXNatbibTextCitations
17829     \expandafter\expandafter\expandafter
17830     \expandafter\expandafter\expandafter\expandafter{%
17831     \expandafter\expandafter\expandafter
17832     \expandafter\expandafter\expandafter\expandafter}%
17833     \expandafter\expandafter\expandafter
17834     \@gobbletwo
17835     \fi
17836 \else% After a prenote or a postnote, dump the accumulator
17837     \ifx\relax#1\relax\relax\else
17838         \citet{#1}%
17839     \fi
17840     , \citet[#3][#4]{#5}%
17841     \ifnum\markdownLaTeXCitationsCounter<\markdownLaTeXCitationsTotal
17842     \relax
17843     ,
17844     \else
17845         \ifnum
17846             \markdownLaTeXCitationsCounter=\markdownLaTeXCitationsTotal
17847             \relax
17848             ,
17849             \fi
17850         \fi
17851         \expandafter\expandafter\expandafter
17852         \markdownLaTeXNatbibTextCitations
17853         \expandafter\expandafter\expandafter{%
17854         \expandafter\expandafter\expandafter}%
17855         \expandafter
17856         \@gobbletwo
17857     \fi\markdownLaTeXNatbibTextCitations{#1,#5}}
17858
17859 % BibLaTeX implementation
17860 \def\markdownLaTeXBibLaTeXCitations#1#2#3#4#5{%
17861     \advance\markdownLaTeXCitationsCounter by 1\relax
17862     \ifnum\markdownLaTeXCitationsCounter>\markdownLaTeXCitationsTotal
17863     \relax
17864     \autocites#1[#3][#4]{#5}%
17865     \expandafter\@gobbletwo
17866     \fi\markdownLaTeXBibLaTeXCitations{#1[#3][#4]{#5}}}
17867 \def\markdownLaTeXBibLaTeXTextCitations#1#2#3#4#5{%

```

```

17868 \advance\markdownLaTeXCitationsCounter by 1\relax
17869 \ifnum\markdownLaTeXCitationsCounter>\markdownLaTeXCitationsTotal
17870 \relax
17871 \textcites#1[#3][#4]{#5}%
17872 \expandafter\@gobbletwo
17873 \fi\markdownLaTeXBibLaTeXTextCitations{#1[#3][#4]{#5}}
17874
17875 \markdownSetup{rendererPrototypes = {
17876 cite = {%
17877 \markdownLaTeXCitationsCounter=1%
17878 \def\markdownLaTeXCitationsTotal{#1}%
17879 \@ifundefined{autocites}{%
17880 \@ifundefined{citep}{%
17881 \expandafter\expandafter\expandafter
17882 \markdownLaTeXBasicCitations
17883 \expandafter\expandafter\expandafter{%
17884 \expandafter\expandafter\expandafter}%
17885 \expandafter\expandafter\expandafter{%
17886 \expandafter\expandafter\expandafter}%
17887 }{%
17888 \expandafter\expandafter\expandafter
17889 \markdownLaTeXNatbibCitations
17890 \expandafter\expandafter\expandafter{%
17891 \expandafter\expandafter\expandafter}%
17892 }%
17893 }{%
17894 \expandafter\expandafter\expandafter
17895 \markdownLaTeXBibLaTeXCitations
17896 \expandafter{\expandafter}%
17897 }},
17898 textCite = {%
17899 \markdownLaTeXCitationsCounter=1%
17900 \def\markdownLaTeXCitationsTotal{#1}%
17901 \@ifundefined{autocites}{%
17902 \@ifundefined{citep}{%
17903 \expandafter\expandafter\expandafter
17904 \markdownLaTeXBasicTextCitations
17905 \expandafter\expandafter\expandafter{%
17906 \expandafter\expandafter\expandafter}%
17907 \expandafter\expandafter\expandafter{%
17908 \expandafter\expandafter\expandafter}%
17909 }{%
17910 \expandafter\expandafter\expandafter
17911 \markdownLaTeXNatbibTextCitations
17912 \expandafter\expandafter\expandafter{%
17913 \expandafter\expandafter\expandafter}%
17914 }%

```

```

17915     }{%
17916         \expandafter\expandafter\expandafter
17917         \markdownLaTeXBibLaTeXTextCitations
17918         \expandafter{\expandafter}%
17919     }}}}

```

3.3.5.8 Links

Here is an implementation for hypertext links and relative references.

```

17920 \RequirePackage{url}
17921 \RequirePackage{expl3}
17922 \ExplSyntaxOn
17923 \cs_gset_protected:Npn
17924   \markdownRendererLinkPrototype
17925   #1#2#3#4
17926   {
17927     \tl_set:Nn \l_tmpa_tl { #1 }
17928     \tl_set:Nn \l_tmpb_tl { #2 }
17929     \bool_set:Nn
17930       \l_tmpa_bool
17931       {
17932         \tl_if_eq_p:NN
17933           \l_tmpa_tl
17934           \l_tmpb_tl
17935       }
17936     \tl_set:Nn \l_tmpa_tl { #4 }
17937     \bool_set:Nn
17938       \l_tmpb_bool
17939       {
17940         \tl_if_empty_p:N
17941           \l_tmpa_tl
17942       }

```

If the label and the fully-escaped URI are equivalent and the title is empty, assume that the link is an autolink. Otherwise, assume that the link is either direct or indirect.

```

17943   \bool_if:nTF
17944     {
17945       \l_tmpa_bool && \l_tmpb_bool
17946     }
17947     {
17948       \markdownLaTeXRendererAutolink { #2 } { #3 }
17949     }
17950     {
17951       \markdownLaTeXRendererDirectOrIndirectLink
17952         { #1 } { #2 } { #3 } { #4 }
17953     }
17954 }

```

```

17955 \cs_new_protected:Npn
17956   \markdownLaTeXRendererAutolink #1#2
17957   {

```

If the URL begins with a hash sign, then we assume that it is a relative reference. Otherwise, we assume that it is an absolute URL.

```

17958   \tl_set:Nn
17959     \l_tmpa_tl
17960     { #2 }
17961   \tl_trim_spaces:N
17962     \l_tmpa_tl
17963   \tl_set:Nx
17964     \l_tmpb_tl
17965     {
17966       \tl_range:Nnn
17967         \l_tmpa_tl
17968         { 1 }
17969         { 1 }
17970     }
17971   \str_if_eq:NNTF
17972     \l_tmpb_tl
17973     \c_hash_str
17974     {
17975       \tl_set:Nx
17976         \l_tmpb_tl
17977         {
17978           \tl_range:Nnn
17979             \l_tmpa_tl
17980             { 2 }
17981             { -1 }
17982         }
17983       \exp_args:NV
17984         \ref
17985         \l_tmpb_tl
17986     }
17987     {
17988       \url { #2 }
17989     }
17990   }
17991 \ExplSyntaxOff
17992 \def\markdownLaTeXRendererDirectOrIndirectLink#1#2#3#4{%
17993   #1\footnote{\ifx\empty#4\empty\else#4: \fi\url{#3}}}

```

3.3.5.9 Tables

Here is a basic implementation of tables. If the booktabs package is loaded, then it is used to produce horizontal lines.

```

17994 \newcount\markdownLaTeXRowCount
17995 \newcount\markdownLaTeXRowTotal
17996 \newcount\markdownLaTeXColumnCounter
17997 \newcount\markdownLaTeXColumnTotal
17998 \newtoks\markdownLaTeXTable
17999 \newtoks\markdownLaTeXTableAlignment
18000 \newtoks\markdownLaTeXTableEnd
18001 \AtBeginDocument{%
18002   \@ifpackageloaded{booktabs}{%
18003     \def\markdownLaTeXTopRule{\toprule}%
18004     \def\markdownLaTeXMidRule{\midrule}%
18005     \def\markdownLaTeXBottomRule{\bottomrule}%
18006   }{%
18007     \def\markdownLaTeXTopRule{\hline}%
18008     \def\markdownLaTeXMidRule{\hline}%
18009     \def\markdownLaTeXBottomRule{\hline}%
18010   }%
18011 }
18012 \markdownSetup{rendererPrototypes={
18013   table = {%
18014     \markdownLaTeXTable={}%
18015     \markdownLaTeXTableAlignment={}%
18016     \markdownLaTeXTableEnd={%
18017       \markdownLaTeXBottomRule
18018     \end{tabular}}}%
18019   \ifx\empty#1\empty\else
18020     \addto@hook\markdownLaTeXTable{%
18021       \begin{table}
18022       \centering}%
18023     \addto@hook\markdownLaTeXTableEnd{%
18024       \caption{#1}}}%
18025   \fi
18026 }
18027 }}

```

If the `tableAttributes` option is enabled, we will register any identifiers, so that they can be used as L^AT_EX labels for referencing tables.

```

18028 \ExplSyntaxOn
18029 \seq_new:N
18030 \l_@@_table_identifiers_seq
18031 \markdownSetup {
18032   rendererPrototypes = {
18033     table += {
18034       \seq_map_inline:Nn
18035       \l_@@_table_identifiers_seq
18036       {
18037         \addto@hook

```



```

18038         \markdownLaTeXTableEnd
18039         { \label { ##1 } }
18040     }
18041 },
18042 }
18043 }
18044 \markdownSetup {
18045     rendererPrototypes = {
18046         tableAttributeContextBegin = {
18047             \group_begin:
18048             \markdownSetup {
18049                 rendererPrototypes = {
18050                     attributeIdentifier = {
18051                         \seq_put_right:Nn
18052                         \l_@@_table_identifiers_seq
18053                         { ##1 }
18054                     },
18055                 },
18056             }
18057         },
18058         tableAttributeContextEnd = {
18059             \group_end:
18060         },
18061     },
18062 }
18063 \ExplSyntaxOff
18064 \markdownSetup{rendererPrototypes={
18065     table += {%
18066         \ifx\empty#1\empty\else
18067             \addto@hook\markdownLaTeXTableEnd{%
18068                 \end{table}}%
18069         \fi
18070         \addto@hook\markdownLaTeXTable{\begin{tabular}}%
18071         \markdownLaTeXRowCounter=0%
18072         \markdownLaTeXRowTotal=#2%
18073         \markdownLaTeXColumnTotal=#3%
18074         \markdownLaTeXRenderTableRow
18075     }
18076 }}
18077 \def\markdownLaTeXRenderTableRow#1{%
18078     \markdownLaTeXColumnCounter=0%
18079     \ifnum\markdownLaTeXRowCounter=0\relax
18080         \markdownLaTeXReadAlignments#1%
18081         \markdownLaTeXTable=\expandafter\expandafter\expandafter{%
18082             \expandafter\the\expandafter\markdownLaTeXTable\expandafter{%
18083                 \the\markdownLaTeXTableAlignment}}%
18084         \addto@hook\markdownLaTeXTable{\markdownLaTeXTopRule}%

```

```

18085 \else
18086   \markdownLaTeXRenderTableCell#1%
18087 \fi
18088 \ifnum\markdownLaTeXRowCounter=1\relax
18089   \addto@hook\markdownLaTeXTable\markdownLaTeXMidRule
18090 \fi
18091 \advance\markdownLaTeXRowCounter by 1\relax
18092 \ifnum\markdownLaTeXRowCounter>\markdownLaTeXRowTotal\relax
18093   \the\markdownLaTeXTable
18094   \the\markdownLaTeXTableEnd
18095   \expandafter\@gobble
18096 \fi\markdownLaTeXRenderTableRow}
18097 \def\markdownLaTeXReadAlignments#1{%
18098   \advance\markdownLaTeXColumnCounter by 1\relax
18099   \if#1d%
18100     \addto@hook\markdownLaTeXTableAlignment{1}%
18101   \else
18102     \addto@hook\markdownLaTeXTableAlignment{#1}%
18103   \fi
18104   \ifnum\markdownLaTeXColumnCounter<\markdownLaTeXColumnTotal\relax\else
18105     \expandafter\@gobble
18106   \fi\markdownLaTeXReadAlignments}
18107 \def\markdownLaTeXRenderTableCell#1{%
18108   \advance\markdownLaTeXColumnCounter by 1\relax
18109   \ifnum\markdownLaTeXColumnCounter<\markdownLaTeXColumnTotal\relax
18110     \addto@hook\markdownLaTeXTable{#1&}%
18111   \else
18112     \addto@hook\markdownLaTeXTable{#1\\}%
18113     \expandafter\@gobble
18114   \fi\markdownLaTeXRenderTableCell}

```

3.3.5.10 Line Blocks

Here is a basic implementation of line blocks. If the verse package is loaded, then it is used to produce the verses.

```

18115
18116 \markdownIfOption{lineBlocks}{%
18117   \RequirePackage{verse}
18118   \markdownSetup{rendererPrototypes={
18119     lineBlockBegin = {%
18120       \begingroup
18121       \def\markdownRendererHardLineBreak{\\}%
18122       \begin{verse}%
18123     },
18124     lineBlockEnd = {%
18125       \end{verse}%
18126     \endgroup

```

```

18127     },
18128   }}
18129 }{}
18130

```

3.3.5.11 yaml Metadata

The default setup of YAML metadata will invoke the `\title`, `\author`, and `\date` macros when scalar values for keys that correspond to the `title`, `author`, and `date` relative wildcards are encountered, respectively.

```

18131 \ExplSyntaxOn
18132 \keys_define:nn
18133   { markdown / jekyllData }
18134   {
18135     author .value_required:n = { true },
18136     author .code:n = {
18137       \author
18138       { #1 }
18139     },
18140     date .value_required:n = { true },
18141     date .code:n = {
18142       \date
18143       { #1 }
18144     },
18145     title .value_required:n = { true },
18146     title .code:n = {
18147       \title
18148       { #1 }

```

To complement the default setup of our key-values, we will use the `\maketitle` macro to typeset the title page of a document at the end of YAML metadata. If we are in the preamble, we will wait macro until after the beginning of the document. Otherwise, we will use the `\maketitle` macro straight away, temporarily resetting the category codes of the percent sign and the hash sign back to comment and parameter, respectively.

```

18149     \char_set_catcode_comment:N \%
18150     \char_set_catcode_parameter:N \#
18151     \AddToHook
18152       { begindocument / end }
18153       { \maketitle }
18154     \char_set_catcode_other:N \%
18155     \char_set_catcode_other:N \#
18156   },
18157 }

```

3.3.5.12 Marked Text

If the `mark` option is enabled, we will load either the soul package or the lua-ul package and use it to implement marked text.

```

18158 \@@_if_option:nT
18159 { mark }
18160 {
18161   \sys_if_engine luatex:TF
18162   {
18163     \RequirePackage
18164     { luacolor }
18165     \RequirePackage
18166     { lua-ul }
18167     \markdownSetup
18168     {
18169       rendererPrototypes = {
18170         mark = {
18171           \highLight
18172           { #1 }
18173         },
18174       }
18175     }
18176   }
18177   {
18178     \RequirePackage
18179     { xcolor }
18180     \RequirePackage
18181     { soul }
18182     \markdownSetup
18183     {
18184       rendererPrototypes = {
18185         mark = {
18186           \hl
18187           { #1 }
18188         },
18189       }
18190     }
18191   }
18192 }

```

3.3.5.13 Strike-Through

If the `strikeThrough` option is enabled, we will load either the soul package or the lua-ul package and use it to implement strike-throughs.

```

18193 \@@_if_option:nT
18194 { strikeThrough }
18195 {
18196   \sys_if_engine luatex:TF
18197   {

```

```

18198     \RequirePackage
18199     { lua-ul }
18200     \markdownSetup
18201     {
18202         rendererPrototypes = {
18203             strikeThrough = {
18204                 \strikeThrough
18205                 { #1 }
18206             },
18207         }
18208     }
18209 }
18210 {
18211     \RequirePackage
18212     { soul }
18213     \markdownSetup
18214     {
18215         rendererPrototypes = {
18216             strikeThrough = {
18217                 \st
18218                 { #1 }
18219             },
18220         }
18221     }
18222 }
18223 }

```

3.3.5.14 Images and their attributes

We define images to be rendered as floating figures using the command `\includegraphics`, where the image label is the alt text and the image title is the caption of the figure.

If the `linkAttributes` option is enabled, we will make attributes in the form `<key>=<value>` set the corresponding keys of the `graphicx` package to the corresponding values and we will register any identifiers, so that they can be used as \LaTeX labels for referencing figures.

```

18224 \seq_new:N
18225 \l_@@_image_identifiers_seq
18226 \markdownSetup {
18227     rendererPrototypes = {
18228         image = {
18229             \tl_if_empty:nTF
18230             { #4 }
18231             {
18232                 \begin { center }
18233                 \includegraphics
18234                 [ alt = { #1 } ]

```

```

18235         { #3 }
18236     \end { center }
18237 }
18238 {
18239     \begin { figure }
18240         \begin { center }
18241             \includegraphics
18242                 [ alt = { #1 } ]
18243                 { #3 }
18244             \caption { #4 }
18245             \seq_map_inline:Nn
18246                 \l_@@_image_identifiers_seq
18247                 { \label { ##1 } }
18248             \end { center }
18249         \end { figure }
18250     }
18251 },
18252 }
18253 }
18254 \@@_if_option:nT
18255 { linkAttributes }
18256 {
18257     \RequirePackage { graphicx }
18258 }
18259 \markdownSetup {
18260     rendererPrototypes = {
18261         imageAttributeContextBegin = {
18262             \group_begin:
18263             \markdownSetup {
18264                 rendererPrototypes = {
18265                     attributeIdentifier = {
18266                         \seq_put_right:Nn
18267                         \l_@@_image_identifiers_seq
18268                         { ##1 }
18269                     },
18270                     attributeKeyValue = {
18271                         \setkeys
18272                         { Gin }
18273                         { { ##1 } = { ##2 } }
18274                     },
18275                 },
18276             }
18277         },
18278         imageAttributeContextEnd = {
18279             \group_end:
18280         },
18281     },

```

```

18282 }
18283 \ExplSyntaxOff

```

3.3.5.15 Raw Attributes

In the raw block and inline raw span renderer prototypes, display the content using the default templates of the package `luaxml` when the raw attribute is `html` and default to the plain TeX renderer prototypes otherwise, translating raw attribute `latex` to `tex`.

```

18284 \ExplSyntaxOn
18285 \cs_new:Nn
18286   \@@_luaxml_print_html:n
18287   {
18288     \luabridge_now:n
18289     {
18290       local~input_file = assert(io.open(" #1 ", "r"))
18291       local~input = assert(input_file:read("*a"))
18292       assert(input_file:close())
18293       input = "<body>" .. input .. "</body>"
18294       local~dom = require("luaxml-domobject").html_parse(input)
18295       local~output = require("luaxml-htmltemplates"):process_dom(dom)
18296       print(output)
18297     }
18298   }
18299 \cs_gset_protected:Npn
18300   \markdownRendererInputRawInlinePrototype#1#2
18301   {
18302     \str_case:nnF
18303       { #2 }
18304       {
18305         { latex }
18306         {
18307           \@@_plain_tex_default_input_raw_inline:nn
18308           { #1 }
18309           { tex }
18310         }
18311         { html }
18312         {

```

If we are using `TeX4ht`⁴⁴, we will pass HTML elements to the output HTML document unchanged.

```

18313       \cs_if_exist:NTF
18314       \HCode
18315       {
18316         \if_mode_vertical:

```

⁴⁴See <https://tug.org/tex4ht/>.

```

18317         \IgnorePar
18318         \EndP
18319         \fi:
18320         \special
18321         { t4ht* < #1 }
18322     }
18323     {
18324         \@@_luaxml_print_html:n
18325         { #1 }
18326     }
18327 }
18328 }
18329 {
18330     \@@_plain_tex_default_input_raw_inline:nn
18331     { #1 }
18332     { #2 }
18333 }
18334 }
18335 \cs_gset_protected:Npn
18336 \markdownRendererInputRawBlockPrototype#1#2
18337 {
18338     \str_case:nnF
18339     { #2 }
18340     {
18341         { latex }
18342         {
18343             \@@_plain_tex_default_input_raw_block:nn
18344             { #1 }
18345             { tex }
18346         }
18347         { html }
18348         {

```

If we are using $\mathrm{T}_{\mathrm{E}}\mathrm{X}4\mathrm{ht}$ ⁴⁵, we will pass HTML elements to the output HTML document unchanged.

```

18349         \cs_if_exist:NTF
18350         \HCode
18351         {
18352             \if_mode_vertical:
18353             \IgnorePar
18354             \fi:
18355             \EndP
18356             \special
18357             { t4ht* < #1 }
18358             \par
18359             \ShowPar

```

⁴⁵See <https://tug.org/tex4ht/>.


```

18360         }
18361         {
18362             \@@_luaxml_print_html:n
18363             { #1 }
18364         }
18365     }
18366 }
18367 {
18368     \@@_plain_tex_default_input_raw_block:nn
18369     { #1 }
18370     { #2 }
18371 }
18372 }

```

3.3.5.16 Bracketed spans

If the `bracketedSpans` option is enabled, we will register any identifiers, so that they can be used as \LaTeX labels for referencing the last \LaTeX counter that has been incremented in e.g. ordered lists.

```

18373 \seq_new:N
18374 \l_@@_bracketed_span_identifiers_seq
18375 \markdownSetup {
18376     rendererPrototypes = {
18377         bracketedSpanAttributeContextBegin $= {
18378             \markdownSetup {
18379                 rendererPrototypes = {
18380                     attributeIdentifier = {
18381                         \seq_put_right:Nn
18382                         \l_@@_bracketed_span_identifiers_seq
18383                         { ##1 }
18384                     },
18385                 },
18386             }
18387         },
18388         bracketedSpanAttributeContextEnd ^= {
18389             \seq_map_inline:Nn
18390             \l_@@_bracketed_span_identifiers_seq
18391             { \label { ##1 } }
18392         },
18393     },
18394 }

```

We will also allow acronyms to be manually marked up using the HTML class `acronym`.

```

18395 \markdownSetup {
18396     rendererPrototypes = {
18397         bracketedSpanAttributeContextBegin += {
18398             \markdownSetup {
18399                 rendererPrototypes = {

```

```

18400         attributeClassName = {
18401             \str_if_eq:nnT
18402             { ##1 }
18403             { acronym }
18404             {
18405                 \markdownSetup {
18406                     rendererPrototypes = {
18407                         bracketedSpan = {
18408                             \bool_set_true:N
18409                             \g__markdown_record_acronyms_bool
18410                             \markdownRendererAcronym
18411                             { #####1 }
18412                         }
18413                     }
18414                 }
18415             },
18416         },
18417     },
18418 },
18419 },
18420 },
18421 }
18422 \ExplSyntaxOff
18423 \fi % Closes ~\markdownIfOption{plain}{\iffalse}{\iftrue}~

```

3.3.6 Miscellanea

When buffering user input, we should disable the bytes with the high bit set, since these are made active by the inputenc package. We will do this by redefining the `\markdownMakeOther` macro accordingly. The code is courtesy of Scott Pakin, the creator of the filecontents package.

```

18424 \newcommand\markdownMakeOther{%
18425     \count0=128\relax
18426     \loop
18427         \catcode\count0=11\relax
18428         \advance\count0 by 1\relax
18429     \ifnum\count0<256\repeat}%

```

3.4 ConT_EXt Implementation

The ConT_EXt implementation makes use of the fact that, apart from some subtle differences, the Mark II and Mark IV ConT_EXt formats *seem* to implement (the documentation is scarce) the majority of the plain T_EX format required by the plain T_EX implementation. As a consequence, we can directly reuse the existing plain T_EX implementation after supplying the missing plain T_EX macros.

When buffering user input, we should disable the bytes with the high bit set, since these are made active by the `\enableregime` macro. We will do this by redefining the `\markdownMakeOther` macro accordingly. The code is courtesy of Scott Pakin, the creator of the filecontents L^AT_EX package.

```
18430 \def\markdownMakeOther{%
18431   \count0=128\relax
18432   \loop
18433     \catcode\count0=11\relax
18434     \advance\count0 by 1\relax
18435   \ifnum\count0<256\repeat
```

On top of that, make the pipe character (`|`) inactive during the scanning. This is necessary, since the character is active in ConT_EXt.

```
18436   \catcode`|=12}%
```

3.4.1 Typesetting Markdown

The `\inputmarkdown` and `\inputyaml` macros are defined to accept an optional argument with options recognized by the ConT_EXt interface (see Section 2.4.2).

```
18437 \long\def\inputmarkdown{%
18438   \dosingleempty
18439   \doinputmarkdown}%
18440 \long\def\doinputmarkdown[#1]#2{%
18441   \begingroup
18442     \iffirstargument
18443       \setupmarkdown[#1]%
18444       \fi
18445     \markdownInput{#2}%
18446   \endgroup}%
18447 \long\def\inputyaml{%
18448   \dosingleempty
18449   \doinputyaml}%
18450 \long\def\doinputyaml[#1]#2{%
18451   \doinputmarkdown
18452     [jekyllData, expectJekyllData, ensureJekyllData, #1]{#2}}%
```

The `\startmarkdown`, `\stopmarkdown`, `\startyaml`, and `\stopyaml` macros are implemented using the `\markdownReadAndConvert` macro.

In Knuth’s T_EX, trailing spaces are removed very early on when a line is being put to the input buffer. [21, sec. 31]. According to Eijkhout [22, sec. 2.2], this is because “these spaces are hard to see in an editor”. At the moment, there is no option to suppress this behavior in (Lua)T_EX, but ConT_EXt MkIV funnels all input through its own input handler. This makes it possible to suppress the removal of trailing spaces in ConT_EXt MkIV and therefore to insert hard line breaks into markdown text.

```
18453 \startluacode
18454   document.markdown_buffering = false
```

```

18455 local function preserve_trailing_spaces(line)
18456     if document.markdown_buffering then
18457         line = line:gsub("[ \t][ \t]$", "\t\t")
18458     end
18459     return line
18460 end
18461 resolvers.installinputlinehandler(preserve_trailing_spaces)
18462 \stopluacode
18463 \begingroup
18464 \catcode\|=0%
18465 \catcode\|=12%
18466 |gdef|startmarkdown{%
18467     |ctxlua{document.markdown_buffering = true}%
18468     |markdownReadAndConvert{\stopmarkdown}%
18469                             {|stopmarkdown}}%
18470 |gdef|stopmarkdown{%
18471     |ctxlua{document.markdown_buffering = false}%
18472     |markdownEnd}%
18473 |gdef|startyaml{%
18474     |begingroup
18475     |ctxlua{document.markdown_buffering = true}%
18476     |setupyaml[jekyllData, expectJekyllData, ensureJekyllData]%
18477     |markdownReadAndConvert{\stopyaml}%
18478                             {|stopyaml}}%
18479 |gdef|stopyaml{%
18480     |ctxlua{document.markdown_buffering = false}%
18481     |yamlEnd}%
18482 |endgroup

```

3.4.2 Themes

This section overrides the plain \TeX implementation of the theme-loading mechanism from Section 3.2.2. Furthermore, this section also implements the built-in \ConTeXt themes provided with the Markdown package.

```

18483 \ExplSyntaxOn
18484 \prop_new:N \g_@@_context_loaded_themes_linenos_prop
18485 \prop_new:N \g_@@_context_loaded_themes_versions_prop
18486 \cs_gset_protected:Nn
18487   \@@_load_theme:nnn
18488   {

```

Determine whether either this is a built-in theme according to the prop `\g_@@_context_built_in_themes_prop` or a file named `t-markdowntheme<munged theme name>.tex` exists. If it does, load it. Otherwise, try loading a plain \TeX theme instead.

```

18489     \bool_if:nTF

```

```

18490 {
18491   \bool_lazy_or_p:nn
18492   {
18493     \prop_if_in_p:Nn
18494     \g_@@_context_built_in_themes_prop
18495     { #1 }
18496   }
18497   {
18498     \file_if_exist_p:n
18499     { t - markdown theme #3.tex }
18500   }
18501 }
18502 {
18503   \prop_get:NnNTF
18504   \g_@@_context_loaded_themes_linenos_prop
18505   { #1 }
18506   \l_tmpa_tl
18507   {
18508     \prop_get:NnN
18509     \g_@@_context_loaded_themes_versions_prop
18510     { #1 }
18511     \l_tmpb_tl
18512     \str_if_eq:nVTF
18513     { #2 }
18514     \l_tmpb_tl
18515     {
18516       \msg_warning:nnnVn
18517       { markdown }
18518       { repeatedly-loaded-context-theme }
18519       { #1 }
18520       \l_tmpa_tl
18521       { #2 }
18522     }
18523     {
18524       \msg_error:nnnnVV
18525       { markdown }
18526       { different-versions-of-context-theme }
18527       { #1 }
18528       { #2 }
18529       \l_tmpb_tl
18530       \l_tmpa_tl
18531     }
18532   }
18533   {
18534     \prop_gput:Nnx
18535     \g_@@_context_loaded_themes_linenos_prop
18536     { #1 }

```

```

18537         { \tex_the:D \tex_inputlineno:D } % noqa: W200
18538     \prop_gput:Nnn
18539         \g_@@_context_loaded_themes_versions_prop
18540         { #1 }
18541         { #2 }

```

Load built-in plain TeX themes from the prop `\g_@@_context_built_in_themes_prop` and from the filesystem otherwise.

```

18542     \prop_if_in:NnTF
18543         \g_@@_context_built_in_themes_prop
18544         { #1 }
18545     {
18546         \msg_info:nnnn
18547         { markdown }
18548         { loading-built-in-context-theme }
18549         { #1 }
18550         { #2 }
18551         \prop_item:Nn
18552             \g_@@_context_built_in_themes_prop
18553             { #1 }
18554     }
18555     {
18556         \msg_info:nnnn
18557         { markdown }
18558         { loading-context-theme }
18559         { #1 }
18560         { #2 }
18561         \usemodule
18562             [ t ]
18563             [ markdown theme #3 ]
18564     }
18565 }
18566 }
18567 {
18568     \@@_plain_tex_load_theme:nnn
18569     { #1 }
18570     { #2 }
18571     { #3 }
18572 }
18573 }
18574 \msg_new:nnn
18575 { markdown }
18576 { loading-built-in-context-theme }
18577 { Loading~version~#2~of~built-in-ConTeXt-Markdown-theme~#1 }
18578 \msg_new:nnn
18579 { markdown }
18580 { loading-context-theme }

```

```

18581 { Loading~version~#2~of~ConTeXt~Markdown~theme~#1 }
18582 \msg_new:nnn
18583 { markdown }
18584 { repeatedly-loaded-context-theme }
18585 {
18586   Version~#3~of~ConTeXt~Markdown~theme~#1~was~previously~
18587   loaded~on~line~#2,~not~loading~it~again
18588 }
18589 \msg_new:nnn
18590 { markdown }
18591 { different-versions-of-context-theme }
18592 {
18593   Tried~to~load~version~#2~of~ConTeXt~Markdown~theme~#1~
18594   but~version~#3~has~already~been~loaded~on~line~#4
18595 }
18596 \ExplSyntaxOff

```

The [witiko/markdown/defaults](#) ConTeXt theme provides default definitions for token renderer prototypes. First, the ConTeXt theme loads the plain T_EX theme with the default definitions for plain T_EX:

```

18597 \markdownLoadPlainTeXTheme

```

Next, the ConTeXt theme overrides some of the plain T_EX definitions. See Section 3.4.3 for the actual definitions.

3.4.3 Token Renderer Prototypes

The following configuration should be considered placeholder. If the option `plain` has been enabled (see Section 2.2.2.3), none of the definitions will take effect.

```

18598 \markdownIfOption{plain}{\iffalse}{\iftrue}
18599 \def\markdownRendererHardLineBreakPrototype{\blank}%
18600 \def\markdownRendererLeftBracePrototype{\textbraceleft}%
18601 \def\markdownRendererRightBracePrototype{\textbraceright}%
18602 \def\markdownRendererDollarSignPrototype{\textdollar}%
18603 \def\markdownRendererPercentSignPrototype{\percent}%
18604 \def\markdownRendererUnderscorePrototype{\textunderscore}%
18605 \def\markdownRendererCircumflexPrototype{\textcircumflex}%
18606 \def\markdownRendererBackslashPrototype{\textbackslash}%
18607 \def\markdownRendererTildePrototype{\textasciitilde}%
18608 \def\markdownRendererPipePrototype{\char`|}%
18609 \def\markdownRendererLinkPrototype#1#2#3#4{%
18610   \useURL[#1][#3][#4]#1\footnote[#1]{\ifx\empty#4\empty\else#4:
18611     \fi\texttt<\hyphenatedurl{#3}>}}%
18612 \usemodule[database]
18613 \defineseparatedlist
18614 [MarkdownConTeXtCSV]
18615 [separator={,},

```

```

18616     before=\bTABLE,after=\eTABLE,
18617     first=\bTR,last=\eTR,
18618     left=\bTD,right=\eTD]
18619 \def\markdownConTeXtCSV{csv}
18620 \def\markdownRendererContentBlockPrototype#1#2#3#4{%
18621     \def\markdownConTeXtCSV@arg{#1}%
18622     \ifx\markdownConTeXtCSV@arg\markdownConTeXtCSV
18623         \placetable[] [tab:#1]{#4}{%
18624             \processseparatedfile[MarkdownConTeXtCSV] [#3]}%
18625     \else
18626         \markdownInput{#3}%
18627     \fi}%
18628 \def\markdownRendererImagePrototype#1#2#3#4{%
18629     \placefigure[] []{#4}{\externalfigure[#3]}}%
18630 \def\markdownRendererUlBeginPrototype{\startitemize}%
18631 \def\markdownRendererUlBeginTightPrototype{\startitemize[packed]}%
18632 \def\markdownRendererUlItemPrototype{\item}%
18633 \def\markdownRendererUlEndPrototype{\stopitemize}%
18634 \def\markdownRendererUlEndTightPrototype{\stopitemize}%
18635 \def\markdownRendererOlBeginPrototype{\startitemize[n]}%
18636 \def\markdownRendererOlBeginTightPrototype{\startitemize[packed,n]}%
18637 \def\markdownRendererOlItemPrototype{\item}%
18638 \def\markdownRendererOlItemWithNumberPrototype#1{\sym{#1.}}%
18639 \def\markdownRendererOlEndPrototype{\stopitemize}%
18640 \def\markdownRendererOlEndTightPrototype{\stopitemize}%
18641 \definedescription
18642     [MarkdownConTeXtDlItemPrototype]
18643     [location=hanging,
18644     margin=standard,
18645     headstyle=bold]%
18646 \definestartstop
18647     [MarkdownConTeXtDlPrototype]
18648     [before=\blank,
18649     after=\blank]%
18650 \definestartstop
18651     [MarkdownConTeXtDlTightPrototype]
18652     [before=\blank\startpacked,
18653     after=\stoppacked\blank]%
18654 \def\markdownRendererDlBeginPrototype{%
18655     \startMarkdownConTeXtDlPrototype}%
18656 \def\markdownRendererDlBeginTightPrototype{%
18657     \startMarkdownConTeXtDlTightPrototype}%
18658 \def\markdownRendererDlItemPrototype#1{%
18659     \startMarkdownConTeXtDlItemPrototype{#1}}%
18660 \def\markdownRendererDlItemEndPrototype{%
18661     \stopMarkdownConTeXtDlItemPrototype}%
18662 \def\markdownRendererDlEndPrototype{%

```



```

18663 \stopMarkdownConTeXtDlPrototype}%
18664 \def\markdownRendererDlEndTightPrototype{%
18665 \stopMarkdownConTeXtDlTightPrototype}%
18666 \def\markdownRendererEmphasisPrototype#1{\em#1}%
18667 \def\markdownRendererStrongEmphasisPrototype#1{\bf#1}%
18668 \def\markdownRendererBlockQuoteBeginPrototype{\startquotation}%
18669 \def\markdownRendererBlockQuoteEndPrototype{\stopquotation}%
18670 \def\markdownRendererLineBlockBeginPrototype{%
18671 \begingroup
18672 \def\markdownRendererHardLineBreak{
18673 }%
18674 \startlines
18675 }%
18676 \def\markdownRendererLineBlockEndPrototype{%
18677 \stoplines
18678 \endgroup
18679 }%
18680 \def\markdownRendererInputVerbatimPrototype#1{\typefile{#1}}%

```

3.4.3.1 Fenced Code

When no infostring has been specified, default to the indented code block renderer.

```

18681 \ExplSyntaxOn
18682 \cs_gset:Npn
18683 \markdownRendererInputFencedCodePrototype#1#2#3
18684 {
18685 \tl_if_empty:nTF
18686 { #2 }
18687 { \markdownRendererInputVerbatim{#1} }

```

Otherwise, extract the first word of the infostring and treat it as the name of the programming language in which the code block is written. This name is then used in the ConTeXt `\definetytyping` macro, which allows the user to set up code highlighting mapping as follows:

```

\definetytyping [latex]
\setuptyping [latex] [option=TEX]

\starttext
\startmarkdown
~~~ latex
\documentclass{article}
\begin{document}
Hello world!
\end{document}
~~~

```

```
\stopmarkdown
\stoptext
```

```

18688     {
18689         \regex_extract_once:nnN
18690         { \w* }
18691         { #2 }
18692         \l_tmpa_seq
18693         \seq_pop_left:NN
18694         \l_tmpa_seq
18695         \l_tmpa_tl
18696         \typefile[ \l_tmpa_tl ][] {#1}
18697     }
18698 }
18699 \ExplSyntaxOff
18700 \def\markdownRendererHeadingOnePrototype#1{\chapter{#1}}%
18701 \def\markdownRendererHeadingTwoPrototype#1{\section{#1}}%
18702 \def\markdownRendererHeadingThreePrototype#1{\subsection{#1}}%
18703 \def\markdownRendererHeadingFourPrototype#1{\subsubsection{#1}}%
18704 \def\markdownRendererHeadingFivePrototype#1{\subsubsubsection{#1}}%
18705 \def\markdownRendererHeadingSixPrototype#1{\subsubsubsubsection{#1}}%
18706 \def\markdownRendererThematicBreakPrototype{%
18707     \blackrule[height=1pt, width=\hsize]}%
18708 \def\markdownRendererNotePrototype#1{\footnote{#1}}%
18709 \def\markdownRendererTickedBoxPrototype{$\boxtimes$}
18710 \def\markdownRendererHalfTickedBoxPrototype{$\boxdot$}
18711 \def\markdownRendererUntickedBoxPrototype{$\square$}
18712 \def\markdownRendererStrikeThroughPrototype#1{\overstrides{#1}}
18713 \def\markdownRendererSuperscriptPrototype#1{\high{#1}}
18714 \def\markdownRendererSubscriptPrototype#1{\low{#1}}
18715 \def\markdownRendererDisplayMathPrototype#1{%
18716     \startformula#1\stopformula}%

```

3.4.3.2 Tables

There is a basic implementation of tables.

```

18717 \newcount\markdownConTeXtRowCounter
18718 \newcount\markdownConTeXtRowTotal
18719 \newcount\markdownConTeXtColumnCounter
18720 \newcount\markdownConTeXtColumnTotal
18721 \newtoks\markdownConTeXtTable
18722 \newtoks\markdownConTeXtTableFloat
18723 \def\markdownRendererTablePrototype#1#2#3{%
18724     \markdownConTeXtTable={}%
18725     \ifx\empty#1\empty
18726         \markdownConTeXtTableFloat={%
18727             \the\markdownConTeXtTable}%

```

```

18728 \else
18729 \markdownConTeXtTableFloat={%
18730 \placetable{#1}{\the\markdownConTeXtTable}}%
18731 \fi
18732 \begingroup
18733 \setupTABLE[r][each][topframe=off, bottomframe=off,
18734 leftframe=off, rightframe=off]
18735 \setupTABLE[c][each][topframe=off, bottomframe=off,
18736 leftframe=off, rightframe=off]
18737 \setupTABLE[r][1][topframe=on, bottomframe=on]
18738 \setupTABLE[r][#1][bottomframe=on]
18739 \markdownConTeXtRowCounter=0%
18740 \markdownConTeXtRowTotal=#2%
18741 \markdownConTeXtColumnTotal=#3%
18742 \markdownConTeXtRenderTableRow}
18743 \def\markdownConTeXtRenderTableRow#1{%
18744 \markdownConTeXtColumnCounter=0%
18745 \ifnum\markdownConTeXtRowCounter=0\relax
18746 \markdownConTeXtReadAlignments#1%
18747 \markdownConTeXtTable={\bTABLE}%
18748 \else
18749 \markdownConTeXtTable=\expandafter{%
18750 \the\markdownConTeXtTable\bTR}%
18751 \markdownConTeXtRenderTableCell#1%
18752 \markdownConTeXtTable=\expandafter{%
18753 \the\markdownConTeXtTable\eTR}%
18754 \fi
18755 \advance\markdownConTeXtRowCounter by 1\relax
18756 \ifnum\markdownConTeXtRowCounter>\markdownConTeXtRowTotal\relax
18757 \markdownConTeXtTable=\expandafter{%
18758 \the\markdownConTeXtTable\eTABLE}%
18759 \the\markdownConTeXtTableFloat
18760 \endgroup
18761 \expandafter\gobbleoneargument
18762 \fi\markdownConTeXtRenderTableRow}
18763 \def\markdownConTeXtReadAlignments#1{%
18764 \advance\markdownConTeXtColumnCounter by 1\relax
18765 \if#1d%
18766 \setupTABLE[c][\the\markdownConTeXtColumnCounter][align=right]
18767 \fi\if#1l%
18768 \setupTABLE[c][\the\markdownConTeXtColumnCounter][align=right]
18769 \fi\if#1c%
18770 \setupTABLE[c][\the\markdownConTeXtColumnCounter][align=middle]
18771 \fi\if#1r%
18772 \setupTABLE[c][\the\markdownConTeXtColumnCounter][align=left]
18773 \fi
18774 \ifnum\markdownConTeXtColumnCounter<\markdownConTeXtColumnTotal\relax

```

```

18775 \else
18776   \expandafter\gobbleoneargument
18777 \fi\markdownConTeXtReadAlignments}
18778 \def\markdownConTeXtRenderTableCell#1{%
18779   \advance\markdownConTeXtColumnCounter by 1\relax
18780   \markdownConTeXtTable=\expandafter{%
18781     \the\markdownConTeXtTable\bTD#1\eTD}%
18782   \ifnum\markdownConTeXtColumnCounter<\markdownConTeXtColumnTotal\relax
18783   \else
18784     \expandafter\gobbleoneargument
18785   \fi\markdownConTeXtRenderTableCell}

```

3.4.3.3 Raw Attributes

In the raw block and inline raw span renderer prototypes, default to the plain TeX renderer prototypes, translating raw attribute `context` to `tex`.

```

18786 \ExplSyntaxOn
18787 \cs_gset:Npn
18788   \markdownRendererInputRawInlinePrototype#1#2
18789 {
18790   \str_case:nnF
18791     { #2 }
18792     {
18793       { latex }
18794       {
18795         \@@_plain_tex_default_input_raw_inline:nn
18796         { #1 }
18797         { context }
18798       }
18799     }
18800   {
18801     \@@_plain_tex_default_input_raw_inline:nn
18802     { #1 }
18803     { #2 }
18804   }
18805 }
18806 \cs_gset:Npn
18807   \markdownRendererInputRawBlockPrototype#1#2
18808 {
18809   \str_case:nnF
18810     { #2 }
18811     {
18812       { context }
18813       {
18814         \@@_plain_tex_default_input_raw_block:nn
18815         { #1 }
18816         { tex }

```

```

18817     }
18818   }
18819   {
18820     \@@_plain_tex_default_input_raw_block:nn
18821     { #1 }
18822     { #2 }
18823   }
18824 }
18825 \cs_gset_eq:NN
18826   \markdownRendererInputRawBlockPrototype
18827   \markdownRendererInputRawInlinePrototype
18828 \fi % Closes \markdownIfOption{plain}{\iffalse}{\iftrue}`
18829 \ExplSyntaxOff
18830 \stopmodule
18831 \protect

```

At the end of the ConT_EXt module, we load the [witiko/markdown/defaults](#) ConT_EXt theme with the default definitions for token renderer prototypes unless the option `noDefaults` has been enabled (see Section 2.2.2.3).

```

18832 \ExplSyntaxOn
18833 \str_if_eq:VVT
18834   \c_@@_top_layer_tl
18835   \c_@@_option_layer_context_tl
18836   {
18837     \use:c
18838     { ExplSyntaxOff }
18839     \@@_if_option:nF
18840     { noDefaults }
18841     {
18842       \@@_if_option:nTF
18843       { experimental }
18844       {
18845         \@@_setup:n
18846         { theme = witiko/markdown/defaults@experimental }
18847       }
18848       {
18849         \@@_setup:n
18850         { theme = witiko/markdown/defaults }
18851       }
18852     }
18853     \use:c
18854     { ExplSyntaxOn }
18855   }
18856 \ExplSyntaxOff
18857 \stopmodule
18858 \protect

```

References

- [1] Hans Hagen. *ConT_EXt Lua Documents*. July 8, 2023. URL: <https://www.pragma-ade.nl/general/manuals/cld-mkiv.pdf> (visited on 09/22/2025).
- [2] LuaT_EX development team. *LuaT_EX reference manual*. Version 1.21. Feb. 1, 2025. URL: <http://mirrors.ctan.org/systems/doc/luatex/luatex.pdf> (visited on 05/12/2025).
- [3] L^AT_EX Project. *l3kernel. L^AT_EX3 programming conventions*. Dec. 25, 2024. URL: <https://ctan.org/pkg/l3kernel> (visited on 01/06/2025).
- [4] Frank Mittelbach, Ulrike Fischer, and L^AT_EX Project. *The documentmetadata-support code*. June 1, 2024. URL: <https://mirrors.ctan.org/macros/latex/required/latex-lab/documentmetadata-support-code.pdf> (visited on 10/21/2024).
- [5] Vít Novotný. *TeXový interpret jazyka Markdown (markdown.sty)*. 2015. URL: <https://www.muni.cz/en/research/projects/32984> (visited on 02/19/2018).
- [6] Anton Sotkov. *File transclusion syntax for Markdown*. Jan. 19, 2017. URL: <https://github.com/iainc/Markdown-Content-Blocks> (visited on 01/08/2018).
- [7] John MacFarlane. *Pandoc. a universal document converter*. 2022. URL: <https://pandoc.org/> (visited on 10/05/2022).
- [8] Bonita Sharif and Jonathan I. Maletic. “An Eye Tracking Study on camelCase and under_score Identifier Styles.” In: *2010 IEEE 18th International Conference on Program Comprehension*. 2010, pp. 196–205. DOI: [10.1109/ICPC.2010.41](https://doi.org/10.1109/ICPC.2010.41).
- [9] Donald Ervin Knuth. *The T_EXbook*. 3rd ed. Vol. A. Computers & Typesetting. Reading, MA: Addison-Wesley, 1986. ix, 479. ISBN: 0-201-13447-0.
- [10] Frank Mittelbach. *The doc and shortverb Packages*. Apr. 15, 2017. URL: <https://mirrors.ctan.org/macros/latex/base/doc.pdf> (visited on 02/19/2018).
- [11] Till Tantau, Joseph Wright, and Vedran Miletic. *The Beamer class*. Feb. 10, 2021. URL: <https://mirrors.ctan.org/macros/latex/contrib/beamer/doc/beameruserguide.pdf> (visited on 02/11/2021).
- [12] Vít Starý Novotný. *Versioned Themes*. Markdown Enhancement Proposal. Oct. 13, 2024. URL: <https://github.com/Witiko/markdown/discussions/514> (visited on 10/21/2024).
- [13] Vít Starý Novotný et al. *Convert control sequence with a variable number of undelimited parameters into a token list*. URL: <https://tex.stackexchange.com/q/716362/70941> (visited on 04/28/2024).

- [14] Vít Starý Novotný. *Routing YAML metadata to expl3 key-values*. Markdown Enhancement Proposal. Oct. 14, 2024. URL: <https://github.com/witiko/markdown/discussions/517> (visited on 01/06/2025).
- [15] Frank Mittelbach. *L^AT_EX's hook management*. June 26, 2024. URL: <https://mirrors.ctan.org/macros/latex/base/lthooks-code.pdf> (visited on 10/02/2024).
- [16] Geoffrey M. Poore. *The minted Package. Highlighted source code in L^AT_EX*. July 19, 2017. URL: <https://mirrors.ctan.org/macros/latex/contrib/minted/minted.pdf> (visited on 09/01/2020).
- [17] Unicode Consortium. *The Unicode Standard. Version 16.0 – Core Specification*. Sept. 10, 2024. URL: <https://www.unicode.org/versions/Unicode16.0.0/UnicodeStandard-16.0.pdf> (visited on 05/07/2025).
- [18] Roberto Ierusalimsky. *Programming in Lua*. 3rd ed. Rio de Janeiro: PUC-Rio, 2013. xviii, 347. ISBN: 978-85-903798-5-0.
- [19] Johannes Braams et al. *The L^AT_EX_{2_ε} Sources*. Apr. 15, 2017. URL: <https://mirrors.ctan.org/macros/latex/base/source2e.pdf> (visited on 01/08/2018).
- [20] L^AT_EX Project. *The L^AT_EX₃ Interfaces*. Jan. 19, 2026. URL: <https://mirrors.ctan.org/macros/latex/required/l3kernel/interface3.pdf> (visited on 02/18/2026).
- [21] Donald Ervin Knuth. *T_EX: The Program*. Vol. B. Computers & Typesetting. Reading, MA: Addison-Wesley, 1986. xvi, 594. ISBN: 978-0-201-13437-7.
- [22] Victor Eijkhout. *T_EX by Topic. A T_EXnician's Reference*. Wokingham, England: Addison-Wesley, Feb. 1, 1992. 307 pp. ISBN: 978-0-201-56882-0.

Index

acronyms	23, 94, 177, 485, 486, 488
autoIdentifiers	23, 36, 94, 116
blankBeforeBlockquote	24
blankBeforeCodeFence	24
blankBeforeDivFence	24
blankBeforeHeading	25
blankBeforeHtmlBlock	25
blankBeforeList	25
bracketedSpans	26, 97, 98, 521
breakableBlockquotes	26
cacheDir	4, 18, 21, 63, 174, 206, 422, 445, 466

citationNbsps	26
citations	27, 101
codeSpans	27
contentBlocks	22, 28, 38
contentBlocksLanguageMap	22
contentLevel	28
debugExtensions	9, 22, 29, 363
debugExtensionsFileName	22, 29
defaultOptions	10, 55, 420, 422
definitionLists	29, 110
depth_first_search	183
eagerCache	18, 420
ensureJekyllData	30, 30, 31, 41
entities.char_entity	261
entities.dec_entity	260
entities.hex_entity	260
entities.hex_entity_with_x_char	260
escape_minimal	265
escape_programmatic_text	265
escape_typographic_text	265
expandtabs	323
expectJekyllData	30, 30, 31, 41
experimental	5, 19, 38, 491
experimentalOptions	10, 420, 422
extensions	32, 182, 369
extensions.acronyms	184, 369
extensions.citations	372
extensions.content_blocks	376
extensions.definition_lists	379
extensions.fancy_lists	381
extensions.fenced_code	387
extensions.fenced_divs	392
extensions.header_attributes	397
extensions.inline_code_attributes	398
extensions.jekyll_data	416
extensions.line_blocks	399
extensions.link_attributes	400
extensions.mark	400
extensions.notes	402
extensions.pipe_table	404

<code>extensions.raw_inline</code>	409
<code>extensions.strike_through</code>	410
<code>extensions.subscripts</code>	410
<code>extensions.superscripts</code>	411
<code>extensions.tex_math</code>	412
<code>fancyLists</code>	33, 126–131, 491
<code>fencedCode</code>	33, 44, 102, 114, 132, 434, 437
<code>fencedCodeAttributes</code>	34, 94, 114, 437
<code>fencedDivs</code>	34, 45, 115
<code>finalizeCache</code>	18, 19, 23, 35, 35, 63, 174, 420, 421
<code>frozenCache</code>	23, 35, 63, 83, 86, 174, 434, 445
<code>frozenCacheCounter</code>	35, 421, 474
<code>frozenCacheFileName</code>	23, 35, 63, 421
<code>\g_markdown_diagrams_infostrings_prop</code>	439
<code>gfmAutoIdentifiers</code>	24, 36, 94, 116
<code>hashEnumerators</code>	36
<code>headerAttributes</code>	36, 45, 94, 116
<code>html</code>	37, 37, 38, 96, 104, 106, 504
<code>htmlOutput</code>	37, 96, 104, 106
<code>htmlOverLinks</code>	19, 38
<code>hybrid</code>	38, 38, 44, 50, 52, 66, 86, 133, 174, 265, 324, 473
<code>inlineCodeAttributes</code>	40, 94, 103
<code>inlineNotes</code>	40
<code>\inputmarkdown</code>	178, 179, 180, 523
<code>inputTempFileName</code>	64, 67, 467, 468, 471
<code>\inputyaml</code>	30, 31, 41, 178, 179, 180, 523
<code>iterlines</code>	323
<code>jeekyllData</code>	3, 30, 31, 40, 41, 142–145, 147
<code>languages_json</code>	376, 376
<code>lineBlocks</code>	42, 121
<code>linkAttributes</code>	41, 94, 119, 123, 343, 517
<code>mark</code>	42, 123, 516
<code>\markdown</code>	169, 170, 171, 477
<code>markdown</code>	169, 169, 170, 476
<code>markdown*</code>	169, 169, 174, 476
<code>\markdownBegin</code>	57, 58–60, 167, 169, 170, 178
<code>\markdownCleanup</code>	466

<code>\markdownConvert</code>	466
<code>\markdownEnd</code>	57, 58–60, 167, 169–171, 178
<code>\markdownError</code>	167, 167
<code>\markdownEscape</code>	57, 61, 474
<code>\markdownIfOption</code>	62
<code>\markdownIfSnippetExists</code>	88
<code>\markdownInfo</code>	167, 167
<code>\markdownInput</code>	57, 60, 169, 171, 174, 179, 472, 476
<code>\markdownInputFilename</code>	465
<code>\markdownInputFileStream</code>	467
<code>\markdownInputPlainTeX</code>	476
<code>\markdownLoadPlainTeXTheme</code>	175, 181, 433
<code>\markdownLuaExecute</code>	469, 472
<code>\markdownLuaOptions</code>	462, 466
<code>\markdownMakeOther</code>	167, 522, 523
<code>\markdownOptionExperimental</code>	67
<code>\markdownOptionFinalizeCache</code>	63
<code>\markdownOptionFrozenCache</code>	63
<code>\markdownOptionInputTempFileName</code>	64
<code>\markdownOptionNoDefaults</code>	65
<code>\markdownOptionOutputDir</code>	64, 64, 68, 69
<code>\markdownOptionPlain</code>	65
<code>\markdownOptionStripPercentSigns</code>	66
<code>\markdownOutputFileStream</code>	467
<code>\markdownPrepare</code>	466
<code>\markdownPrepareInputFilename</code>	465
<code>\markdownPrepareLuaOptions</code>	462
<code>\markdownReadAndConvert</code>	167, 467, 476, 477, 523
<code>\markdownReadAndConvertProcessLine</code>	468, 469
<code>\markdownReadAndConvertStripPercentSigns</code>	468
<code>\markdownReadAndConvertTab</code>	467
<code>\markdownRendererAcronym</code>	94
<code>\markdownRendererAttributeClassName</code>	94
<code>\markdownRendererAttributeIdentifier</code>	94
<code>\markdownRendererAttributeKeyValue</code>	95
<code>\markdownRendererBlockHtmlComment</code>	104
<code>\markdownRendererBlockHtmlStandaloneTag</code>	104
<code>\markdownRendererBlockQuoteBegin</code>	97
<code>\markdownRendererBlockQuoteEnd</code>	97
<code>\markdownRendererBracketedSpan</code>	98
<code>\markdownRendererBracketedSpanAttributeContextBegin</code>	98
<code>\markdownRendererBracketedSpanAttributeContextEnd</code>	98

<code>\markdownRendererCite</code>	101, 102
<code>\markdownRendererCodeSpan</code>	103
<code>\markdownRendererCodeSpanAttributeContextBegin</code>	103
<code>\markdownRendererCodeSpanAttributeContextEnd</code>	103
<code>\markdownRendererContentBlock</code>	108, 109
<code>\markdownRendererContentBlockCode</code>	109
<code>\markdownRendererContentBlockOnlineImage</code>	109
<code>\markdownRendererDisplayMath</code>	139
<code>\markdownRendererDlBegin</code>	110
<code>\markdownRendererDlBeginTight</code>	110
<code>\markdownRendererDlDefinitionBegin</code>	112
<code>\markdownRendererDlDefinitionEnd</code>	112
<code>\markdownRendererDlEnd</code>	112
<code>\markdownRendererDlEndTight</code>	113
<code>\markdownRendererDlItem</code>	111
<code>\markdownRendererDlItemEnd</code>	111
<code>\markdownRendererDocumentBegin</code>	124
<code>\markdownRendererDocumentEnd</code>	124
<code>\markdownRendererEllipsis</code>	46, 113
<code>\markdownRendererEmphasis</code>	114, 152
<code>\markdownRendererError</code>	141
<code>\markdownRendererFancyOlBegin</code>	126, 127
<code>\markdownRendererFancyOlBeginTight</code>	127
<code>\markdownRendererFancyOlEnd</code>	130
<code>\markdownRendererFancyOlEndTight</code>	131
<code>\markdownRendererFancyOlItem</code>	128
<code>\markdownRendererFancyOlItemEnd</code>	129
<code>\markdownRendererFancyOlItemWithNumber</code>	129
<code>\markdownRendererFencedCodeAttributeContextBegin</code>	114
<code>\markdownRendererFencedCodeAttributeContextEnd</code>	114
<code>\markdownRendererFencedDivAttributeContextBegin</code>	115
<code>\markdownRendererFencedDivAttributeContextEnd</code>	115
<code>\markdownRendererHalfTickedBox</code>	140
<code>\markdownRendererHardLineBreak</code>	122
<code>\markdownRendererHeaderAttributeContextBegin</code>	116
<code>\markdownRendererHeaderAttributeContextEnd</code>	116
<code>\markdownRendererHeadingFive</code>	118
<code>\markdownRendererHeadingFour</code>	118
<code>\markdownRendererHeadingOne</code>	117
<code>\markdownRendererHeadingSix</code>	118
<code>\markdownRendererHeadingThree</code>	117
<code>\markdownRendererHeadingTwo</code>	117

<code>\markdownRendererImage</code>	119
<code>\markdownRendererImageAttributeContextBegin</code>	119
<code>\markdownRendererImageAttributeContextEnd</code>	119
<code>\markdownRendererInlineHtmlCdataSection</code>	107
<code>\markdownRendererInlineHtmlCloseTag</code>	107
<code>\markdownRendererInlineHtmlComment</code>	96
<code>\markdownRendererInlineHtmlDeclaration</code>	107
<code>\markdownRendererInlineHtmlEmptyTag</code>	107
<code>\markdownRendererInlineHtmlOpenTag</code>	107
<code>\markdownRendererInlineHtmlProcessingInstruction</code>	107
<code>\markdownRendererInlineHtmlTag</code>	96, 106
<code>\markdownRendererInlineMath</code>	139
<code>\markdownRendererInputBlockHtmlCdataElement</code>	104
<code>\markdownRendererInputBlockHtmlCdataSection</code>	104
<code>\markdownRendererInputBlockHtmlDeclaration</code>	104
<code>\markdownRendererInputBlockHtmlElement</code>	96, 104
<code>\markdownRendererInputBlockHtmlPcdataElement</code>	104
<code>\markdownRendererInputBlockHtmlProcessingInstruction</code>	104
<code>\markdownRendererInputFencedCode</code>	102
<code>\markdownRendererInputRawBlock</code>	132
<code>\markdownRendererInputRawInline</code>	131
<code>\markdownRendererInputVerbatim</code>	102
<code>\markdownRendererInterblockSeparator</code>	120
<code>\markdownRendererJekyllDataBegin</code>	142
<code>\markdownRendererJekyllDataBoolean</code>	144
<code>\markdownRendererJekyllDataEmpty</code>	147
<code>\markdownRendererJekyllDataEnd</code>	142
<code>\markdownRendererJekyllDataMappingBegin</code>	143
<code>\markdownRendererJekyllDataMappingEnd</code>	143
<code>\markdownRendererJekyllDataNumber</code>	145
<code>\markdownRendererJekyllDataProgrammaticString</code>	145, 145, 146
<code>\markdownRendererJekyllDataSequenceBegin</code>	143
<code>\markdownRendererJekyllDataSequenceEnd</code>	144
<code>\markdownRendererJekyllDataString</code>	146, 146, 150
<code>\markdownRendererJekyllDataStringPrototype</code>	162
<code>\markdownRendererJekyllDataTypographicString</code>	145, 145, 146, 416
<code>\markdownRendererLineBlockBegin</code>	121
<code>\markdownRendererLineBlockEnd</code>	121
<code>\markdownRendererLink</code>	122, 152
<code>\markdownRendererLinkAttributeContextBegin</code>	123
<code>\markdownRendererLinkAttributeContextEnd</code>	123
<code>\markdownRendererMark</code>	124

<code>\markdownRendererNbsp</code>	125
<code>\markdownRendererNote</code>	125
<code>\markdownRendererOlBegin</code>	125
<code>\markdownRendererOlBeginTight</code>	126
<code>\markdownRendererOlEnd</code>	130
<code>\markdownRendererOlEndTight</code>	130
<code>\markdownRendererOlItem</code>	46, 127
<code>\markdownRendererOlItemEnd</code>	128
<code>\markdownRendererOlItemWithNumber</code>	46, 128
<code>\markdownRendererParagraphSeparator</code>	120
<code>\markdownRendererReplacementCharacter</code>	133
<code>\markdownRendererSectionBegin</code>	132
<code>\markdownRendererSectionEnd</code>	132
<code>\markdownRendererSoftLineBreak</code>	122
<code>\markdownRendererStrikeThrough</code>	136
<code>\markdownRendererStrongEmphasis</code>	114
<code>\markdownRendererSubscript</code>	137
<code>\markdownRendererSuperscript</code>	137
<code>\markdownRendererTable</code>	138
<code>\markdownRendererTableAttributeContextBegin</code>	138
<code>\markdownRendererTableAttributeContextEnd</code>	138
<code>\markdownRendererTextCite</code>	101
<code>\markdownRendererThematicBreak</code>	140
<code>\markdownRendererTickedBox</code>	140
<code>\markdownRendererUlBegin</code>	99
<code>\markdownRendererUlBeginTight</code>	99
<code>\markdownRendererUlEnd</code>	100
<code>\markdownRendererUlEndTight</code>	101
<code>\markdownRendererUlItem</code>	99
<code>\markdownRendererUlItemEnd</code>	100
<code>\markdownRendererUntickedBox</code>	140
<code>\markdownRendererWarning</code>	141
<code>\markdownSetup</code>	62, 62, 66, 173, 174, 180, 477, 487
<code>\markdownSetupSnippet</code>	87, 87
<code>\markdownThemeVersion</code>	76, 76, 77
<code>\markdownWarning</code>	167, 167
<code>\markinline</code>	57, 59, 169, 171, 470, 475
<code>\markinlinePlainTeX</code>	475
<code>\mmdcCommand</code>	441
<code>new</code>	7, 19, 20, 420, 422
<code>notes</code>	42, 125

<code>parsers</code>	284 , 322
<code>parsers.commented_line</code>	302
<code>parsers.unicode</code>	286
<code>pipeTables</code>	7 , 43 , 49 , 138
<code>preserveTabs</code>	44 , 47 , 323
<code>rawAttribute</code>	39 , 44 , 44 , 131 , 132
<code>read_decompositions</code>	185
<code>reader</code>	8 , 33 , 182 , 284 , 322 , 369
<code>reader->add_special_character</code>	8 , 9 , 33 , 363
<code>reader->auto_link_email</code>	351
<code>reader->auto_link_url</code>	351
<code>reader->create_parser</code>	323
<code>reader->finalize_grammar</code>	358 , 427
<code>reader->initialize_named_group</code>	363
<code>reader->insert_pattern</code>	8 , 9 , 33 , 359 , 365
<code>reader->lookup_note_reference</code>	336
<code>reader->lookup_reference</code>	336
<code>reader->normalize_tag</code>	322
<code>reader->options</code>	322
<code>reader->parser_functions</code>	323
<code>reader->parser_functions.name</code>	323
<code>reader->parsers</code>	322 , 322
<code>reader->register_link</code>	335
<code>reader->update_rule</code>	359 , 362 , 365
<code>reader->writer</code>	322
<code>reader.new</code>	322 , 322 , 427
<code>relativeReferences</code>	38 , 45
<code>serialize_byte_parser</code>	184
<code>serialize_byte_range_parser</code>	184
<code>serialize_replacement</code>	184
<code>\setupmarkdown</code>	180 , 180
<code>\setupyaml</code>	180
<code>shiftHeadings</code>	7 , 45
<code>singletonCache</code>	19
<code>slice</code>	7 , 45 , 262 , 277 , 278
<code>smartEllipses</code>	46 , 113 , 174
<code>\startmarkdown</code>	178 , 178 , 523
<code>startNumber</code>	46 , 127 – 129
<code>\startyaml</code>	30 , 31 , 41 , 178 , 178 , 523
<code>\stopmarkdown</code>	178 , 178 , 523

<code>\stopyaml</code>	30, 31, 41, 178, 178, 523
<code>strikeThrough</code>	47, 136, 516
<code>stripIndent</code>	47, 323
<code>stripPercentSigns</code>	467, 468
<code>subscripts</code>	48, 137
<code>superscripts</code>	48, 137
<code>syntax</code>	360, 365
<code>tableAttributes</code>	48, 138, 512
<code>tableCaptions</code>	7, 48, 49, 138
<code>taskLists</code>	49, 140, 503
<code>texComments</code>	50, 324
<code>texMathDollars</code>	39, 50, 139
<code>texMathDoubleBackslash</code>	39, 51, 139
<code>texMathSingleBackslash</code>	39, 51, 139
<code>tightLists</code>	51, 99, 101, 110, 113, 126, 127, 130, 131, 491
<code>underscores</code>	52
<code>unicode_data.casefold_mapping</code>	196, 207
<code>unicode_data.categories</code>	198, 286
<code>unicode_data.ccc</code>	199, 207
<code>unicode_data.composition_mapping</code>	192, 211
<code>unicode_data.decomposition_mapping</code>	186, 188, 210
<code>unicodeNormalization</code>	20, 20, 21
<code>unicodeNormalizationForm</code>	20, 20
<code>util.cache</code>	202, 202
<code>util.cache_verbatim</code>	202
<code>util.canonically_order</code>	207
<code>util.casefold</code>	207
<code>util.compose</code>	211
<code>util.decompose</code>	210
<code>util.encode_json_string</code>	202
<code>util.err</code>	201
<code>util.escaper</code>	205
<code>util.expand_tabs_in_line</code>	202
<code>util.find_file</code>	214
<code>util.find_files</code>	214
<code>util.flatten</code>	203
<code>util.intersperse</code>	204
<code>util.map</code>	205
<code>util.normalize</code>	214
<code>util.pathname</code>	206

util.rope_last	204
util.rope_to_string	204
util.salt	206
util.table_copy	202
util.walk	203, 204
util.warning	206
walkable_syntax	8, 22, 29, 358, 359, 362, 363, 365
writer	182, 182, 261, 369
writer->acronym	369
writer->active_attributes	276, 276, 277
writer->attribute_type_levels	276
writer->attributes	274
writer->block_html_cdata_element	269
writer->block_html_cdata_section	270
writer->block_html_comment	270
writer->block_html_declaration	270
writer->block_html_element	269
writer->block_html_pCDATA_element	270
writer->block_html_processing_instruction	270
writer->block_html_standalone_tag	271
writer->blockquote	272
writer->bulletitem	268
writer->bulletlist	267
writer->citations	372
writer->code	266
writer->contentblock	377
writer->defer_call	284, 284
writer->definitionlist	379
writer->display_math	412
writer->div_begin	393
writer->div_end	393
writer->document	273
writer->ellipsis	264
writer->emphasis	272
writer->error	266
writer->escape	265
writer->escaped_chars	264, 265
writer->escaped_minimal_strings	264, 265
writer->escaped_strings	264
writer->escaped_uri_chars	264, 265
writer->fancyitem	382

writer->fancylist	382
writer->fencedCode	388
writer->flatten_inlines	262, 262
writer->get_state	283
writer->hard_line_break	263
writer->heading	282
writer->identifier	265
writer->image	267
writer->infostring	265
writer->inline_html_cdata_section	271
writer->inline_html_close_tag	271
writer->inline_html_comment	269
writer->inline_html_declaration	271
writer->inline_html_empty_tag	272
writer->inline_html_open_tag	271
writer->inline_html_processing_instruction	271
writer->inline_html_tag	269
writer->inline_math	412
writer->interblocksep	263
writer->is_writing	262, 262
writer->jekyllData	416
writer->lineblock	399
writer->link	266
writer->mark	400
writer->math	265
writer->nbsp	262
writer->note	402
writer->options	261
writer->ordereditem	269
writer->orderedlist	268
writer->paragraph	263
writer->paragraphsep	263
writer->plain	263
writer->pop_attributes	276, 277
writer->push_attributes	276, 277
writer->rawBlock	388
writer->rawInline	409
writer->set_state	284
writer->slice_begin	262
writer->slice_end	262
writer->soft_line_break	263
writer->space	262

<code>writer->span</code>	371
<code>writer->strike_through</code>	410
<code>writer->string</code>	265
<code>writer->strong</code>	272
<code>writer->subscript</code>	410
<code>writer->superscript</code>	411
<code>writer->table</code>	406
<code>writer->thematic_break</code>	264
<code>writer->checkbox</code>	272
<code>writer->undosep</code>	263, 367
<code>writer->uri</code>	265
<code>writer->verbatim</code>	273
<code>writer->warning</code>	206, 266
<code>writer.new</code>	261, 261, 427
<code>\yaml</code>	171
<code>yaml</code>	30, 31, 41, 169, 170, 171, 476
<code>\yamlBegin</code>	30, 31, 41, 57, 58, 59, 167, 170, 178
<code>\yamlEnd</code>	30, 31, 41, 57, 58, 59, 167, 170, 171, 178
<code>\yamlInput</code>	30, 31, 41, 57, 60, 169, 172, 179, 476
<code>\yamlSetup</code>	62