A Markdown Interpreter for TEX

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Contents

1 Introduction

The Markdown package[1] converts markdown[2] markup to TEX commands. The functionality is provided both as a Lua module and as plain TEX, LATEX, and ConTEXt macro packages that can be used to directly typeset TEXdocuments containing markdown markup. Unlike other convertors, the Markdown package 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. 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]

```
local metadata = {
    version   = "2.8.1",
    comment   = "A module for the conversion from markdown to plain TeX",
    author    = "John MacFarlane, Hans Hagen, Vít Novotný",
    copyright = {"2009-2016 John MacFarlane, Hans Hagen",
                 "2016-2019 Vít Novotný"},
    license   = "LPPL 1.3"
}

```

[1] See https://ctan.org/pkg/markdown.
[2] See https://daringfireball.net/projects/markdown/basics/.
[3] See http://mirrors.ctan.org/macros/generic/markdown/markdown.html.

```
10 if not modules then modules = { } end
11 modules['markdown'] = metadata
```

1.1 Feedback

Please use the Markdown project page on GitHub[4] 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 on the TEX-LATEX Stack Exchange.[5]

1.2 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.

Funding by the the Faculty of Informatics at the Masaryk University in Brno [1] is gratefully acknowledged.

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

1.3 Requirements

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

1.3.1 Lua Requirements

The Lua part of the package requires that the following Lua modules are available from within the LuaTEX engine:

LPeg $\geq$ 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 $\geq$ 0.10 is included in LuaTEX $\geq$ 0.72.0 (TEXLive $\geq$ 2013).

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

Selene Unicode A library that provides support for the processing of wide strings. It is used by the Lunamark library to cast image, link, and footnote tags to the lower case. Selene Unicode is included in all releases of LuaTEX (TEXLive $\geq$ 2008).

[4] See https://github.com/witiko/markdown/issues.
[5] See https://tex.stackexchange.com.

```
13 local unicode = require("unicode")
```

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 (TeXLive $\geq$ 2008).

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

All the abovelisted modules are statically linked into the current version of the LuaTeX engine [2, Section 3.3].

1.3.2 Plain TeX Requirements

The plain TeX part of the package requires that the plain TeX format (or its superset) is loaded, all the Lua prerequisites (see Section 1.3.1), and 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 `\markdownOptionCacheDir` macro 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 3.2].

The Lua File System module is statically linked into the LuaTeX engine [2, Section 3.3].

Unless you convert markdown documents to TeX manually using the Lua command-line interface (see Section 2.1.5), 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) or if you enforce the use of shell using the `\markdownMode` macro, 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.

1.3.3 LaTeX Requirements

The LaTeX part of the package requires that the LaTeX 2_ε format is loaded,

```
15 \NeedsTeXFormat{LaTeX2e}%
```

all the plain TeX prerequisites (see Section 1.3.2), and the following LaTeX 2_ε packages:

keyval A package that enables the creation of parameter sets. This package is used to provide the `\markdownSetup` macro, the package options processing, as well as the parameters of the `markdown*` LaTeX environment.

```
\RequirePackage{keyval}
```

url A package that provides the `\url` macro for the typesetting of URLs. It is used to provide the default token renderer prototype (see Section 2.2.4) for links.

```
\RequirePackage{url}
```

graphicx A package that provides the `\includegraphics` macro for the typesetting of images. It is used to provide the corresponding default token renderer prototype (see Section 2.2.4).

```
\RequirePackage{graphicx}
```

paralist A package that provides the `compactitem`, `compactenum`, and `compactdesc` macros for the typesetting of tight bulleted lists, ordered lists, and definition lists. It is used to provide the corresponding default token renderer prototypes (see Section 2.2.4).

ifthen A package that provides a concise syntax for the inspection of macro values. It is used to determine whether or not the paralist package should be loaded based on the user options.

```
\RequirePackage{ifthen}
```

fancyvrb A package that provides the `\VerbatimInput` macros for the verbatim inclusion of files containing code. It is used to provide the corresponding default token renderer prototype (see Section 2.2.4).

```
\RequirePackage{fancyvrb}
```

csvsimple A package that provides the default token renderer prototype for iA Writer content blocks with the CSV filename extension (see Section 2.2.4).

```
\RequirePackage{csvsimple}
```

gobble A package that provides the `\@gobblethree` TEX command.

```
\RequirePackage{gobble}
```

1.3.4 ConTEXt Prerequisites

The ConTEXt part of the package requires that either the Mark II or the Mark IV format is loaded, all the plain TEX prerequisites (see Section 1.3.2), and the following ConTEXt modules:

m-database A module that provides the default token renderer prototype for iA Writer content blocks with the CSV filename extension (see Section 2.2.4).

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 TEX nor Lua provide interfaces as a language construct, the separation to interfaces and implementations is purely abstract. 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.

2.1 Lua Interface

The Lua interface provides the conversion from UTF-8 encoded markdown to plain TEX. This interface is used by the plain TEX 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.

```
23 local M = {metadata = metadata}
```

2.1.1 Conversion from Markdown to Plain TEX

The Lua interface exposes the `new(options)` method. This method creates converter functions that perform the conversion from markdown to plain TEX according to the table `options` that contains options recognized by the Lua interface. (see Section 2.1.2). 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 TEX output using the default options and prints the TEX output:

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

2.1.2 Options

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

```
24 local defaultOptions = {}
```

2.1.3 File and Directory Names

`cacheDir`=⟨*path*⟩ 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 TEX 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.

```
25 defaultOptions.cacheDir = "."
```

2.1.4 Parser Options

`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.

```
26 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.

```
27 defaultOptions.blankBeforeCodeFence = 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.

```
28 defaultOptions.blankBeforeHeading = false
```

`breakableBlockquotes`=true, false default: `false`

`true` A blank line separates block quotes.

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

```
defaultOptions.breakableBlockquotes = false
```

`citationNbsps`=true, false default: `false`

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

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

```
defaultOptions.citationNbsps = true
```

`citations`=true, false default: `false`

`true` Enable the pandoc citation syntax extension:

```
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.

```
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.''
```

```
32 defaultOptions.codeSpans = true
```

`contentBlocks`=`true`, `false` default: `false`

`true` Enable the iA Writer content blocks syntax extension [3]:

```
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.

```
33 defaultOptions.contentBlocks = false
```

`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. See Section 2.2.3.9 for more information.

```
34 defaultOptions.contentBlocksLanguageMap = "markdown-languages.json"
```

`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.

```
35 defaultOptions.definitionLists = false
```

`fencedCode`=`true`, `false` default: `false`

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

`false` Disable the commonmark fenced code block extension.

```
36 defaultOptions.fencedCode = false
```

`footnotes`=`true`, `false` default: `false`

`true` Enable the pandoc footnote syntax extension:

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

[^1]: Here is the footnote.

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

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

        { some.code }

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

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

`false` Disable the pandoc footnote syntax extension.

```
37 defaultOptions.footnotes = 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.

```
38 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}
==================
```

These HTML attributes have currently no effect other than enabling content slicing, see the `slice` option.

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

```
39 defaultOptions.headerAttributes = false
```

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

`true` Enable the recognition of HTML tags, block elements, comments, HTML instructions, and entities in the input. Tags, block elements (along with contents), HTML instructions, and comments will be ignored and HTML entities will be replaced with the corresponding Unicode codepoints.

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

```
40 defaultOptions.html = false
```

`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 interpretted by TEX. This is encouraged when typesetting automatically generated content or markdown documents that were not prepared with this package in mind.

```
41 defaultOptions.hybrid = false
```

`inlineFootnotes`=true, false default: `false`

`true` Enable the pandoc inline footnote syntax extension:

```
Here is an inline note.^[Inlines 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 footnote syntax extension.

```
42 defaultOptions.inlineFootnotes = false
```

`pipeTables`=true, false default: `false`

`true` Enable the PHP Markdown table syntax extension:

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

`false` Disable the PHP Markdown table syntax extension.

```
43 defaultOptions.pipeTables = false
```

`preserveTabs`=true, false default: `false`

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

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

```
44 defaultOptions.preserveTabs = 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. Instead, those headings will be shifted to level 6, when ⟨*shift amount*⟩ is positive, and to level 1, when ⟨*shift amount*⟩ is negative.

```
45 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 (`$`) selects the end of a document.
- `^`⟨*identifier*⟩ selects the beginning of a section with the HTML attribute `#`⟨*identifier*⟩ (see the `headerAttributes` option).
- `$`⟨*identifier*⟩ selects the end of a section with the HTML attribute `#`⟨*identifier*⟩.
- ⟨*identifier*⟩ corresponds to `^`⟨*identifier*⟩ for the first selector and to `$`⟨*identifier*⟩ for the second selector.

Specifying only a single selector, ⟨*identifier*⟩, is equivalent to specifying the two selectors ⟨*identifier*⟩ ⟨*identifier*⟩, which is equivalent to `^`⟨*identifier*⟩ `$`⟨*identifier*⟩, i.e. the entire section with the HTML attribute `#`⟨*identifier*⟩ will be selected.

```
46 defaultOptions.slice = "^ $"
```

`smartEllipses`=`true`, `false` default: `false`

`true` Convert any ellipses in the input to the `\markdownRendererEllipsis` TEX macro.

`false` Preserve all ellipses in the input.

```
47 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 `\markdownRendererOlItemWithNumber` TEX macro.

`false` Ignore the numbers in the ordered list items. Each item will only produce a `\markdownRendererOlItem` TEX macro.

```
48 defaultOptions.startNumber = true
```

`tableCaptions`=`true`, `false` default: `false`

`true` Enable the Pandoc `table_captions` syntax extension 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` Enable the Pandoc `table_captions` syntax extension.

```
49 defaultOptions.tableCaptions = false
```

`tightLists`=`true`, `false` default: `true`

`true` Lists whose bullets do not consist of multiple paragraphs will be passed to the `\markdownRendererOlBeginTight`, `\markdownRendererOlEndTight`, `\markdownRendererUlBeginTight`, `\markdownRendererUlEndTight`, `\markdownRendererDlBeginTight`, and `\markdownRendererDlEndTight` TEX macros.

`false` Lists whose bullets do not consist of multiple paragraphs will be treated the same way as lists that do consist of multiple paragraphs.

```
50 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.

```
51 defaultOptions.underscores = true
```

2.1.5 Command-Line Interface

To provide finer control over the conversion and to simplify debugging, a command-line Lua interface for converting a Markdown document to TEX is also provided.

```
52
53 HELP_STRING = [[
54 Usage: texlua ]] .. arg[0] .. [[ [OPTIONS] -- [INPUT_FILE] [OUTPUT_FILE]
55 where OPTIONS are documented in the Lua interface section of the
56 technical Markdown package documentation.
57
58 When OUTPUT_FILE is unspecified, the result of the conversion will be
59 written to the standard output. When INPUT_FILE is also unspecified, the
60 result of the conversion will be read from the standard input.
61
62 Report bugs to: witiko@mail.muni.cz
63 Markdown package home page: <https://github.com/witiko/markdown>]]
64
65 VERSION_STRING = [[
66 markdown-cli.lua (Markdown) ]] .. metadata.version .. [[
67
68 Copyright (C) ]] .. table.concat(metadata.copyright,
69                                  "\nCopyright (C) ") .. [[
70
71 License: ]] .. metadata.license
72
73 local function warn(s)
74   io.stderr:write("Warning: " .. s .. "\n") end
75
76 local function error(s)
77   io.stderr:write("Error: " .. s .. "\n")
78   os.exit(1) end
79
80 local process_options = true
81 local options = {}
82 local input_filename
83 local output_filename
84 for i = 1, #arg do
85   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.

```
86     if arg[i] == "--" then
87       process_options = false
88       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 2.1.2.

```
    elseif arg[i]:match("=") then
      key, value = arg[i]:match("(.-)=(.*)")
```

The `defaultOptions` table is consulted to identify whether ⟨*value*⟩ should be parsed as a string or as a boolean.

```
      default_type = type(defaultOptions[key])
      if default_type == "boolean" then
        options[key] = (value == "true")
      else
        if default_type ~= "string" then
          if default_type == "nil" then
            warn('Option "' .. key .. '" not recognized.')
          else
            warn('Option "' .. key .. '" type not recognized, please file ' ..
                 'a report to the package maintainer.')
          end
          warn('Parsing the ' .. 'value "' .. value ..'" of option "' ..
               key .. '" as a string.')
        end
        options[key] = value
      end
      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.

```
    elseif arg[i] == "--help" or arg[i] == "-h" then
      print(HELP_STRING)
      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.

```
    elseif arg[i] == "--version" or arg[i] == "-v" then
      print(VERSION_STRING)
      os.exit()
    end
  end
```

The first argument that matches none of the above patters is assumed to be the input filename. The input filename should correspond to the Markdown document that is going to be converted to a TEX document.

```
  if input_filename == nil then
    input_filename = arg[i]
```

The first argument that matches none of the above patters is assumed to be the output filename. The output filename should correspond to the TEX document that will result from the conversion.

```
118   elseif output_filename == nil then
119     output_filename = arg[i]
120   else
121     error('Unexpected argument: "' .. arg[i] .. '".')
122   end
123   ::continue::
124 end
```

The command-line Lua interface is implemented by the `markdown-cli.lua` file that can be invoked from the command line as follows:

```
texlua /path/to/markdown-cli.lua cacheDir=. -- hello.md hello.tex
```

to convert the Markdown document `hello.md` to a TEX document `hello.tex`. After the Markdown package for our TEX format has been loaded, the converted document can be typeset as follows:

```
\input hello
```

This shows another advantage of using the command-line interface compared to using a higher-level TEX interface: it is unnecessary to provide shell access for the TEX engine.

2.2 Plain TEX Interface

The plain TEX interface provides macros for the typesetting of markdown input from within plain TEX, for setting the Lua interface options (see Section 2.1.2) used during the conversion from markdown to plain TEX and for changing the way markdown the tokens are rendered.

```
125 \def\markdownLastModified{2019/04/30}%
126 \def\markdownVersion{2.8.1}%
```

The plain TEX interface is implemented by the `markdown.tex` file that can be loaded as follows:

```
\input markdown
```

It is expected that the special plain TEX characters have the expected category codes, when `\input`ting the file.

2.2.1 Typesetting Markdown

The interface exposes the \markdownBegin, \markdownEnd, and \markdownInput macros.

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

```
\let\markdownBegin\relax
\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 corrolary, 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 TEX [4, p. 46]. As a corrolary, 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 TEX 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 TEX code showcases the usage of the \markdownBegin and \markdownEnd macros:

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

The \markdownInput macro accepts a single parameter containing the filename of a markdown document and expands to the result of the conversion of the input markdown document to plain TEX.

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

This macro is not subject to the abovelisted 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
```

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 2.1.2), while some of them are specific to the plain TEX interface.

2.2.2.1 File and Directory Names

The \markdownOptionHelperScriptFileName macro sets the filename of the helper Lua script file that is created during the conversion from markdown to plain TEX in TEX engines without the \directlua primitive. It defaults to \jobname.markdown.lua, where \jobname is the base name of the document being typeset.

The expansion of this macro must not contain quotation marks (") or backslash symbols (extbackslash). Mind that TEX engines tend to put quotation marks around \jobname, when it contains spaces.

```
\def\markdownOptionHelperScriptFileName{\jobname.markdown.lua}%
```

The \markdownOptionInputTempFileName macro sets the filename of the temporary input file that is created during the conversion from markdown to plain TEX in \markdownMode other than 2. It defaults to \jobname.markdown.out. The same limitations as in the case of the \markdownOptionHelperScriptFileName macro apply here.

```
\def\markdownOptionInputTempFileName{\jobname.markdown.in}%
```

The \markdownOptionOutputTempFileName macro sets the filename of the temporary output file that is created during the conversion from markdown to plain TEX in \markdownMode other than 2. It defaults to \jobname.markdown.out. The same limitations apply here as in the case of the \markdownOptionHelperScriptFileName macro.

```
\def\markdownOptionOutputTempFileName{\jobname.markdown.out}%
```

The \markdownOptionErrorTempFileName macro sets the filename of the temporary output file that is created when a Lua error is encountered during the conversion from markdown to plain TEX in \markdownMode other than 2. It defaults to \jobname.markdown.err. The same limitations apply here as in the case of the \markdownOptionHelperScriptFileName macro.

```
\def\markdownOptionErrorTempFileName{\jobname.markdown.err}%
```

The \markdownOptionOutputDir macro sets the path to the directory that will contain the cache files produced by the Lua implementation and also the auxiliary files produced by the plain TEX implementation. The option defaults to ..

The path must be set to the same value as the -output-directory option of your 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 \markdownOptionHelperScriptFileName macro.

```
\def\markdownOptionOutputDir{.}%
```

The \markdownOptionCacheDir macro corresponds to the Lua interface cacheDir option that sets the path to the directory that will contain the produced cache files. The option defaults to _markdown_\jobname, which is a similar naming scheme to the one used by the minted LATEX package. The same limitations apply here as in the case of the \markdownOptionHelperScriptFileName macro.

```
\def\markdownOptionCacheDir{\markdownOptionOutputDir/_markdown_\jobname}%
```

2.2.2.2 Lua Interface Options

The following macros map directly to the options recognized by the Lua interface (see Section 2.1.2) and are not processed by the plain TEX implementation, only passed along to Lua. They are undefined, which makes them fall back to the default values provided by the Lua interface.

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 \markdownOptionHelperScriptFileName macro.

```
\let\markdownOptionBlankBeforeBlockquote\undefined
\let\markdownOptionBlankBeforeCodeFence\undefined
\let\markdownOptionBlankBeforeHeading\undefined
\let\markdownOptionBreakableBlockquotes\undefined
\let\markdownOptionCitations\undefined
\let\markdownOptionCitationNbsps\undefined
\let\markdownOptionContentBlocks\undefined
\let\markdownOptionContentBlocksLanguageMap\undefined
\let\markdownOptionDefinitionLists\undefined
\let\markdownOptionFootnotes\undefined
\let\markdownOptionFencedCode\undefined
\let\markdownOptionHashEnumerators\undefined
\let\markdownOptionHeaderAttributes\undefined
\let\markdownOptionHtml\undefined
```

```
\let\markdownOptionHybrid\undefined
\let\markdownOptionInlineFootnotes\undefined
\let\markdownOptionPipeTables\undefined
\let\markdownOptionPreserveTabs\undefined
\let\markdownOptionShiftHeadings\undefined
\let\markdownOptionSlice\undefined
\let\markdownOptionSmartEllipses\undefined
\let\markdownOptionStartNumber\undefined
\let\markdownOptionTableCaptions\undefined
\let\markdownOptionTightLists\undefined
```

2.2.2.3 Miscellaneous Options

The `\markdownOptionStripPercentSigns` macro controls whether a percent sign (`%`) at the beginning of a line will be discarded when buffering Markdown input (see Section 3.2.4) or not. Notably, this enables the use of markdown when writing TEX package documentation using the Doc LATEX package [5] or similar. The recognized values of the macro are `true` (discard) and `false` (retain).

```
\def\markdownOptionStripPercentSigns{false}%
```

The `\markdownIfOption{`⟨*name*⟩`}` macro is provided for testing, whether the value of `\markdownOption`⟨*name*⟩ is `true` or `false`.

```
\def\markdownIfOption#1{%
  \def\next##1##2##3##4##5{%
    \expandafter\def\expandafter\next\expandafter{%
      \csname iffalse\endcsname}%
    \if##1t\if##2r\if##3u\if##4e
      \expandafter\def\expandafter\next\expandafter{%
        \csname iftrue\endcsname}%
    \fi\fi\fi\fi
    \next}%
  \expandafter\expandafter\expandafter\next
    \csname markdownOption#1\endcsname\relax\relax\relax\relax\relax}
```

2.2.3 Token Renderers

The following TEX 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 2.2.4).

2.2.3.1 Interblock Separator Renderer

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

```
\def\markdownRendererInterblockSeparator{%
  \markdownRendererInterblockSeparatorPrototype}%
```

2.2.3.2 Line Break Renderer

The `\markdownRendererLineBreak` macro represents a forced line break. The macro receives no arguments.

```
\def\markdownRendererLineBreak{%
  \markdownRendererLineBreakPrototype}%
```

2.2.3.3 Ellipsis Renderer

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

```
\def\markdownRendererEllipsis{%
  \markdownRendererEllipsisPrototype}%
```

2.2.3.4 Non-Breaking Space Renderer

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

```
\def\markdownRendererNbsp{%
  \markdownRendererNbspPrototype}%
```

2.2.3.5 Special Character Renderers

The following macros replace any special plain TEX characters, including the active pipe character (`|`) of ConTEXt, in the input text. These macros will only be produced, when the `hybrid` option is `false`.

```
\def\markdownRendererLeftBrace{%
  \markdownRendererLeftBracePrototype}%
\def\markdownRendererRightBrace{%
  \markdownRendererRightBracePrototype}%
\def\markdownRendererDollarSign{%
  \markdownRendererDollarSignPrototype}%
\def\markdownRendererPercentSign{%
  \markdownRendererPercentSignPrototype}%
\def\markdownRendererAmpersand{%
  \markdownRendererAmpersandPrototype}%
\def\markdownRendererUnderscore{%
  \markdownRendererUnderscorePrototype}%
\def\markdownRendererHash{%
  \markdownRendererHashPrototype}%
\def\markdownRendererCircumflex{%
  \markdownRendererCircumflexPrototype}%
\def\markdownRendererBackslash{%
  \markdownRendererBackslashPrototype}%
\def\markdownRendererTilde{%
  \markdownRendererTildePrototype}%
\def\markdownRendererPipe{%
  \markdownRendererPipePrototype}%
```

2.2.3.6 Code Span Renderer

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

```
\def\markdownRendererCodeSpan{%
  \markdownRendererCodeSpanPrototype}%
```

2.2.3.7 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.

```
\def\markdownRendererLink{%
  \markdownRendererLinkPrototype}%
```

2.2.3.8 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.

```
\def\markdownRendererImage{%
  \markdownRendererImagePrototype}%
```

2.2.3.9 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.

```
\def\markdownRendererContentBlock{%
  \markdownRendererContentBlockPrototype}%
```

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

```
\def\markdownRendererContentBlockOnlineImage{%
  \markdownRendererContentBlockOnlineImagePrototype}%
```

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[6] contains a record (k, v), then a non-online-image content block with the filename extension s, `s: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

[6] Local files take precedence. Filenames other than `markdown-languages.json` may be specified using the `contentBlocksLanguageMap` Lua option.

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 place a `markdown-languages.json` file inside your working directory or inside your local TEX 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 beside syntax highlighting. The `Languages.json` file provided by Sotkov [3] is a good starting point.

```
\def\markdownRendererContentBlockCode{%
  \markdownRendererContentBlockCodePrototype}%
```

2.2.3.10 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.

```
\def\markdownRendererUlBegin{%
  \markdownRendererUlBeginPrototype}%
```

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 `false`. The macro receives no arguments.

```
\def\markdownRendererUlBeginTight{%
  \markdownRendererUlBeginTightPrototype}%
```

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

```
\def\markdownRendererUlItem{%
  \markdownRendererUlItemPrototype}%
```

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

```
\def\markdownRendererUlItemEnd{%
  \markdownRendererUlItemEndPrototype}%
```

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.

```
\def\markdownRendererUlEnd{%
  \markdownRendererUlEndPrototype}%
```

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 `false`. The macro receives no arguments.

```
\def\markdownRendererUlEndTight{%
  \markdownRendererUlEndTightPrototype}%
```

2.2.3.11 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). The macro receives no arguments.

```
\def\markdownRendererOlBegin{%
  \markdownRendererOlBeginPrototype}%
```

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 `false`. The macro receives no arguments.

```
\def\markdownRendererOlBeginTight{%
  \markdownRendererOlBeginTightPrototype}%
```

The `\markdownRendererOlItem` macro represents an item in an ordered list. This macro will only be produced, when the `startNumber` option is `false`. The macro receives no arguments.

```
\def\markdownRendererOlItem{%
  \markdownRendererOlItemPrototype}%
```

The `\markdownRendererOlItemEnd` macro represents the end of an item in an ordered list. The macro receives no arguments.

```
\def\markdownRendererOlItemEnd{%
  \markdownRendererOlItemEndPrototype}%
```

The `\markdownRendererOlItemWithNumber` macro represents an item in an ordered list. This macro will only be produced, when the `startNumber` option is `true`. The macro receives no arguments.

```
\def\markdownRendererOlItemWithNumber{%
  \markdownRendererOlItemWithNumberPrototype}%
```

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

```
\def\markdownRendererOlEnd{%
  \markdownRendererOlEndPrototype}%
```

The `\markdownRendererOlEndTight` 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 `false`. The macro receives no arguments.

```
\def\markdownRendererOlEndTight{%
  \markdownRendererOlEndTightPrototype}%
```

2.2.3.12 Definition List Renderers

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

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.

```
\def\markdownRendererDlBegin{%
  \markdownRendererDlBeginPrototype}%
```

The `\markdownRendererDlBeginTight` macro represents the beginning of a definition list that contains an item with several paragraphs of text (the list is not tight). This macro will only be produced, when the `tightLists` option is `false`. The macro receives no arguments.

```
\def\markdownRendererDlBeginTight{%
  \markdownRendererDlBeginTightPrototype}%
```

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

```
\def\markdownRendererDlItem{%
  \markdownRendererDlItemPrototype}%
```

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

```
\def\markdownRendererDlItemEnd{%
  \markdownRendererDlItemEndPrototype}%
```

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

```
\def\markdownRendererDlDefinitionBegin{%
  \markdownRendererDlDefinitionBeginPrototype}%
```

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

```
\def\markdownRendererDlDefinitionEnd{%
  \markdownRendererDlDefinitionEndPrototype}%
```

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.

```
\def\markdownRendererDlEnd{%
  \markdownRendererDlEndPrototype}%
```

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 `false`. The macro receives no arguments.

```
\def\markdownRendererDlEndTight{%
  \markdownRendererDlEndTightPrototype}%
```

2.2.3.13 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.

```
\def\markdownRendererEmphasis{%
  \markdownRendererEmphasisPrototype}%
```

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

```
\def\markdownRendererStrongEmphasis{%
  \markdownRendererStrongEmphasisPrototype}%
```

2.2.3.14 Block Quote Renderers

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

```
\def\markdownRendererBlockQuoteBegin{%
  \markdownRendererBlockQuoteBeginPrototype}%
```

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

```
\def\markdownRendererBlockQuoteEnd{%
  \markdownRendererBlockQuoteEndPrototype}%
```

2.2.3.15 Code Block Renderers

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

```
\def\markdownRendererInputVerbatim{%
  \markdownRendererInputVerbatimPrototype}%
```

The `\markdownRendererInputFencedCode` macro represents a fenced code block. This macro will only be produced, when the `fencedCode` option is `true`. The macro receives two arguments that correspond to the filename of a file contaning the code block contents and to the code fence infostring.

```
\def\markdownRendererInputFencedCode{%
  \markdownRendererInputFencedCodePrototype}%
```

2.2.3.16 Heading Renderers

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

```
\def\markdownRendererHeadingOne{%
  \markdownRendererHeadingOnePrototype}%
```

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

```
\def\markdownRendererHeadingTwo{%
  \markdownRendererHeadingTwoPrototype}%
```

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

```
\def\markdownRendererHeadingThree{%
  \markdownRendererHeadingThreePrototype}%
```

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

```
\def\markdownRendererHeadingFour{%
  \markdownRendererHeadingFourPrototype}%
```

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

```
\def\markdownRendererHeadingFive{%
  \markdownRendererHeadingFivePrototype}%
```

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

```
\def\markdownRendererHeadingSix{%
  \markdownRendererHeadingSixPrototype}%
```

2.2.3.17 Horizontal Rule Renderer

The `\markdownRendererHorizontalRule` macro represents a horizontal rule. The macro receives no arguments.

```
\def\markdownRendererHorizontalRule{%
  \markdownRendererHorizontalRulePrototype}%
```

2.2.3.18 Footnote Renderer

The `\markdownRendererFootnote` macro represents a footnote. This macro will only be produced, when the `footnotes` option is `true`. The macro receives a single argument that corresponds to the footnote text.

```
\def\markdownRendererFootnote{%
  \markdownRendererFootnotePrototype}%
```

2.2.3.19 Parenthesized Citations Renderer

The `\markdownRendererCite` macro represents a string of one or more parenthetical citations. This macro will only be produced, when the `citations` option is `true`. 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.

```
\def\markdownRendererCite{%
  \markdownRendererCitePrototype}%
```

2.2.3.20 Text Citations Renderer

The `\markdownRendererTextCite` macro represents a string of one or more text citations. This macro will only be produced, when the `citations` option is `true`. The macro receives parameters in the same format as the `\markdownRendererCite` macro.

```
\def\markdownRendererTextCite{%
  \markdownRendererTextCitePrototype}%
```

2.2.3.21 Table Renderer

The `\markdownRendererTable` macro represents a table. This macro will only be produced, when the `pipeTables` option is `true`. 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.

```
\def\markdownRendererTable{%
  \markdownRendererTablePrototype}%
```

2.2.4 Token Renderer Prototypes

The following TEX macros provide definitions for the token renderers (see Section 2.2.3) that have not been redefined by the user. These macros are intended to be redefined by macro package authors who wish to provide sensible default token renderers. They are also redefined by the LATEX and ConTEXt implementations (see sections 3.3 and 3.4).

```
\def\markdownRendererInterblockSeparatorPrototype{}%
\def\markdownRendererLineBreakPrototype{}%
\def\markdownRendererEllipsisPrototype{}%
\def\markdownRendererNbspPrototype{}%
```

```
\def\markdownRendererLeftBracePrototype{}%
\def\markdownRendererRightBracePrototype{}%
\def\markdownRendererDollarSignPrototype{}%
\def\markdownRendererPercentSignPrototype{}%
\def\markdownRendererAmpersandPrototype{}%
\def\markdownRendererUnderscorePrototype{}%
\def\markdownRendererHashPrototype{}%
\def\markdownRendererCircumflexPrototype{}%
\def\markdownRendererBackslashPrototype{}%
\def\markdownRendererTildePrototype{}%
\def\markdownRendererPipePrototype{}%
\def\markdownRendererCodeSpanPrototype#1{}%
\def\markdownRendererLinkPrototype#1#2#3#4{}%
\def\markdownRendererImagePrototype#1#2#3#4{}%
\def\markdownRendererContentBlockPrototype#1#2#3#4{}%
\def\markdownRendererContentBlockOnlineImagePrototype#1#2#3#4{}%
\def\markdownRendererContentBlockCodePrototype#1#2#3#4#5{}%
\def\markdownRendererUlBeginPrototype{}%
\def\markdownRendererUlBeginTightPrototype{}%
\def\markdownRendererUlItemPrototype{}%
\def\markdownRendererUlItemEndPrototype{}%
\def\markdownRendererUlEndPrototype{}%
\def\markdownRendererUlEndTightPrototype{}%
\def\markdownRendererOlBeginPrototype{}%
\def\markdownRendererOlBeginTightPrototype{}%
\def\markdownRendererOlItemPrototype{}%
\def\markdownRendererOlItemWithNumberPrototype#1{}%
\def\markdownRendererOlItemEndPrototype{}%
\def\markdownRendererOlEndPrototype{}%
\def\markdownRendererOlEndTightPrototype{}%
\def\markdownRendererDlBeginPrototype{}%
\def\markdownRendererDlBeginTightPrototype{}%
\def\markdownRendererDlItemPrototype#1{}%
\def\markdownRendererDlItemEndPrototype{}%
\def\markdownRendererDlDefinitionBeginPrototype{}%
\def\markdownRendererDlDefinitionEndPrototype{}%
\def\markdownRendererDlEndPrototype{}%
\def\markdownRendererDlEndTightPrototype{}%
\def\markdownRendererEmphasisPrototype#1{}%
\def\markdownRendererStrongEmphasisPrototype#1{}%
\def\markdownRendererBlockQuoteBeginPrototype{}%
\def\markdownRendererBlockQuoteEndPrototype{}%
\def\markdownRendererInputVerbatimPrototype#1{}%
\def\markdownRendererInputFencedCodePrototype#1#2{}%
\def\markdownRendererHeadingOnePrototype#1{}%
\def\markdownRendererHeadingTwoPrototype#1{}%
\def\markdownRendererHeadingThreePrototype#1{}%
```

```
\def\markdownRendererHeadingFourPrototype#1{}%
\def\markdownRendererHeadingFivePrototype#1{}%
\def\markdownRendererHeadingSixPrototype#1{}%
\def\markdownRendererHorizontalRulePrototype{}%
\def\markdownRendererFootnotePrototype#1{}%
\def\markdownRendererCitePrototype#1{}%
\def\markdownRendererTextCitePrototype#1{}%
\def\markdownRendererTablePrototype#1#2#3{}%
```

2.2.5 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.

```
\def\markdownInfo#1{}%
\def\markdownWarning#1{}%
```

The `\markdownError` macro receives a second argument that provides a help text.

```
\def\markdownError#1#2{}%
```

You may redefine these macros to redirect and process the info, warning, and error messages.

2.2.6 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*.

```
\let\markdownMakeOther\relax
```

The `\markdownReadAndConvert` macro implements the `\markdownBegin` macro. The first argument specifies the token sequence that will terminate the markdown input (`\markdownEnd` in the instance of the `\markdownBegin` macro) when the plain TEX special characters have had their category changed to *other*. The second argument specifies the token sequence that will actually be inserted into the document, when the ending token sequence has been found.

```
\let\markdownReadAndConvert\relax
\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*.

```
  \catcode`\|=0\catcode`\\=12%
  |gdef|markdownBegin{%
    |markdownReadAndConvert{\markdownEnd}%
```

```
                                {|markdownEnd}}%
|endgroup
```

The macro is exposed in the interface, so that the user can create their own markdown environments. Due to the way the arguments are passed to Lua (see Section 3.2.6), the first argument may not contain the string `]]` (regardless of the category code of the bracket symbol (`]`)).

The `\markdownMode` macro specifies how the plain TEX implementation interfaces with the Lua interface. The valid values and their meaning are as follows:

- `0` – Shell escape via the 18 output file stream
- `1` – Shell escape via the Lua `os.execute` method
- `2` – Direct Lua access

By defining the macro, the user can coerce the package to use a specific mode. If the user does not define the macro prior to loading the plain TEX implementation, the correct value will be automatically detected. The outcome of changing the value of `\markdownMode` after the implementation has been loaded is undefined.

```
\ifx\markdownMode\undefined
  \ifx\directlua\undefined
    \def\markdownMode{0}%
  \else
    \def\markdownMode{2}%
  \fi
\fi
```

The following macros are no longer a part of the plain TEX interface and are only defined for backwards compatibility:

```
\def\markdownLuaRegisterIBCallback#1{\relax}%
\def\markdownLuaUnregisterIBCallback#1{\relax}%
```

2.3 LaTeX Interface

The LaTeX interface provides LaTeX environments for the typesetting of markdown input from within LaTeX, facilities for setting Lua interface options (see Section 2.1.2) used during the conversion from markdown to plain TEX, and facilities for changing the way markdown tokens are rendered. The rest of the interface is inherited from the plain TEX interface (see Section 2.2).

The LaTeX interface is implemented by the `markdown.sty` file, which can be loaded from the LaTeX document preamble as follows:

```
\usepackage[⟨options⟩]{markdown}
```

where ⟨*options*⟩ are the LaTeX interface options (see Section 2.3.2). Note that ⟨*options*⟩ inside the `\usepackage` macro may not set the `markdownRenderers` (see Section 2.3.2.2) and `markdownRendererPrototypes` (see Section 2.3.2.3) keys. This limitation is due to the way LaTeX 2ε parses package options.

2.3.1 Typesetting Markdown

The interface exposes the `markdown` and `markdown*` LaTeX environments, and redefines the `\markdownInput` command.

The `markdown` and `markdown*` LaTeX environments are used to typeset markdown document fragments. The starred version of the `markdown` environment accepts LaTeX interface options (see Section 2.3.2) as its only argument. These options will only influence this markdown document fragment.

```
\newenvironment{markdown}\relax\relax
\newenvironment{markdown*}[1]\relax\relax
```

You may prepend your own code to the `\markdown` macro and append your own code to the `\endmarkdown` macro to produce special effects before and after the `markdown` LaTeX environment (and likewise for the starred version).

Note that the `markdown` and `markdown*` LaTeX environments are subject to the same limitations as the `\markdownBegin` and `\markdownEnd` macros exposed by the plain TeX interface.

The following example LaTeX code showcases the usage of the `markdown` and `markdown*` environments:

```
\documentclass{article}
\usepackage{markdown}
\begin{document}
% ...
\begin{markdown}
_Hello_ **world** ...
\end{markdown}
% ...
\end{document}
```

```
\documentclass{article}
\usepackage{markdown}
\begin{document}
% ...
\begin{markdown*}{smartEllipses}
_Hello_ **world** ...
\end{markdown*}
% ...
\end{document}
```

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 TeX. Unlike the `\markdownInput` macro provided by the plain TeX interface, this macro also accepts LaTeX interface options (see Section 2.3.2) as its optional argument. These options will only influnce this markdown document.

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

```
\documentclass{article}
\usepackage{markdown}
\begin{document}
% ...
```

```
\markdownInput[smartEllipses]{hello.md}
% ...
\end{document}
```

2.3.2 Options

The LaTeX options are represented by a comma-delimited list of ⟨*key*⟩=⟨*value*⟩ pairs. For boolean options, the =⟨*value*⟩ part is optional, and ⟨*key*⟩ will be interpreted as ⟨*key*⟩=`true`.

The LaTeX options map directly to the options recognized by the plain TeX interface (see Section 2.2.2) and to the markdown token renderers and their prototypes recognized by the plain TeX interface (see Sections 2.2.3 and 2.2.4).

The LaTeX options may be specified when loading the LaTeX package (see Section 2.3), when using the `markdown*` LaTeX environment, or via the `\markdownSetup` macro. The `\markdownSetup` macro receives the options to set up as its only argument.

```
\newcommand\markdownSetup[1]{%
  \setkeys{markdownOptions}{#1}%
```

2.3.2.1 Plain TeX Interface Options

The following options map directly to the option macros exposed by the plain TeX interface (see Section 2.2.2).

```
\define@key{markdownOptions}{helperScriptFileName}{%
  \def\markdownOptionHelperScriptFileName{#1}}%
\define@key{markdownOptions}{inputTempFileName}{%
  \def\markdownOptionInputTempFileName{#1}}%
\define@key{markdownOptions}{outputTempFileName}{%
  \def\markdownOptionOutputTempFileName{#1}}%
\define@key{markdownOptions}{errorTempFileName}{%
  \def\markdownOptionErrorTempFileName{#1}}%
\define@key{markdownOptions}{cacheDir}{%
  \def\markdownOptionCacheDir{#1}}%
\define@key{markdownOptions}{outputDir}{%
  \def\markdownOptionOutputDir{#1}}%
\define@key{markdownOptions}{blankBeforeBlockquote}[true]{%
  \def\markdownOptionBlankBeforeBlockquote{#1}}%
\define@key{markdownOptions}{blankBeforeCodeFence}[true]{%
  \def\markdownOptionBlankBeforeCodeFence{#1}}%
\define@key{markdownOptions}{blankBeforeHeading}[true]{%
  \def\markdownOptionBlankBeforeHeading{#1}}%
\define@key{markdownOptions}{breakableBlockquotes}[true]{%
  \def\markdownOptionBreakableBlockquotes{#1}}%
\define@key{markdownOptions}{citations}[true]{%
  \def\markdownOptionCitations{#1}}%
\define@key{markdownOptions}{citationNbsps}[true]{%
```

```
  \def\markdownOptionCitationNbsps{#1}}%
\define@key{markdownOptions}{contentBlocks}[true]{%
  \def\markdownOptionContentBlocks{#1}}%
\define@key{markdownOptions}{codeSpans}[true]{%
  \def\markdownOptionCodeSpans{#1}}%
\define@key{markdownOptions}{contentBlocksLanguageMap}{%
  \def\markdownOptionContentBlocksLanguageMap{#1}}%
\define@key{markdownOptions}{definitionLists}[true]{%
  \def\markdownOptionDefinitionLists{#1}}%
\define@key{markdownOptions}{footnotes}[true]{%
  \def\markdownOptionFootnotes{#1}}%
\define@key{markdownOptions}{fencedCode}[true]{%
  \def\markdownOptionFencedCode{#1}}%
\define@key{markdownOptions}{hashEnumerators}[true]{%
  \def\markdownOptionHashEnumerators{#1}}%
\define@key{markdownOptions}{headerAttributes}[true]{%
  \def\markdownOptionHeaderAttributes{#1}}%
\define@key{markdownOptions}{html}[true]{%
  \def\markdownOptionHtml{#1}}%
\define@key{markdownOptions}{hybrid}[true]{%
  \def\markdownOptionHybrid{#1}}%
\define@key{markdownOptions}{inlineFootnotes}[true]{%
  \def\markdownOptionInlineFootnotes{#1}}%
\define@key{markdownOptions}{pipeTables}[true]{%
  \def\markdownOptionPipeTables{#1}}%
\define@key{markdownOptions}{preserveTabs}[true]{%
  \def\markdownOptionPreserveTabs{#1}}%
\define@key{markdownOptions}{smartEllipses}[true]{%
  \def\markdownOptionSmartEllipses{#1}}%
\define@key{markdownOptions}{shiftHeadings}{%
  \def\markdownOptionShiftHeadings{#1}}%
\define@key{markdownOptions}{slice}{%
  \def\markdownOptionSlice{#1}}%
\define@key{markdownOptions}{startNumber}[true]{%
  \def\markdownOptionStartNumber{#1}}%
\define@key{markdownOptions}{tableCaptions}[true]{%
  \def\markdownOptionTableCaptions{#1}}%
\define@key{markdownOptions}{tightLists}[true]{%
  \def\markdownOptionTightLists{#1}}%
\define@key{markdownOptions}{underscores}[true]{%
  \def\markdownOptionUnderscores{#1}}%
\define@key{markdownOptions}{stripPercentSigns}[true]{%
  \def\markdownOptionStripPercentSigns{#1}}%
```

The following example LaTeX code showcases a possible configuration of plain TeX interface options `\markdownOptionHybrid`, `\markdownOptionSmartEllipses`, and `\markdownOptionCacheDir`.

```
\markdownSetup{
  hybrid,
  smartEllipses,
  cacheDir = /tmp,
}
```

2.3.2.2 Plain TEX Markdown Token Renderers

The LATEX interface recognizes an option with the `renderers` key, whose value must be a list of options that map directly to the markdown token renderer macros exposed by the plain TEX interface (see Section 2.2.3).

```
\define@key{markdownRenderers}{interblockSeparator}{%
  \renewcommand\markdownRendererInterblockSeparator{#1}}%
\define@key{markdownRenderers}{lineBreak}{%
  \renewcommand\markdownRendererLineBreak{#1}}%
\define@key{markdownRenderers}{ellipsis}{%
  \renewcommand\markdownRendererEllipsis{#1}}%
\define@key{markdownRenderers}{nbsp}{%
  \renewcommand\markdownRendererNbsp{#1}}%
\define@key{markdownRenderers}{leftBrace}{%
  \renewcommand\markdownRendererLeftBrace{#1}}%
\define@key{markdownRenderers}{rightBrace}{%
  \renewcommand\markdownRendererRightBrace{#1}}%
\define@key{markdownRenderers}{dollarSign}{%
  \renewcommand\markdownRendererDollarSign{#1}}%
\define@key{markdownRenderers}{percentSign}{%
  \renewcommand\markdownRendererPercentSign{#1}}%
\define@key{markdownRenderers}{ampersand}{%
  \renewcommand\markdownRendererAmpersand{#1}}%
\define@key{markdownRenderers}{underscore}{%
  \renewcommand\markdownRendererUnderscore{#1}}%
\define@key{markdownRenderers}{hash}{%
  \renewcommand\markdownRendererHash{#1}}%
\define@key{markdownRenderers}{circumflex}{%
  \renewcommand\markdownRendererCircumflex{#1}}%
\define@key{markdownRenderers}{backslash}{%
  \renewcommand\markdownRendererBackslash{#1}}%
\define@key{markdownRenderers}{tilde}{%
  \renewcommand\markdownRendererTilde{#1}}%
\define@key{markdownRenderers}{pipe}{%
  \renewcommand\markdownRendererPipe{#1}}%
\define@key{markdownRenderers}{codeSpan}{%
  \renewcommand\markdownRendererCodeSpan[1]{#1}}%
\define@key{markdownRenderers}{link}{%
  \renewcommand\markdownRendererLink[4]{#1}}%
```

```
\define@key{markdownRenderers}{contentBlock}{%
  \renewcommand\markdownRendererContentBlock[4]{#1}}%
\define@key{markdownRenderers}{contentBlockOnlineImage}{%
  \renewcommand\markdownRendererContentBlockOnlineImage[4]{#1}}%
\define@key{markdownRenderers}{contentBlockCode}{%
  \renewcommand\markdownRendererContentBlockCode[5]{#1}}%
\define@key{markdownRenderers}{image}{%
  \renewcommand\markdownRendererImage[4]{#1}}%
\define@key{markdownRenderers}{ulBegin}{%
  \renewcommand\markdownRendererUlBegin{#1}}%
\define@key{markdownRenderers}{ulBeginTight}{%
  \renewcommand\markdownRendererUlBeginTight{#1}}%
\define@key{markdownRenderers}{ulItem}{%
  \renewcommand\markdownRendererUlItem{#1}}%
\define@key{markdownRenderers}{ulItemEnd}{%
  \renewcommand\markdownRendererUlItemEnd{#1}}%
\define@key{markdownRenderers}{ulEnd}{%
  \renewcommand\markdownRendererUlEnd{#1}}%
\define@key{markdownRenderers}{ulEndTight}{%
  \renewcommand\markdownRendererUlEndTight{#1}}%
\define@key{markdownRenderers}{olBegin}{%
  \renewcommand\markdownRendererOlBegin{#1}}%
\define@key{markdownRenderers}{olBeginTight}{%
  \renewcommand\markdownRendererOlBeginTight{#1}}%
\define@key{markdownRenderers}{olItem}{%
  \renewcommand\markdownRendererOlItem{#1}}%
\define@key{markdownRenderers}{olItemWithNumber}{%
  \renewcommand\markdownRendererOlItemWithNumber[1]{#1}}%
\define@key{markdownRenderers}{olItemEnd}{%
  \renewcommand\markdownRendererOlItemEnd{#1}}%
\define@key{markdownRenderers}{olEnd}{%
  \renewcommand\markdownRendererOlEnd{#1}}%
\define@key{markdownRenderers}{olEndTight}{%
  \renewcommand\markdownRendererOlEndTight{#1}}%
\define@key{markdownRenderers}{dlBegin}{%
  \renewcommand\markdownRendererDlBegin{#1}}%
\define@key{markdownRenderers}{dlBeginTight}{%
  \renewcommand\markdownRendererDlBeginTight{#1}}%
\define@key{markdownRenderers}{dlItem}{%
  \renewcommand\markdownRendererDlItem[1]{#1}}%
\define@key{markdownRenderers}{dlItemEnd}{%
  \renewcommand\markdownRendererDlItemEnd{#1}}%
\define@key{markdownRenderers}{dlDefinitionBegin}{%
  \renewcommand\markdownRendererDlDefinitionBegin{#1}}%
\define@key{markdownRenderers}{dlDefinitionEnd}{%
  \renewcommand\markdownRendererDlDefinitionEnd{#1}}%
\define@key{markdownRenderers}{dlEnd}{%
```

```
  \renewcommand\markdownRendererDlEnd{#1}}%
\define@key{markdownRenderers}{dlEndTight}{%
  \renewcommand\markdownRendererDlEndTight{#1}}%
\define@key{markdownRenderers}{emphasis}{%
  \renewcommand\markdownRendererEmphasis[1]{#1}}%
\define@key{markdownRenderers}{strongEmphasis}{%
  \renewcommand\markdownRendererStrongEmphasis[1]{#1}}%
\define@key{markdownRenderers}{blockQuoteBegin}{%
  \renewcommand\markdownRendererBlockQuoteBegin{#1}}%
\define@key{markdownRenderers}{blockQuoteEnd}{%
  \renewcommand\markdownRendererBlockQuoteEnd{#1}}%
\define@key{markdownRenderers}{inputVerbatim}{%
  \renewcommand\markdownRendererInputVerbatim[1]{#1}}%
\define@key{markdownRenderers}{inputFencedCode}{%
  \renewcommand\markdownRendererInputFencedCode[2]{#1}}%
\define@key{markdownRenderers}{headingOne}{%
  \renewcommand\markdownRendererHeadingOne[1]{#1}}%
\define@key{markdownRenderers}{headingTwo}{%
  \renewcommand\markdownRendererHeadingTwo[1]{#1}}%
\define@key{markdownRenderers}{headingThree}{%
  \renewcommand\markdownRendererHeadingThree[1]{#1}}%
\define@key{markdownRenderers}{headingFour}{%
  \renewcommand\markdownRendererHeadingFour[1]{#1}}%
\define@key{markdownRenderers}{headingFive}{%
  \renewcommand\markdownRendererHeadingFive[1]{#1}}%
\define@key{markdownRenderers}{headingSix}{%
  \renewcommand\markdownRendererHeadingSix[1]{#1}}%
\define@key{markdownRenderers}{horizontalRule}{%
  \renewcommand\markdownRendererHorizontalRule{#1}}%
\define@key{markdownRenderers}{footnote}{%
  \renewcommand\markdownRendererFootnote[1]{#1}}%
\define@key{markdownRenderers}{cite}{%
  \renewcommand\markdownRendererCite[1]{#1}}%
\define@key{markdownRenderers}{textCite}{%
  \renewcommand\markdownRendererTextCite[1]{#1}}%
\define@key{markdownRenderers}{table}{%
  \renewcommand\markdownRendererTable[3]{#1}}%
```

The following example LaTeX code showcases a possible configuration of the `\markdownRendererLink` and `\markdownRendererEmphasis` markdown token renderers.

```
\markdownSetup{
  renderers = {
    link = {#4},                    % Render links as the link title.
    emphasis = {\emph{#1}},     % Render emphasized text via `\emph`.
```

```
  }
}
```

2.3.2.3 Plain TEX Markdown Token Renderer Prototypes

The LATEX interface recognizes an option with the `rendererPrototypes` key, whose value must be a list of options that map directly to the markdown token renderer prototype macros exposed by the plain TEX interface (see Section 2.2.4).

```
\define@key{markdownRendererPrototypes}{interblockSeparator}{%
  \renewcommand\markdownRendererInterblockSeparatorPrototype{#1}}%
\define@key{markdownRendererPrototypes}{lineBreak}{%
  \renewcommand\markdownRendererLineBreakPrototype{#1}}%
\define@key{markdownRendererPrototypes}{ellipsis}{%
  \renewcommand\markdownRendererEllipsisPrototype{#1}}%
\define@key{markdownRendererPrototypes}{nbsp}{%
  \renewcommand\markdownRendererNbspPrototype{#1}}%
\define@key{markdownRendererPrototypes}{leftBrace}{%
  \renewcommand\markdownRendererLeftBracePrototype{#1}}%
\define@key{markdownRendererPrototypes}{rightBrace}{%
  \renewcommand\markdownRendererRightBracePrototype{#1}}%
\define@key{markdownRendererPrototypes}{dollarSign}{%
  \renewcommand\markdownRendererDollarSignPrototype{#1}}%
\define@key{markdownRendererPrototypes}{percentSign}{%
  \renewcommand\markdownRendererPercentSignPrototype{#1}}%
\define@key{markdownRendererPrototypes}{ampersand}{%
  \renewcommand\markdownRendererAmpersandPrototype{#1}}%
\define@key{markdownRendererPrototypes}{underscore}{%
  \renewcommand\markdownRendererUnderscorePrototype{#1}}%
\define@key{markdownRendererPrototypes}{hash}{%
  \renewcommand\markdownRendererHashPrototype{#1}}%
\define@key{markdownRendererPrototypes}{circumflex}{%
  \renewcommand\markdownRendererCircumflexPrototype{#1}}%
\define@key{markdownRendererPrototypes}{backslash}{%
  \renewcommand\markdownRendererBackslashPrototype{#1}}%
\define@key{markdownRendererPrototypes}{tilde}{%
  \renewcommand\markdownRendererTildePrototype{#1}}%
\define@key{markdownRendererPrototypes}{pipe}{%
  \renewcommand\markdownRendererPipePrototype{#1}}%
\define@key{markdownRendererPrototypes}{codeSpan}{%
  \renewcommand\markdownRendererCodeSpanPrototype[1]{#1}}%
\define@key{markdownRendererPrototypes}{link}{%
  \renewcommand\markdownRendererLinkPrototype[4]{#1}}%
\define@key{markdownRendererPrototypes}{contentBlock}{%
  \renewcommand\markdownRendererContentBlockPrototype[4]{#1}}%
\define@key{markdownRendererPrototypes}{contentBlockOnlineImage}{%
  \renewcommand\markdownRendererContentBlockOnlineImagePrototype[4]{#1}}%
```

```
\define@key{markdownRendererPrototypes}{contentBlockCode}{%
  \renewcommand\markdownRendererContentBlockCodePrototype[5]{#1}}%
\define@key{markdownRendererPrototypes}{image}{%
  \renewcommand\markdownRendererImagePrototype[4]{#1}}%
\define@key{markdownRendererPrototypes}{ulBegin}{%
  \renewcommand\markdownRendererUlBeginPrototype{#1}}%
\define@key{markdownRendererPrototypes}{ulBeginTight}{%
  \renewcommand\markdownRendererUlBeginTightPrototype{#1}}%
\define@key{markdownRendererPrototypes}{ulItem}{%
  \renewcommand\markdownRendererUlItemPrototype{#1}}%
\define@key{markdownRendererPrototypes}{ulItemEnd}{%
  \renewcommand\markdownRendererUlItemEndPrototype{#1}}%
\define@key{markdownRendererPrototypes}{ulEnd}{%
  \renewcommand\markdownRendererUlEndPrototype{#1}}%
\define@key{markdownRendererPrototypes}{ulEndTight}{%
  \renewcommand\markdownRendererUlEndTightPrototype{#1}}%
\define@key{markdownRendererPrototypes}{olBegin}{%
  \renewcommand\markdownRendererOlBeginPrototype{#1}}%
\define@key{markdownRendererPrototypes}{olBeginTight}{%
  \renewcommand\markdownRendererOlBeginTightPrototype{#1}}%
\define@key{markdownRendererPrototypes}{olItem}{%
  \renewcommand\markdownRendererOlItemPrototype{#1}}%
\define@key{markdownRendererPrototypes}{olItemWithNumber}{%
  \renewcommand\markdownRendererOlItemWithNumberPrototype[1]{#1}}%
\define@key{markdownRendererPrototypes}{olItemEnd}{%
  \renewcommand\markdownRendererOlItemEndPrototype{#1}}%
\define@key{markdownRendererPrototypes}{olEnd}{%
  \renewcommand\markdownRendererOlEndPrototype{#1}}%
\define@key{markdownRendererPrototypes}{olEndTight}{%
  \renewcommand\markdownRendererOlEndTightPrototype{#1}}%
\define@key{markdownRendererPrototypes}{dlBegin}{%
  \renewcommand\markdownRendererDlBeginPrototype{#1}}%
\define@key{markdownRendererPrototypes}{dlBeginTight}{%
  \renewcommand\markdownRendererDlBeginTightPrototype{#1}}%
\define@key{markdownRendererPrototypes}{dlItem}{%
  \renewcommand\markdownRendererDlItemPrototype[1]{#1}}%
\define@key{markdownRendererPrototypes}{dlItemEnd}{%
  \renewcommand\markdownRendererDlItemEndPrototype{#1}}%
\define@key{markdownRendererPrototypes}{dlDefinitionBegin}{%
  \renewcommand\markdownRendererDlDefinitionBeginPrototype{#1}}%
\define@key{markdownRendererPrototypes}{dlDefinitionEnd}{%
  \renewcommand\markdownRendererDlDefinitionEndPrototype{#1}}%
\define@key{markdownRendererPrototypes}{dlEnd}{%
  \renewcommand\markdownRendererDlEndPrototype{#1}}%
\define@key{markdownRendererPrototypes}{dlEndTight}{%
  \renewcommand\markdownRendererDlEndTightPrototype{#1}}%
\define@key{markdownRendererPrototypes}{emphasis}{%
```

```
  \renewcommand\markdownRendererEmphasisPrototype[1]{#1}}%
\define@key{markdownRendererPrototypes}{strongEmphasis}{%
  \renewcommand\markdownRendererStrongEmphasisPrototype[1]{#1}}%
\define@key{markdownRendererPrototypes}{blockQuoteBegin}{%
  \renewcommand\markdownRendererBlockQuoteBeginPrototype{#1}}%
\define@key{markdownRendererPrototypes}{blockQuoteEnd}{%
  \renewcommand\markdownRendererBlockQuoteEndPrototype{#1}}%
\define@key{markdownRendererPrototypes}{inputVerbatim}{%
  \renewcommand\markdownRendererInputVerbatimPrototype[1]{#1}}%
\define@key{markdownRendererPrototypes}{inputFencedCode}{%
  \renewcommand\markdownRendererInputFencedCodePrototype[2]{#1}}%
\define@key{markdownRendererPrototypes}{headingOne}{%
  \renewcommand\markdownRendererHeadingOnePrototype[1]{#1}}%
\define@key{markdownRendererPrototypes}{headingTwo}{%
  \renewcommand\markdownRendererHeadingTwoPrototype[1]{#1}}%
\define@key{markdownRendererPrototypes}{headingThree}{%
  \renewcommand\markdownRendererHeadingThreePrototype[1]{#1}}%
\define@key{markdownRendererPrototypes}{headingFour}{%
  \renewcommand\markdownRendererHeadingFourPrototype[1]{#1}}%
\define@key{markdownRendererPrototypes}{headingFive}{%
  \renewcommand\markdownRendererHeadingFivePrototype[1]{#1}}%
\define@key{markdownRendererPrototypes}{headingSix}{%
  \renewcommand\markdownRendererHeadingSixPrototype[1]{#1}}%
\define@key{markdownRendererPrototypes}{horizontalRule}{%
  \renewcommand\markdownRendererHorizontalRulePrototype{#1}}%
\define@key{markdownRendererPrototypes}{footnote}{%
  \renewcommand\markdownRendererFootnotePrototype[1]{#1}}%
\define@key{markdownRendererPrototypes}{cite}{%
  \renewcommand\markdownRendererCitePrototype[1]{#1}}%
\define@key{markdownRendererPrototypes}{textCite}{%
  \renewcommand\markdownRendererTextCitePrototype[1]{#1}}%
\define@key{markdownRendererPrototypes}{table}{%
  \renewcommand\markdownRendererTablePrototype[3]{#1}}%
```

The following example LaTeX code showcases a possible configuration of the `\markdownRendererImagePrototype` and `\markdownRendererCodeSpanPrototype` markdown token renderer prototypes.

```
\markdownSetup{
  rendererPrototypes = {
    image = {\includegraphics{#2}},
    codeSpan = {\texttt{#1}},    % Render inline code via `\texttt`.
  }
}
```

2.4 ConTEXt Interface

The ConTEXt interface provides a start-stop macro pair for the typesetting of markdown input from within ConTEXt. The rest of the interface is inherited from the plain TEX interface (see Section 2.2).

```
675 \writestatus{loading}{ConTeXt User Module / markdown}%
676 \unprotect
```

The ConTEXt interface is implemented by the `t-markdown.tex` ConTEXt module file that can be loaded as follows:

```
\usemodule[t][markdown]
```

It is expected that the special plain TEX characters have the expected category codes, when `\input`ting the file.

2.4.1 Typesetting Markdown

The interface exposes the `\startmarkdown` and `\stopmarkdown` macro pair for the typesetting of a markdown document fragment.

```
677 \let\startmarkdown\relax
678 \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.

Note that the `\startmarkdown` and `\stopmarkdown` macros are subject to the same limitations as the `\markdownBegin` and `\markdownEnd` macros exposed by the plain TEX interface.

The following example ConTEXt code showcases the usage of the `\startmarkdown` and `\stopmarkdown` macros:

```
\usemodule[t][markdown]
\starttext
\startmarkdown
_Hello_ **world** ...
\stopmarkdown
\stoptext
```

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.

3.1 Lua Implementation

The Lua implementation implements `writer` and `reader` objects that provide the conversion from markdown to plain TEX.

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 TEX writer were hidden behind the converter functions exposed by the Lua interface (see Section 2.1).

```
local upper, gsub, format, length =
  string.upper, string.gsub, string.format, string.len
local concat = table.concat
local P, R, S, V, C, Cg, Cb, Cmt, Cc, Ct, B, Cs, any =
  lpeg.P, lpeg.R, lpeg.S, lpeg.V, lpeg.C, lpeg.Cg, lpeg.Cb,
  lpeg.Cmt, lpeg.Cc, lpeg.Ct, lpeg.B, lpeg.Cs, lpeg.P(1)
```

3.1.1 Utility Functions

This section documents the utility functions 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.

```
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.

```
function util.err(msg, exit_code)
  io.stderr:write("markdown.lua: " .. msg .. "\n")
  os.exit(exit_code or 1)
end
```

The `util.cache` method computes the digest of `string` and `salt`, adds the `suffix` and looks into the directory `dir`, whether a file with such a name exists. If it does not, it gets created with `transform(string)` as its content. The filename is then returned.

```
function util.cache(dir, string, salt, transform, suffix)
  local digest = md5.sumhexa(string .. (salt or ""))
  local name = util.pathname(dir, digest .. suffix)
  local file = io.open(name, "r")
  if file == nil then -- If no cache entry exists, then create a new one.
    local file = assert(io.open(name, "w"))
    local result = string
    if transform ~= nil then
      result = transform(result)
    end
    assert(file:write(result))
    assert(file:close())
```

```
  end
  return name
end
```

The `util.table_copy` method creates a shallow copy of a table `t` and its metatable.

```
function util.table_copy(t)
  local u = { }
  for k, v in pairs(t) do u[k] = v end
  return setmetatable(u, getmetatable(t))
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 [6, Chapter 21].

```
function util.expand_tabs_in_line(s, tabstop)
  local tab = tabstop or 4
  local corr = 0
  return (s:gsub("()\t", function(p)
            local sp = tab - (p - 1 + corr) % tab
            corr = corr - 1 + sp
            return string.rep(" ", sp)
          end))
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.

```
function util.walk(t, f)
  local typ = type(t)
  if typ == "string" then
    f(t)
  elseif typ == "table" then
    local i = 1
    local n
    n = t[i]
    while n do
      util.walk(n, f)
      i = i + 1
      n = t[i]
    end
  elseif typ == "function" then
    local ok, val = pcall(t)
    if ok then
      util.walk(val,f)
    end
  else
```

```
738     f(tostring(t))
739   end
740 end
```

The `util.flatten` method flattens an array `ary` that does not contain cycles and returns the result.

```
741 function util.flatten(ary)
742   local new = {}
743   for _,v in ipairs(ary) do
744     if type(v) == "table" then
745       for _,w in ipairs(util.flatten(v)) do
746         new[#new + 1] = w
747       end
748     else
749       new[#new + 1] = v
750     end
751   end
752   return new
753 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.

```
754 function util.rope_to_string(rope)
755   local buffer = {}
756   util.walk(rope, function(x) buffer[#buffer + 1] = x end)
757   return table.concat(buffer)
758 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.

```
759 function util.rope_last(rope)
760   if #rope == 0 then
761     return nil
762   else
763     local l = rope[#rope]
764     if type(l) == "table" then
765       return util.rope_last(l)
766     else
767       return l
768     end
769   end
770 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`.

```
771 function util.intersperse(ary, x)
772   local new = {}
```

```
  local l = #ary
  for i,v in ipairs(ary) do
    local n = #new
    new[n + 1] = v
    if i ~= l then
      new[n + 2] = x
    end
  end
  return new
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`.

```
function util.map(ary, f)
  local new = {}
  for i,v in ipairs(ary) do
    new[i] = f(v)
  end
  return new
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 occurances of escapable strings and characters (in this order).

The method uses LPeg, which is faster than the Lua `string.gsub` built-in method.

```
function util.escaper(char_escapes, string_escapes)
```

Build a string of escapable characters.

```
  local char_escapes_list = ""
  for i,_ in pairs(char_escapes) do
    char_escapes_list = char_escapes_list .. i
  end
```

Create an LPeg capture `escapable` that produces the escaped string corresponding to the matched escapable character.

```
  local escapable = S(char_escapes_list) / char_escapes
```

If `string_escapes` is provided, turn `escapable` into the

$$\sum_{\texttt{(k,v)} \in \texttt{string\_escapes}} \texttt{P(k) / v} + \texttt{escapable}$$

capture that replaces any occurance of the string `k` with the string `v` for each $(\texttt{k}, \texttt{v}) \in$ `string_escapes`. Note that the pattern summation is not commutative and its operands are inspected in the summation order during the matching. As a corrolary, the strings always take precedence over the characters.

```
  if string_escapes then
```

```
797     for k,v in pairs(string_escapes) do
798       escapable = P(k) / v + escapable
799     end
800   end
```

Create an LPeg capture `escape_string` that captures anything `escapable` does and matches any other unmatched characters.

```
801   local escape_string = Cs((escapable + any)^0)
```

Return a function that matches the input string `s` against the `escape_string` capture.

```
802   return function(s)
803     return lpeg.match(escape_string, s)
804   end
805 end
```

The `util.pathname` method produces a pathname out of a directory name `dir` and a filename `file` and returns it.

```
806 function util.pathname(dir, file)
807   if #dir == 0 then
808     return file
809   else
810     return dir .. "/" .. file
811   end
812 end
```

3.1.2 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.

```
813 local entities = {}
814
815 local character_entities = {
816   ["Tab"] = 9,
817   ["NewLine"] = 10,
818   ["excl"] = 33,
819   ["quot"] = 34,
820   ["QUOT"] = 34,
821   ["num"] = 35,
822   ["dollar"] = 36,
823   ["percnt"] = 37,
824   ["amp"] = 38,
825   ["AMP"] = 38,
826   ["apos"] = 39,
827   ["lpar"] = 40,
828   ["rpar"] = 41,
```

```
  ["ast"] = 42,
  ["midast"] = 42,
  ["plus"] = 43,
  ["comma"] = 44,
  ["period"] = 46,
  ["sol"] = 47,
  ["colon"] = 58,
  ["semi"] = 59,
  ["lt"] = 60,
  ["LT"] = 60,
  ["equals"] = 61,
  ["gt"] = 62,
  ["GT"] = 62,
  ["quest"] = 63,
  ["commat"] = 64,
  ["lsqb"] = 91,
  ["lbrack"] = 91,
  ["bsol"] = 92,
  ["rsqb"] = 93,
  ["rbrack"] = 93,
  ["Hat"] = 94,
  ["lowbar"] = 95,
  ["grave"] = 96,
  ["DiacriticalGrave"] = 96,
  ["lcub"] = 123,
  ["lbrace"] = 123,
  ["verbar"] = 124,
  ["vert"] = 124,
  ["VerticalLine"] = 124,
  ["rcub"] = 125,
  ["rbrace"] = 125,
  ["nbsp"] = 160,
  ["NonBreakingSpace"] = 160,
  ["iexcl"] = 161,
  ["cent"] = 162,
  ["pound"] = 163,
  ["curren"] = 164,
  ["yen"] = 165,
  ["brvbar"] = 166,
  ["sect"] = 167,
  ["Dot"] = 168,
  ["die"] = 168,
  ["DoubleDot"] = 168,
  ["uml"] = 168,
  ["copy"] = 169,
  ["COPY"] = 169,
  ["ordf"] = 170,
```

```
  ["laquo"] = 171,
  ["not"] = 172,
  ["shy"] = 173,
  ["reg"] = 174,
  ["circledR"] = 174,
  ["REG"] = 174,
  ["macr"] = 175,
  ["OverBar"] = 175,
  ["strns"] = 175,
  ["deg"] = 176,
  ["plusmn"] = 177,
  ["pm"] = 177,
  ["PlusMinus"] = 177,
  ["sup2"] = 178,
  ["sup3"] = 179,
  ["acute"] = 180,
  ["DiacriticalAcute"] = 180,
  ["micro"] = 181,
  ["para"] = 182,
  ["middot"] = 183,
  ["centerdot"] = 183,
  ["CenterDot"] = 183,
  ["cedil"] = 184,
  ["Cedilla"] = 184,
  ["sup1"] = 185,
  ["ordm"] = 186,
  ["raquo"] = 187,
  ["frac14"] = 188,
  ["frac12"] = 189,
  ["half"] = 189,
  ["frac34"] = 190,
  ["iquest"] = 191,
  ["Agrave"] = 192,
  ["Aacute"] = 193,
  ["Acirc"] = 194,
  ["Atilde"] = 195,
  ["Auml"] = 196,
  ["Aring"] = 197,
  ["AElig"] = 198,
  ["Ccedil"] = 199,
  ["Egrave"] = 200,
  ["Eacute"] = 201,
  ["Ecirc"] = 202,
  ["Euml"] = 203,
  ["Igrave"] = 204,
  ["Iacute"] = 205,
  ["Icirc"] = 206,
```

```
  ["Iuml"] = 207,
  ["ETH"] = 208,
  ["Ntilde"] = 209,
  ["Ograve"] = 210,
  ["Oacute"] = 211,
  ["Ocirc"] = 212,
  ["Otilde"] = 213,
  ["Ouml"] = 214,
  ["times"] = 215,
  ["Oslash"] = 216,
  ["Ugrave"] = 217,
  ["Uacute"] = 218,
  ["Ucirc"] = 219,
  ["Uuml"] = 220,
  ["Yacute"] = 221,
  ["THORN"] = 222,
  ["szlig"] = 223,
  ["agrave"] = 224,
  ["aacute"] = 225,
  ["acirc"] = 226,
  ["atilde"] = 227,
  ["auml"] = 228,
  ["aring"] = 229,
  ["aelig"] = 230,
  ["ccedil"] = 231,
  ["egrave"] = 232,
  ["eacute"] = 233,
  ["ecirc"] = 234,
  ["euml"] = 235,
  ["igrave"] = 236,
  ["iacute"] = 237,
  ["icirc"] = 238,
  ["iuml"] = 239,
  ["eth"] = 240,
  ["ntilde"] = 241,
  ["ograve"] = 242,
  ["oacute"] = 243,
  ["ocirc"] = 244,
  ["otilde"] = 245,
  ["ouml"] = 246,
  ["divide"] = 247,
  ["div"] = 247,
  ["oslash"] = 248,
  ["ugrave"] = 249,
  ["uacute"] = 250,
  ["ucirc"] = 251,
  ["uuml"] = 252,
```

```
  ["yacute"] = 253,
  ["thorn"] = 254,
  ["yuml"] = 255,
  ["Amacr"] = 256,
  ["amacr"] = 257,
  ["Abreve"] = 258,
  ["abreve"] = 259,
  ["Aogon"] = 260,
  ["aogon"] = 261,
  ["Cacute"] = 262,
  ["cacute"] = 263,
  ["Ccirc"] = 264,
  ["ccirc"] = 265,
  ["Cdot"] = 266,
  ["cdot"] = 267,
  ["Ccaron"] = 268,
  ["ccaron"] = 269,
  ["Dcaron"] = 270,
  ["dcaron"] = 271,
  ["Dstrok"] = 272,
  ["dstrok"] = 273,
  ["Emacr"] = 274,
  ["emacr"] = 275,
  ["Edot"] = 278,
  ["edot"] = 279,
  ["Eogon"] = 280,
  ["eogon"] = 281,
  ["Ecaron"] = 282,
  ["ecaron"] = 283,
  ["Gcirc"] = 284,
  ["gcirc"] = 285,
  ["Gbreve"] = 286,
  ["gbreve"] = 287,
  ["Gdot"] = 288,
  ["gdot"] = 289,
  ["Gcedil"] = 290,
  ["Hcirc"] = 292,
  ["hcirc"] = 293,
  ["Hstrok"] = 294,
  ["hstrok"] = 295,
  ["Itilde"] = 296,
  ["itilde"] = 297,
  ["Imacr"] = 298,
  ["imacr"] = 299,
  ["Iogon"] = 302,
  ["iogon"] = 303,
  ["Idot"] = 304,
```

```
  ["imath"] = 305,
  ["inodot"] = 305,
  ["IJlig"] = 306,
  ["ijlig"] = 307,
  ["Jcirc"] = 308,
  ["jcirc"] = 309,
  ["Kcedil"] = 310,
  ["kcedil"] = 311,
  ["kgreen"] = 312,
  ["Lacute"] = 313,
  ["lacute"] = 314,
  ["Lcedil"] = 315,
  ["lcedil"] = 316,
  ["Lcaron"] = 317,
  ["lcaron"] = 318,
  ["Lmidot"] = 319,
  ["lmidot"] = 320,
  ["Lstrok"] = 321,
  ["lstrok"] = 322,
  ["Nacute"] = 323,
  ["nacute"] = 324,
  ["Ncedil"] = 325,
  ["ncedil"] = 326,
  ["Ncaron"] = 327,
  ["ncaron"] = 328,
  ["napos"] = 329,
  ["ENG"] = 330,
  ["eng"] = 331,
  ["Omacr"] = 332,
  ["omacr"] = 333,
  ["Odblac"] = 336,
  ["odblac"] = 337,
  ["OElig"] = 338,
  ["oelig"] = 339,
  ["Racute"] = 340,
  ["racute"] = 341,
  ["Rcedil"] = 342,
  ["rcedil"] = 343,
  ["Rcaron"] = 344,
  ["rcaron"] = 345,
  ["Sacute"] = 346,
  ["sacute"] = 347,
  ["Scirc"] = 348,
  ["scirc"] = 349,
  ["Scedil"] = 350,
  ["scedil"] = 351,
  ["Scaron"] = 352,
```

```
  ["scaron"] = 353,
  ["Tcedil"] = 354,
  ["tcedil"] = 355,
  ["Tcaron"] = 356,
  ["tcaron"] = 357,
  ["Tstrok"] = 358,
  ["tstrok"] = 359,
  ["Utilde"] = 360,
  ["utilde"] = 361,
  ["Umacr"] = 362,
  ["umacr"] = 363,
  ["Ubreve"] = 364,
  ["ubreve"] = 365,
  ["Uring"] = 366,
  ["uring"] = 367,
  ["Udblac"] = 368,
  ["udblac"] = 369,
  ["Uogon"] = 370,
  ["uogon"] = 371,
  ["Wcirc"] = 372,
  ["wcirc"] = 373,
  ["Ycirc"] = 374,
  ["ycirc"] = 375,
  ["Yuml"] = 376,
  ["Zacute"] = 377,
  ["zacute"] = 378,
  ["Zdot"] = 379,
  ["zdot"] = 380,
  ["Zcaron"] = 381,
  ["zcaron"] = 382,
  ["fnof"] = 402,
  ["imped"] = 437,
  ["gacute"] = 501,
  ["jmath"] = 567,
  ["circ"] = 710,
  ["caron"] = 711,
  ["Hacek"] = 711,
  ["breve"] = 728,
  ["Breve"] = 728,
  ["dot"] = 729,
  ["DiacriticalDot"] = 729,
  ["ring"] = 730,
  ["ogon"] = 731,
  ["tilde"] = 732,
  ["DiacriticalTilde"] = 732,
  ["dblac"] = 733,
  ["DiacriticalDoubleAcute"] = 733,
```

```
1111  ["DownBreve"] = 785,
1112  ["UnderBar"] = 818,
1113  ["Alpha"] = 913,
1114  ["Beta"] = 914,
1115  ["Gamma"] = 915,
1116  ["Delta"] = 916,
1117  ["Epsilon"] = 917,
1118  ["Zeta"] = 918,
1119  ["Eta"] = 919,
1120  ["Theta"] = 920,
1121  ["Iota"] = 921,
1122  ["Kappa"] = 922,
1123  ["Lambda"] = 923,
1124  ["Mu"] = 924,
1125  ["Nu"] = 925,
1126  ["Xi"] = 926,
1127  ["Omicron"] = 927,
1128  ["Pi"] = 928,
1129  ["Rho"] = 929,
1130  ["Sigma"] = 931,
1131  ["Tau"] = 932,
1132  ["Upsilon"] = 933,
1133  ["Phi"] = 934,
1134  ["Chi"] = 935,
1135  ["Psi"] = 936,
1136  ["Omega"] = 937,
1137  ["alpha"] = 945,
1138  ["beta"] = 946,
1139  ["gamma"] = 947,
1140  ["delta"] = 948,
1141  ["epsiv"] = 949,
1142  ["varepsilon"] = 949,
1143  ["epsilon"] = 949,
1144  ["zeta"] = 950,
1145  ["eta"] = 951,
1146  ["theta"] = 952,
1147  ["iota"] = 953,
1148  ["kappa"] = 954,
1149  ["lambda"] = 955,
1150  ["mu"] = 956,
1151  ["nu"] = 957,
1152  ["xi"] = 958,
1153  ["omicron"] = 959,
1154  ["pi"] = 960,
1155  ["rho"] = 961,
1156  ["sigmav"] = 962,
1157  ["varsigma"] = 962,
```

```
["sigmaf"] = 962,
["sigma"] = 963,
["tau"] = 964,
["upsi"] = 965,
["upsilon"] = 965,
["phi"] = 966,
["phiv"] = 966,
["varphi"] = 966,
["chi"] = 967,
["psi"] = 968,
["omega"] = 969,
["thetav"] = 977,
["vartheta"] = 977,
["thetasym"] = 977,
["Upsi"] = 978,
["upsih"] = 978,
["straightphi"] = 981,
["piv"] = 982,
["varpi"] = 982,
["Gammad"] = 988,
["gammad"] = 989,
["digamma"] = 989,
["kappav"] = 1008,
["varkappa"] = 1008,
["rhov"] = 1009,
["varrho"] = 1009,
["epsi"] = 1013,
["straightepsilon"] = 1013,
["bepsi"] = 1014,
["backepsilon"] = 1014,
["IOcy"] = 1025,
["DJcy"] = 1026,
["GJcy"] = 1027,
["Jukcy"] = 1028,
["DScy"] = 1029,
["Iukcy"] = 1030,
["YIcy"] = 1031,
["Jsercy"] = 1032,
["LJcy"] = 1033,
["NJcy"] = 1034,
["TSHcy"] = 1035,
["KJcy"] = 1036,
["Ubrcy"] = 1038,
["DZcy"] = 1039,
["Acy"] = 1040,
["Bcy"] = 1041,
["Vcy"] = 1042,
```

```
1205    ["Gcy"] = 1043,
1206    ["Dcy"] = 1044,
1207    ["IEcy"] = 1045,
1208    ["ZHcy"] = 1046,
1209    ["Zcy"] = 1047,
1210    ["Icy"] = 1048,
1211    ["Jcy"] = 1049,
1212    ["Kcy"] = 1050,
1213    ["Lcy"] = 1051,
1214    ["Mcy"] = 1052,
1215    ["Ncy"] = 1053,
1216    ["Ocy"] = 1054,
1217    ["Pcy"] = 1055,
1218    ["Rcy"] = 1056,
1219    ["Scy"] = 1057,
1220    ["Tcy"] = 1058,
1221    ["Ucy"] = 1059,
1222    ["Fcy"] = 1060,
1223    ["KHcy"] = 1061,
1224    ["TScy"] = 1062,
1225    ["CHcy"] = 1063,
1226    ["SHcy"] = 1064,
1227    ["SHCHcy"] = 1065,
1228    ["HARDcy"] = 1066,
1229    ["Ycy"] = 1067,
1230    ["SOFTcy"] = 1068,
1231    ["Ecy"] = 1069,
1232    ["YUcy"] = 1070,
1233    ["YAcy"] = 1071,
1234    ["acy"] = 1072,
1235    ["bcy"] = 1073,
1236    ["vcy"] = 1074,
1237    ["gcy"] = 1075,
1238    ["dcy"] = 1076,
1239    ["iecy"] = 1077,
1240    ["zhcy"] = 1078,
1241    ["zcy"] = 1079,
1242    ["icy"] = 1080,
1243    ["jcy"] = 1081,
1244    ["kcy"] = 1082,
1245    ["lcy"] = 1083,
1246    ["mcy"] = 1084,
1247    ["ncy"] = 1085,
1248    ["ocy"] = 1086,
1249    ["pcy"] = 1087,
1250    ["rcy"] = 1088,
1251    ["scy"] = 1089,
```

```
["tcy"] = 1090,
["ucy"] = 1091,
["fcy"] = 1092,
["khcy"] = 1093,
["tscy"] = 1094,
["chcy"] = 1095,
["shcy"] = 1096,
["shchcy"] = 1097,
["hardcy"] = 1098,
["ycy"] = 1099,
["softcy"] = 1100,
["ecy"] = 1101,
["yucy"] = 1102,
["yacy"] = 1103,
["iocy"] = 1105,
["djcy"] = 1106,
["gjcy"] = 1107,
["jukcy"] = 1108,
["dscy"] = 1109,
["iukcy"] = 1110,
["yicy"] = 1111,
["jsercy"] = 1112,
["ljcy"] = 1113,
["njcy"] = 1114,
["tshcy"] = 1115,
["kjcy"] = 1116,
["ubrcy"] = 1118,
["dzcy"] = 1119,
["ensp"] = 8194,
["emsp"] = 8195,
["emsp13"] = 8196,
["emsp14"] = 8197,
["numsp"] = 8199,
["puncsp"] = 8200,
["thinsp"] = 8201,
["ThinSpace"] = 8201,
["hairsp"] = 8202,
["VeryThinSpace"] = 8202,
["ZeroWidthSpace"] = 8203,
["NegativeVeryThinSpace"] = 8203,
["NegativeThinSpace"] = 8203,
["NegativeMediumSpace"] = 8203,
["NegativeThickSpace"] = 8203,
["zwnj"] = 8204,
["zwj"] = 8205,
["lrm"] = 8206,
["rlm"] = 8207,
```

```
["hyphen"] = 8208,
["dash"] = 8208,
["ndash"] = 8211,
["mdash"] = 8212,
["horbar"] = 8213,
["Verbar"] = 8214,
["Vert"] = 8214,
["lsquo"] = 8216,
["OpenCurlyQuote"] = 8216,
["rsquo"] = 8217,
["rsquor"] = 8217,
["CloseCurlyQuote"] = 8217,
["lsquor"] = 8218,
["sbquo"] = 8218,
["ldquo"] = 8220,
["OpenCurlyDoubleQuote"] = 8220,
["rdquo"] = 8221,
["rdquor"] = 8221,
["CloseCurlyDoubleQuote"] = 8221,
["ldquor"] = 8222,
["bdquo"] = 8222,
["dagger"] = 8224,
["Dagger"] = 8225,
["ddagger"] = 8225,
["bull"] = 8226,
["bullet"] = 8226,
["nldr"] = 8229,
["hellip"] = 8230,
["mldr"] = 8230,
["permil"] = 8240,
["pertenk"] = 8241,
["prime"] = 8242,
["Prime"] = 8243,
["tprime"] = 8244,
["bprime"] = 8245,
["backprime"] = 8245,
["lsaquo"] = 8249,
["rsaquo"] = 8250,
["oline"] = 8254,
["caret"] = 8257,
["hybull"] = 8259,
["frasl"] = 8260,
["bsemi"] = 8271,
["qprime"] = 8279,
["MediumSpace"] = 8287,
["NoBreak"] = 8288,
["ApplyFunction"] = 8289,
```

```
["af"] = 8289,
["InvisibleTimes"] = 8290,
["it"] = 8290,
["InvisibleComma"] = 8291,
["ic"] = 8291,
["euro"] = 8364,
["tdot"] = 8411,
["TripleDot"] = 8411,
["DotDot"] = 8412,
["Copf"] = 8450,
["complexes"] = 8450,
["incare"] = 8453,
["gscr"] = 8458,
["hamilt"] = 8459,
["HilbertSpace"] = 8459,
["Hscr"] = 8459,
["Hfr"] = 8460,
["Poincareplane"] = 8460,
["quaternions"] = 8461,
["Hopf"] = 8461,
["planckh"] = 8462,
["planck"] = 8463,
["hbar"] = 8463,
["plankv"] = 8463,
["hslash"] = 8463,
["Iscr"] = 8464,
["imagline"] = 8464,
["image"] = 8465,
["Im"] = 8465,
["imagpart"] = 8465,
["Ifr"] = 8465,
["Lscr"] = 8466,
["lagran"] = 8466,
["Laplacetrf"] = 8466,
["ell"] = 8467,
["Nopf"] = 8469,
["naturals"] = 8469,
["numero"] = 8470,
["copysr"] = 8471,
["weierp"] = 8472,
["wp"] = 8472,
["Popf"] = 8473,
["primes"] = 8473,
["rationals"] = 8474,
["Qopf"] = 8474,
["Rscr"] = 8475,
["realine"] = 8475,
```

```
1393  ["real"] = 8476,
1394  ["Re"] = 8476,
1395  ["realpart"] = 8476,
1396  ["Rfr"] = 8476,
1397  ["reals"] = 8477,
1398  ["Ropf"] = 8477,
1399  ["rx"] = 8478,
1400  ["trade"] = 8482,
1401  ["TRADE"] = 8482,
1402  ["integers"] = 8484,
1403  ["Zopf"] = 8484,
1404  ["ohm"] = 8486,
1405  ["mho"] = 8487,
1406  ["Zfr"] = 8488,
1407  ["zeetrf"] = 8488,
1408  ["iiota"] = 8489,
1409  ["angst"] = 8491,
1410  ["bernou"] = 8492,
1411  ["Bernoullis"] = 8492,
1412  ["Bscr"] = 8492,
1413  ["Cfr"] = 8493,
1414  ["Cayleys"] = 8493,
1415  ["escr"] = 8495,
1416  ["Escr"] = 8496,
1417  ["expectation"] = 8496,
1418  ["Fscr"] = 8497,
1419  ["Fouriertrf"] = 8497,
1420  ["phmmat"] = 8499,
1421  ["Mellintrf"] = 8499,
1422  ["Mscr"] = 8499,
1423  ["order"] = 8500,
1424  ["orderof"] = 8500,
1425  ["oscr"] = 8500,
1426  ["alefsym"] = 8501,
1427  ["aleph"] = 8501,
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  ["oopf"] = 120160,
  ["popf"] = 120161,
  ["qopf"] = 120162,
  ["ropf"] = 120163,
  ["sopf"] = 120164,
  ["topf"] = 120165,
  ["uopf"] = 120166,
  ["vopf"] = 120167,
  ["wopf"] = 120168,
  ["xopf"] = 120169,
  ["yopf"] = 120170,
  ["zopf"] = 120171,
}
```

Given a string `s` of decimal digits, the `entities.dec_entity` returns the corresponding UTF8-encoded Unicode codepoint.

```
function entities.dec_entity(s)
  return unicode.utf8.char(tonumber(s))
end
```

Given a string `s` of hexadecimal digits, the `entities.hex_entity` returns the corresponding UTF8-encoded Unicode codepoint.

```
function entities.hex_entity(s)
  return unicode.utf8.char(tonumber("0x"..s))
end
```

Given a character entity name `s` (like `ouml`), the `entities.char_entity` returns the corresponding UTF8-encoded Unicode codepoint.

```
function entities.char_entity(s)
  local n = character_entities[s]
  if n == nil then
    return "&" .. s .. ";"
  end
  return unicode.utf8.char(n)
end
```

3.1.3 Plain TEX Writer

This section documents the `writer` object, which implements the routines for producing the TEX output. The object is an amalgamate of the generic, TEX, LATEX writer objects that were located in the `lunamark/writer/generic.lua`, `lunamark/writer/tex.lua`, and `lunamark/writer/latex.lua` files in the Lunamark 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.

```
M.writer = {}
```

The `writer.new` method creates and returns a new TEX writer object associated with the Lua interface options (see Section 2.1.2) `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*⟩.

```
function M.writer.new(options)
  local self = {}
  options = options or {}
```

Make the `options` table inherit from the `defaultOptions` table.

```
  setmetatable(options, { __index = function (_, key)
    return defaultOptions[key] end })
```

Parse the `slice` option and define `writer->slice_begin` `writer->slice_end`, and `writer->is_writing`.

```
  local slice_specifiers = {}
  for specifier in options.slice:gmatch("[^%s]+") do
    table.insert(slice_specifiers, specifier)
  end

  if #slice_specifiers == 2 then
    self.slice_begin, self.slice_end = table.unpack(slice_specifiers)
    local slice_begin_type = self.slice_begin:sub(1, 1)
    if slice_begin_type ~= "^" and slice_begin_type ~= "$" then
      self.slice_begin = "^" .. self.slice_begin
    end
    local slice_end_type = self.slice_end:sub(1, 1)
    if slice_end_type ~= "^" and slice_end_type ~= "$" then
      self.slice_end = "$" .. self.slice_end
    end
  elseif #slice_specifiers == 1 then
    self.slice_begin = "^" .. slice_specifiers[1]
    self.slice_end = "$" .. slice_specifiers[1]
  end

  if self.slice_begin == "^" and self.slice_end ~= "^" then
    self.is_writing = true
  else
    self.is_writing = false
  end
```

Define `writer->suffix` as the suffix of the produced cache files.

```
  self.suffix = ".tex"
```

Define `writer->space` as the output format of a space character.

```
  self.space = " "
```

Define `writer->nbsp` as the output format of a non-breaking space character.

```
  self.nbsp = "\\markdownRendererNbsp{}"
```

Define `writer->plain` as a function that will transform an input plain text block `s` to the output format.

```
  function self.plain(s)
    return s
  end
```

Define `writer->paragraph` as a function that will transform an input paragraph `s` to the output format.

```
2898   function self.paragraph(s)
2899     if not self.is_writing then return "" end
2900     return s
2901   end
```

Define `writer->pack` as a function that will take the filename `name` of the output file prepared by the reader and transform it to the output format.

```
2902   function self.pack(name)
2903     return [[\input ]] .. name .. [[\relax{}]]
2904   end
```

Define `writer->interblocksep` as the output format of a block element separator.

```
2905   function self.interblocksep()
2906     if not self.is_writing then return "" end
2907     return "\\markdownRendererInterblockSeparator\n{}"
2908   end
```

Define `writer->eof` as the end of file marker in the output format.

```
2909   self.eof = [[\relax]]
```

Define `writer->linebreak` as the output format of a forced line break.

```
2910   self.linebreak = "\\markdownRendererLineBreak\n{}"
```

Define `writer->ellipsis` as the output format of an ellipsis.

```
2911   self.ellipsis = "\\markdownRendererEllipsis{}"
```

Define `writer->hrule` as the output format of a horizontal rule.

```
2912   function self.hrule()
2913     if not self.is_writing then return "" end
2914     return "\\markdownRendererHorizontalRule{}"
2915   end
```

Define a table `escaped_chars` containing the mapping from special plain TEX characters (including the active pipe character (`|`) of ConTEXt) to their escaped variants. Define tables `escaped_minimal_chars` and `escaped_minimal_strings` containing the mapping from special plain characters and character strings that need to be escaped even in content that will not be typeset.

```
2916   local escaped_chars = {
2917     ["{"] = "\\markdownRendererLeftBrace{}",
2918     ["}"] = "\\markdownRendererRightBrace{}",
2919     ["$"] = "\\markdownRendererDollarSign{}",
2920     ["%"] = "\\markdownRendererPercentSign{}",
2921     ["&"] = "\\markdownRendererAmpersand{}",
2922     ["_"] = "\\markdownRendererUnderscore{}",
2923     ["#"] = "\\markdownRendererHash{}",
2924     ["^"] = "\\markdownRendererCircumflex{}",
2925     ["\\"] = "\\markdownRendererBackslash{}",
2926     ["~"] = "\\markdownRendererTilde{}",
2927     ["|"] = "\\markdownRendererPipe{}",
```

```
  }
  local escaped_uri_chars = {
    ["{"] = "\\markdownRendererLeftBrace{}",
    ["}"] = "\\markdownRendererRightBrace{}",
    ["%"] = "\\markdownRendererPercentSign{}",
    ["\\"] = "\\markdownRendererBackslash{}",
  }
  local escaped_citation_chars = {
    ["{"] = "\\markdownRendererLeftBrace{}",
    ["}"] = "\\markdownRendererRightBrace{}",
    ["%"] = "\\markdownRendererPercentSign{}",
    ["#"] = "\\markdownRendererHash{}",
    ["\\"] = "\\markdownRendererBackslash{}",
  }
  local escaped_minimal_strings = {
    ["^^"] = "\\markdownRendererCircumflex\\markdownRendererCircumflex ",
  }
```

Use the `escaped_chars` table to create an escaper function `escape` and the `escaped_minimal_chars` and `escaped_minimal_strings` tables to create an escaper function `escape_minimal`.

```
  local escape = util.escaper(escaped_chars)
  local escape_citation = util.escaper(escaped_citation_chars,
    escaped_minimal_strings)
  local escape_uri = util.escaper(escaped_uri_chars, escaped_minimal_strings)
```

Define `writer->string` as a function that will transform an input plain text span `s` to the output format and `writer->uri` as a function that will transform an input URI `u` to the output format. If the `hybrid` option is `true`, use identity functions. Otherwise, use the `escape` and `escape_minimal` functions.

```
  if options.hybrid then
    self.string = function(s) return s end
    self.citation = function(c) return c end
    self.uri = function(u) return u end
  else
    self.string = escape
    self.citation = escape_citation
    self.uri = escape_uri
  end
```

Define `writer->code` as a function that will transform an input inlined code span `s` to the output format.

```
  function self.code(s)
    return {"\\markdownRendererCodeSpan{",escape(s),"}"}
  end
```

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, and `tit` to the title of the link.

```
function self.link(lab,src,tit)
  return {"\\markdownRendererLink{",lab,"}",
                          "{",self.string(src),"}",
                          "{",self.uri(src),"}",
                          "{",self.string(tit or ""),"}"}
end
```

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.

```
function self.table(rows, caption)
  local buffer = {"\\markdownRendererTable{",
    caption or "", "}{", #rows - 1, "}{", #rows[1], "}"}
  local temp = rows[2] -- put alignments on the first row
  rows[2] = rows[1]
  rows[1] = temp
  for i, row in ipairs(rows) do
    table.insert(buffer, "{")
    for _, column in ipairs(row) do
      if i > 1 then -- do not use braces for alignments
        table.insert(buffer, "{")
      end
      table.insert(buffer, column)
      if i > 1 then
        table.insert(buffer, "}%\n")
      end
    end
    table.insert(buffer, "}%\n")
  end
  return buffer
end
```

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, and `tit` to the title of the image.

```
function self.image(lab,src,tit)
  return {"\\markdownRendererImage{",lab,"}",
                           "{",self.string(src),"}",
                           "{",self.uri(src),"}",
                           "{",self.string(tit or ""),"}"}
end
```

The `languages_json` table maps programming language filename extensions to fence infostrings. All `options.contentBlocksLanguageMap` files located by kpathsea

are loaded into a chain of tables. `languages_json` corresponds to the first table and is chained with the rest via Lua metatables.

```
local languages_json = (function()
  local kpse = require("kpse")
  kpse.set_program_name("luatex")
  local base, prev, curr
  for _, file in ipairs{kpse.lookup(options.contentBlocksLanguageMap,
                                    { all=true })} do
    json = io.open(file, "r"):read("*all")
                             :gsub('("[^\n]-"):','[%1]=')
    curr = (function()
      local _ENV={ json=json, load=load } -- run in sandbox
      return load("return "..json)()
    end)()
    if type(curr) == "table" then
      if base == nil then
        base = curr
      else
        setmetatable(prev, { __index = curr })
      end
      prev = curr
    end
  end
  return base or {}
end)()
```

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.

```
function self.contentblock(src,suf,type,tit)
  if not self.is_writing then return "" end
  src = src.."."..suf
  suf = suf:lower()
  if type == "onlineimage" then
    return {"\\markdownRendererContentBlockOnlineImage{",suf,"}",
                            "{",self.string(src),"}",
                            "{",self.uri(src),"}",
                            "{",self.string(tit or ""),"}"}
  elseif languages_json[suf] then
    return {"\\markdownRendererContentBlockCode{",suf,"}",
                            "{",self.string(languages_json[suf]),"}",
                            "{",self.string(src),"}",
                            "{",self.uri(src),"}",
                            "{",self.string(tit or ""),"}"}
  else
    return {"\\markdownRendererContentBlock{",suf,"}",
```

```
                                "{",self.string(src),"}",
                                "{",self.uri(src),"}",
                                "{",self.string(tit or ""),"}"}
  end
end
```

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.

```
local function ulitem(s)
  return {"\\markdownRendererUlItem ",s,
          "\\markdownRendererUlItemEnd "}
end

function self.bulletlist(items,tight)
  if not self.is_writing then return "" end
  local buffer = {}
  for _,item in ipairs(items) do
    buffer[#buffer + 1] = ulitem(item)
  end
  local contents = util.intersperse(buffer,"\n")
  if tight and options.tightLists then
    return {"\\markdownRendererUlBeginTight\n",contents,
      "\n\\markdownRendererUlEndTight "}
  else
    return {"\\markdownRendererUlBegin\n",contents,
      "\n\\markdownRendererUlEnd "}
  end
end
```

Define `writer->ollist` 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 should be used as the number of the first list item.

```
local function olitem(s,num)
  if num ~= nil then
    return {"\\markdownRendererOlItemWithNumber{",num,"}",s,
            "\\markdownRendererOlItemEnd "}
  else
    return {"\\markdownRendererOlItem ",s,
            "\\markdownRendererOlItemEnd "}
  end
end

function self.orderedlist(items,tight,startnum)
  if not self.is_writing then return "" end
  local buffer = {}
```

```
3072      local num = startnum
3073      for _,item in ipairs(items) do
3074        buffer[#buffer + 1] = olitem(item,num)
3075        if num ~= nil then
3076          num = num + 1
3077        end
3078      end
3079      local contents = util.intersperse(buffer,"\n")
3080      if tight and options.tightLists then
3081        return {"\\markdownRendererOlBeginTight\n",contents,
3082          "\n\\markdownRendererOlEndTight "}
3083      else
3084        return {"\\markdownRendererOlBegin\n",contents,
3085          "\n\\markdownRendererOlEnd "}
3086      end
3087    end
```

Define `writer->inline_html` and `writer->display_html` as functions that will transform an inline or block HTML element respectively to the output format, where `html` is the HTML input.

```
3088    function self.inline_html(html)  return "" end
3089    function self.display_html(html) return "" end
```

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.

```
3090    local function dlitem(term, defs)
3091      local retVal = {"\\markdownRendererDlItem{",term,"}"}
3092      for _, def in ipairs(defs) do
3093        retVal[#retVal+1] = {"\\markdownRendererDlDefinitionBegin ",def,
3094                             "\\markdownRendererDlDefinitionEnd "}
3095      end
3096      retVal[#retVal+1] = "\\markdownRendererDlItemEnd "
3097      return retVal
3098    end
3099
3100    function self.definitionlist(items,tight)
3101      if not self.is_writing then return "" end
3102      local buffer = {}
3103      for _,item in ipairs(items) do
3104        buffer[#buffer + 1] = dlitem(item.term, item.definitions)
3105      end
3106      if tight and options.tightLists then
3107        return {"\\markdownRendererDlBeginTight\n", buffer,
3108          "\n\\markdownRendererDlEndTight"}
3109      else
```

```
      return {"\\markdownRendererDlBegin\n", buffer,
        "\n\\markdownRendererDlEnd"}
    end
  end
```

Define `writer->emphasis` as a function that will transform an emphasized span `s` of input text to the output format.

```
  function self.emphasis(s)
    return {"\\markdownRendererEmphasis{",s,"}"}
  end
```

Define `writer->strong` as a function that will transform a strongly emphasized span `s` of input text to the output format.

```
  function self.strong(s)
    return {"\\markdownRendererStrongEmphasis{",s,"}"}
  end
```

Define `writer->blockquote` as a function that will transform an input block quote `s` to the output format.

```
  function self.blockquote(s)
    if #util.rope_to_string(s) == 0 then return "" end
    return {"\\markdownRendererBlockQuoteBegin\n",s,
      "\n\\markdownRendererBlockQuoteEnd "}
  end
```

Define `writer->verbatim` as a function that will transform an input code block `s` to the output format.

```
  function self.verbatim(s)
    if not self.is_writing then return "" end
    local name = util.cache(options.cacheDir, s, nil, nil, ".verbatim")
    return {"\\markdownRendererInputVerbatim{",name,"}"}
  end
```

Define `writer->codeFence` as a function that will transform an input fenced code block `s` with the infostring `i` to the output format.

```
  function self.fencedCode(i, s)
    if not self.is_writing then return "" end
    local name = util.cache(options.cacheDir, s, nil, nil, ".verbatim")
    return {"\\markdownRendererInputFencedCode{",name,"}{",i,"}"}
  end
```

Define `writer->active_headings` as a stack of identifiers of the headings that are currently active.

```
  self.active_headings = {}
```

Define `writer->heading` as a function that will transform an input heading `s` at level `level` with identifiers `identifiers` to the output format.

```
  function self.heading(s,level,attributes)
    local active_headings = self.active_headings
```

```
    local slice_begin_type = self.slice_begin:sub(1, 1)
    local slice_begin_identifier = self.slice_begin:sub(2) or ""
    local slice_end_type = self.slice_end:sub(1, 1)
    local slice_end_identifier = self.slice_end:sub(2) or ""

    while #active_headings < level do
      -- push empty identifiers for implied sections
      table.insert(active_headings, {})
    end

    while #active_headings >= level do
      -- pop identifiers for sections that have ended
      local active_identifiers = active_headings[#active_headings]
      if active_identifiers[slice_begin_identifier] ~= nil
          and slice_begin_type == "$" then
        self.is_writing = true
      end
      if active_identifiers[slice_end_identifier] ~= nil
          and slice_end_type == "$" then
        self.is_writing = false
      end
      table.remove(active_headings, #active_headings)
    end

    -- push identifiers for the new section
    attributes = attributes or {}
    local identifiers = {}
    for index = 1, #attributes do
      attribute = attributes[index]
      identifiers[attribute:sub(2)] = true
    end
    if identifiers[slice_begin_identifier] ~= nil
        and slice_begin_type == "^" then
      self.is_writing = true
    end
    if identifiers[slice_end_identifier] ~= nil
        and slice_end_type == "^" then
      self.is_writing = false
    end
    table.insert(active_headings, identifiers)

    if not self.is_writing then return "" end

    local cmd
    level = level + options.shiftHeadings
    if level <= 1 then
      cmd = "\\markdownRendererHeadingOne"
```

```
    elseif level == 2 then
      cmd = "\\markdownRendererHeadingTwo"
    elseif level == 3 then
      cmd = "\\markdownRendererHeadingThree"
    elseif level == 4 then
      cmd = "\\markdownRendererHeadingFour"
    elseif level == 5 then
      cmd = "\\markdownRendererHeadingFive"
    elseif level >= 6 then
      cmd = "\\markdownRendererHeadingSix"
    else
      cmd = ""
    end
    return {cmd,"{",s,"}"}
  end
```

Define `writer->note` as a function that will transform an input footnote `s` to the output format.

```
  function self.note(s)
    return {"\\markdownRendererFootnote{",s,"}"}
  end
```

Define `writer->citations` as a function that will transform an input array of citations `cites` to the output format. If `text_cites` is `true`, 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.

```
  function self.citations(text_cites, cites)
    local buffer = {"\\markdownRenderer", text_cites and "TextCite" or "Cite",
      "{", #cites, "}"}
    for _,cite in ipairs(cites) do
      buffer[#buffer+1] = {cite.suppress_author and "-" or "+", "{",
        cite.prenote or "", "}{", cite.postnote or "", "}{", cite.name, "}"}
    end
    return buffer
  end

```

```
  return self
end
```

3.1.4 Parsers

The `parsers` hash table stores PEG patterns that are static and can be reused between different `reader` objects.

```
local parsers                 = {}
```

3.1.4.1 Basic Parsers

```
parsers.percent               = P("%")
parsers.at                    = P("@")
parsers.comma                 = P(",")
parsers.asterisk              = P("*")
parsers.dash                  = P("-")
parsers.plus                  = P("+")
parsers.underscore            = P("_")
parsers.period                = P(".")
parsers.hash                  = P("#")
parsers.ampersand             = P("&")
parsers.backtick              = P("`")
parsers.less                  = P("<")
parsers.more                  = P(">")
parsers.space                 = P(" ")
parsers.squote                = P("'")
parsers.dquote                = P('"')
parsers.lparent               = P("(")
parsers.rparent               = P(")")
parsers.lbracket              = P("[")
parsers.rbracket              = P("]")
parsers.lbrace                = P("{")
parsers.rbrace                = P("}")
parsers.circumflex            = P("^")
parsers.slash                 = P("/")
parsers.equal                 = P("=")
parsers.colon                 = P(":")
parsers.semicolon             = P(";")
parsers.exclamation           = P("!")
parsers.pipe                  = P("|")
parsers.tilde                 = P("~")
parsers.tab                   = P("\t")
parsers.newline               = P("\n")
parsers.tightblocksep         = P("\001")

parsers.digit                 = R("09")
parsers.hexdigit              = R("09","af","AF")
```

```
parsers.letter                = R("AZ","az")
parsers.alphanumeric          = R("AZ","az","09")
parsers.keyword               = parsers.letter
                              * parsers.alphanumeric^0
parsers.citation_chars        = parsers.alphanumeric
                              + S("#$%&-+<>~/_")
parsers.internal_punctuation  = S(":;,.?")

parsers.doubleasterisks       = P("**")
parsers.doubleunderscores     = P("__")
parsers.fourspaces            = P("    ")

parsers.any                   = P(1)
parsers.fail                  = parsers.any - 1

parsers.escapable             = S("\\`*_{}[]()+_.!<>#-~:^@;")
parsers.anyescaped            = P("\\") / "" * parsers.escapable
                              + parsers.any

parsers.spacechar             = S("\t ")
parsers.spacing               = S(" \n\r\t")
parsers.nonspacechar          = parsers.any - parsers.spacing
parsers.optionalspace         = parsers.spacechar^0

parsers.specialchar           = S("*_`&[]<!\\.@-^")

parsers.normalchar            = parsers.any - (parsers.specialchar
                                              + parsers.spacing
                                              + parsers.tightblocksep)
parsers.eof                   = -parsers.any
parsers.nonindentspace        = parsers.space^-3 * - parsers.spacechar
parsers.indent                = parsers.space^-3 * parsers.tab
                              + parsers.fourspaces / ""
parsers.linechar              = P(1 - parsers.newline)

parsers.blankline             = parsers.optionalspace
                              * parsers.newline / "\n"
parsers.blanklines            = parsers.blankline^0
parsers.skipblanklines        = (parsers.optionalspace * parsers.newline)^0
parsers.indentedline          = parsers.indent    /""
                              * C(parsers.linechar^1 * parsers.newline^-
1)
parsers.optionallyindentedline = parsers.indent^-1 /""
                              * C(parsers.linechar^1 * parsers.newline^-
1)
parsers.sp                    = parsers.spacing^0
parsers.spnl                  = parsers.optionalspace
```

```
                                * (parsers.newline * parsers.optionalspace)^-
    1
parsers.line                    = parsers.linechar^0 * parsers.newline
parsers.nonemptyline            = parsers.line - parsers.blankline

parsers.chunk                   = parsers.line * (parsers.optionallyindentedline
                                                  - parsers.blankline)^0

parsers.css_identifier_char     = R("AZ", "az", "09") + S("-_")
parsers.css_identifier          = (parsers.hash + parsers.period)
                                * (((parsers.css_identifier_char
                                    - parsers.dash - parsers.digit)
                                   * parsers.css_identifier_char^1)
                                  + (parsers.dash
                                    * (parsers.css_identifier_char
                                      - parsers.digit)
                                    * parsers.css_identifier_char^0))
parsers.attribute_name_char     = parsers.any - parsers.space
                                - parsers.squote - parsers.dquote
                                - parsers.more - parsers.slash
                                - parsers.equal
parsers.attribute_value_char    = parsers.any - parsers.dquote
                                - parsers.more

-- block followed by 0 or more optionally
-- indented blocks with first line indented.
parsers.indented_blocks = function(bl)
  return Cs( bl
         * (parsers.blankline^1 * parsers.indent * -parsers.blankline * bl)^0
         * (parsers.blankline^1 + parsers.eof) )
end
```

3.1.4.2 Parsers Used for Markdown Lists

```
parsers.bulletchar = C(parsers.plus + parsers.asterisk + parsers.dash)

parsers.bullet = ( parsers.bulletchar * #parsers.spacing
                                      * (parsers.tab + parsers.space^-3)
                 + parsers.space * parsers.bulletchar * #parsers.spacing
                                 * (parsers.tab + parsers.space^-2)
                 + parsers.space * parsers.space * parsers.bulletchar
                                 * #parsers.spacing
                                 * (parsers.tab + parsers.space^-1)
                 + parsers.space * parsers.space * parsers.space
                                 * parsers.bulletchar * #parsers.spacing
                 )
```

3.1.4.3 Parsers Used for Markdown Code Spans

```
parsers.openticks   = Cg(parsers.backtick^1, "ticks")

local function captures_equal_length(s,i,a,b)
  return #a == #b and i
end

parsers.closeticks  = parsers.space^-1
                    * Cmt(C(parsers.backtick^1)
                        * Cb("ticks"), captures_equal_length)

parsers.intickschar = (parsers.any - S(" \n\r`"))
                    + (parsers.newline * -parsers.blankline)
                    + (parsers.space - parsers.closeticks)
                    + (parsers.backtick^1 - parsers.closeticks)

parsers.inticks     = parsers.openticks * parsers.space^-1
                    * C(parsers.intickschar^0) * parsers.closeticks
```

3.1.4.4 Parsers Used for Fenced Code Blocks

```
local function captures_geq_length(s,i,a,b)
  return #a >= #b and i
end

parsers.infostring     = (parsers.linechar - (parsers.backtick
                       + parsers.space^1 * (parsers.newline + parsers.eof)))^0

local fenceindent
parsers.fencehead    = function(char)
  return               C(parsers.nonindentspace) / function(s) fenceindent = #s end
                     * Cg(char^3, "fencelength")
                     * parsers.optionalspace * C(parsers.infostring)
                     * parsers.optionalspace * (parsers.newline + parsers.eof)
end

parsers.fencetail    = function(char)
  return               parsers.nonindentspace
                     * Cmt(C(char^3) * Cb("fencelength"), captures_geq_length)
                     * parsers.optionalspace * (parsers.newline + parsers.eof)
                     + parsers.eof
end

parsers.fencedline   = function(char)
  return               C(parsers.line - parsers.fencetail(char))
                     / function(s)
                         i = 1
```

```
                          remaining = fenceindent
                          while true do
                            c = s:sub(i, i)
                            if c == " " and remaining > 0 then
                              remaining = remaining - 1
                              i = i + 1
                            elseif c == "\t" and remaining > 3 then
                              remaining = remaining - 4
                              i = i + 1
                            else
                              break
                            end
                          end
                          return s:sub(i)
                        end
end
```

3.1.4.5 Parsers Used for Markdown Tags and Links

```
parsers.leader      = parsers.space^-3

-- content in balanced brackets, parentheses, or quotes:
parsers.bracketed   = P{ parsers.lbracket
                         * ((parsers.anyescaped - (parsers.lbracket
                                                 + parsers.rbracket
                                                 + parsers.blankline^2)
                            ) + V(1))^0
                         * parsers.rbracket }

parsers.inparens    = P{ parsers.lparent
                         * ((parsers.anyescaped - (parsers.lparent
                                                 + parsers.rparent
                                                 + parsers.blankline^2)
                            ) + V(1))^0
                         * parsers.rparent }

parsers.squoted     = P{ parsers.squote * parsers.alphanumeric
                         * ((parsers.anyescaped - (parsers.squote
                                                 + parsers.blankline^2)
                            ) + V(1))^0
                         * parsers.squote }

parsers.dquoted     = P{ parsers.dquote * parsers.alphanumeric
                         * ((parsers.anyescaped - (parsers.dquote
                                                 + parsers.blankline^2)
                            ) + V(1))^0
                         * parsers.dquote }
```

```
3426
3427 -- bracketed tag for markdown links, allowing nested brackets:
3428 parsers.tag         = parsers.lbracket
3429                     * Cs((parsers.alphanumeric^1
3430                          + parsers.bracketed
3431                          + parsers.inticks
3432                          + (parsers.anyescaped
3433                            - (parsers.rbracket + parsers.blankline^2)))^0)
3434                     * parsers.rbracket
3435
3436 -- url for markdown links, allowing nested brackets:
3437 parsers.url         = parsers.less * Cs((parsers.anyescaped
3438                                         - parsers.more)^0)
3439                                   * parsers.more
3440                     + Cs((parsers.inparens + (parsers.anyescaped
3441                                               - parsers.spacing
3442                                               - parsers.rparent))^1)
3443
3444 -- quoted text, possibly with nested quotes:
3445 parsers.title_s     = parsers.squote * Cs(((parsers.anyescaped-parsers.squote)
3446                                           + parsers.squoted)^0)
3447                                     * parsers.squote
3448
3449 parsers.title_d     = parsers.dquote * Cs(((parsers.anyescaped-parsers.dquote)
3450                                           + parsers.dquoted)^0)
3451                                     * parsers.dquote
3452
3453 parsers.title_p     = parsers.lparent
3454                     * Cs((parsers.inparens + (parsers.anyescaped-parsers.rparent))^0)
3455                     * parsers.rparent
3456
3457 parsers.title       = parsers.title_d + parsers.title_s + parsers.title_p
3458
3459 parsers.optionaltitle
3460                     = parsers.spnl * parsers.title * parsers.spacechar^0
3461                     + Cc("")
```

3.1.4.6 Parsers Used for iA Writer Content Blocks

```
3462 parsers.contentblock_tail
3463                     = parsers.optionaltitle
3464                     * (parsers.newline + parsers.eof)
3465
3466 -- case insensitive online image suffix:
3467 parsers.onlineimagesuffix
3468                     = (function(...)
3469                         local parser = nil
```

```
                        for _,suffix in ipairs({...}) do
                          local pattern=nil
                          for i=1,#suffix do
                            local char=suffix:sub(i,i)
                            char = S(char:lower()..char:upper())
                            if pattern == nil then
                              pattern = char
                            else
                              pattern = pattern * char
                            end
                          end
                          if parser == nil then
                            parser = pattern
                          else
                            parser = parser + pattern
                          end
                        end
                        return parser
                      end)("png", "jpg", "jpeg", "gif", "tif", "tiff")

-- online image url for iA Writer content blocks with mandatory suffix,
-- allowing nested brackets:
parsers.onlineimageurl
                    = (parsers.less
                      * Cs((parsers.anyescaped
                           - parsers.more
                           - #(parsers.period
                              * parsers.onlineimagesuffix
                              * parsers.more
                              * parsers.contentblock_tail))^0)
                      * parsers.period
                      * Cs(parsers.onlineimagesuffix)
                      * parsers.more
                      + (Cs((parsers.inparens
                            + (parsers.anyescaped
                              - parsers.spacing
                              - parsers.rparent
                              - #(parsers.period
                                 * parsers.onlineimagesuffix
                                 * parsers.contentblock_tail)))^0)
                      * parsers.period
                      * Cs(parsers.onlineimagesuffix))
                      ) * Cc("onlineimage")

-- filename for iA Writer content blocks with mandatory suffix:
parsers.localfilepath
                    = parsers.slash
```

```
                    * Cs((parsers.anyescaped
                         - parsers.tab
                         - parsers.newline
                         - #(parsers.period
                            * parsers.alphanumeric^1
                            * parsers.contentblock_tail))^1)
                    * parsers.period
                    * Cs(parsers.alphanumeric^1)
                    * Cc("localfile")
```

3.1.4.7 Parsers Used for Citations

```
parsers.citation_name = Cs(parsers.dash^-1) * parsers.at
                      * Cs(parsers.citation_chars
                          * (((parsers.citation_chars + parsers.internal_punctuation
                              - parsers.comma - parsers.semicolon)
                             * -#((parsers.internal_punctuation - parsers.comma
                                  - parsers.semicolon)^0
                                 * -(parsers.citation_chars + parsers.internal_punctuati
                                    - parsers.comma - parsers.semicolon)))^0
                            * parsers.citation_chars)^-1)

parsers.citation_body_prenote
                    = Cs((parsers.alphanumeric^1
                         + parsers.bracketed
                         + parsers.inticks
                         + (parsers.anyescaped
                           - (parsers.rbracket + parsers.blankline^2))
                         - (parsers.spnl * parsers.dash^-1 * parsers.at))^0)

parsers.citation_body_postnote
                    = Cs((parsers.alphanumeric^1
                         + parsers.bracketed
                         + parsers.inticks
                         + (parsers.anyescaped
                           - (parsers.rbracket + parsers.semicolon
                             + parsers.blankline^2))
                         - (parsers.spnl * parsers.rbracket))^0)

parsers.citation_body_chunk
                    = parsers.citation_body_prenote
                    * parsers.spnl * parsers.citation_name
                    * (parsers.internal_punctuation - parsers.semicolon)^-
1
                    * parsers.spnl * parsers.citation_body_postnote

parsers.citation_body
```

```
                    = parsers.citation_body_chunk
                    * (parsers.semicolon * parsers.spnl
                      * parsers.citation_body_chunk)^0

parsers.citation_headless_body_postnote
                    = Cs((parsers.alphanumeric^1
                         + parsers.bracketed
                         + parsers.inticks
                         + (parsers.anyescaped
                           - (parsers.rbracket + parsers.at
                             + parsers.semicolon + parsers.blankline^2))
                         - (parsers.spnl * parsers.rbracket))^0)

parsers.citation_headless_body
                    = parsers.citation_headless_body_postnote
                    * (parsers.sp * parsers.semicolon * parsers.spnl
                      * parsers.citation_body_chunk)^0
```

3.1.4.8 Parsers Used for Footnotes

```
local function strip_first_char(s)
  return s:sub(2)
end

parsers.RawNoteRef = #(parsers.lbracket * parsers.circumflex)
                   * parsers.tag / strip_first_char
```

3.1.4.9 Parsers Used for Tables

```
local function make_pipe_table_rectangular(rows)
  local num_columns = #rows[2]
  local rectangular_rows = {}
  for i = 1, #rows do
    local row = rows[i]
    local rectangular_row = {}
    for j = 1, num_columns do
      rectangular_row[j] = row[j] or ""
    end
    table.insert(rectangular_rows, rectangular_row)
  end
  return rectangular_rows
end

local function pipe_table_row(allow_empty_first_column
                             , nonempty_column
                             , column_separator
                             , column)
  local row_beginning
```

```
  if allow_empty_first_column then
    row_beginning = -- empty first column
                    #(parsers.spacechar^4
                     * column_separator)
                  * parsers.optionalspace
                  * column
                  * parsers.optionalspace
                  -- non-empty first column
                  + parsers.nonindentspace
                  * nonempty_column^-1
                  * parsers.optionalspace
  else
    row_beginning = parsers.nonindentspace
                  * nonempty_column^-1
                  * parsers.optionalspace
  end

  return Ct(row_beginning
           * (-- single column with no leading pipes
              #(column_separator
                * parsers.optionalspace
                * parsers.newline)
              * column_separator
              * parsers.optionalspace
              -- single column with leading pipes or
              -- more than a single column
              + (column_separator
                * parsers.optionalspace
                * column
                * parsers.optionalspace)^1
              * (column_separator
                * parsers.optionalspace)^-1))
end

parsers.table_hline_separator = parsers.pipe + parsers.plus
parsers.table_hline_column = (parsers.dash
                              - #(parsers.dash
                                 * (parsers.spacechar
                                   + parsers.table_hline_separator
                                   + parsers.newline)))^1
                            * (parsers.colon * Cc("r")
                              + parsers.dash * Cc("d"))
                            + parsers.colon
                            * (parsers.dash
                              - #(parsers.dash
                                 * (parsers.spacechar
                                   + parsers.table_hline_separator
```

```
                                    + parsers.newline)))^1
                               * (parsers.colon * Cc("c")
                                 + parsers.dash * Cc("l"))
parsers.table_hline = pipe_table_row(false
                                     , parsers.table_hline_column
                                     , parsers.table_hline_separator
                                     , parsers.table_hline_column)
parsers.table_caption_beginning = parsers.skipblanklines
                                * parsers.nonindentspace
                                * (P("Table")^-1 * parsers.colon)
                                * parsers.optionalspace
```

3.1.4.10 Parsers Used for HTML

```
-- case-insensitive match (we assume s is lowercase). must be single byte encoding
parsers.keyword_exact = function(s)
  local parser = P(0)
  for i=1,#s do
    local c = s:sub(i,i)
    local m = c .. upper(c)
    parser = parser * S(m)
  end
  return parser
end

parsers.block_keyword =
    parsers.keyword_exact("address") + parsers.keyword_exact("blockquote") +
    parsers.keyword_exact("center") + parsers.keyword_exact("del") +
    parsers.keyword_exact("dir") + parsers.keyword_exact("div") +
    parsers.keyword_exact("p") + parsers.keyword_exact("pre") +
    parsers.keyword_exact("li") + parsers.keyword_exact("ol") +
    parsers.keyword_exact("ul") + parsers.keyword_exact("dl") +
    parsers.keyword_exact("dd") + parsers.keyword_exact("form") +
    parsers.keyword_exact("fieldset") + parsers.keyword_exact("isindex") +
    parsers.keyword_exact("ins") + parsers.keyword_exact("menu") +
    parsers.keyword_exact("noframes") + parsers.keyword_exact("frameset") +
    parsers.keyword_exact("h1") + parsers.keyword_exact("h2") +
    parsers.keyword_exact("h3") + parsers.keyword_exact("h4") +
    parsers.keyword_exact("h5") + parsers.keyword_exact("h6") +
    parsers.keyword_exact("hr") + parsers.keyword_exact("script") +
    parsers.keyword_exact("noscript") + parsers.keyword_exact("table") +
    parsers.keyword_exact("tbody") + parsers.keyword_exact("tfoot") +
    parsers.keyword_exact("thead") + parsers.keyword_exact("th") +
    parsers.keyword_exact("td") + parsers.keyword_exact("tr")

-- There is no reason to support bad html, so we expect quoted attributes
parsers.htmlattributevalue
```

```
                          = parsers.squote * (parsers.any - (parsers.blankline
                                                           + parsers.squote))^0
                                          * parsers.squote
                          + parsers.dquote * (parsers.any - (parsers.blankline
                                                           + parsers.dquote))^0
                                          * parsers.dquote

parsers.htmlattribute     = parsers.spacing^1
                          * (parsers.alphanumeric + S("_-"))^1
                          * parsers.sp * parsers.equal * parsers.sp
                          * parsers.htmlattributevalue

parsers.htmlcomment       = P("<!--") * (parsers.any - P("-->"))^0 * P("-->")

parsers.htmlinstruction   = P("<?")   * (parsers.any - P("?>" ))^0 * P("?>" )

parsers.openelt_any = parsers.less * parsers.keyword * parsers.htmlattribute^0
                    * parsers.sp * parsers.more

parsers.openelt_exact = function(s)
  return parsers.less * parsers.sp * parsers.keyword_exact(s)
       * parsers.htmlattribute^0 * parsers.sp * parsers.more
end

parsers.openelt_block = parsers.sp * parsers.block_keyword
                      * parsers.htmlattribute^0 * parsers.sp * parsers.more

parsers.closeelt_any = parsers.less * parsers.sp * parsers.slash
                     * parsers.keyword * parsers.sp * parsers.more

parsers.closeelt_exact = function(s)
  return parsers.less * parsers.sp * parsers.slash * parsers.keyword_exact(s)
       * parsers.sp * parsers.more
end

parsers.emptyelt_any = parsers.less * parsers.sp * parsers.keyword
                     * parsers.htmlattribute^0 * parsers.sp * parsers.slash
                     * parsers.more

parsers.emptyelt_block = parsers.less * parsers.sp * parsers.block_keyword
                       * parsers.htmlattribute^0 * parsers.sp * parsers.slash
                       * parsers.more

parsers.displaytext = (parsers.any - parsers.less)^1

-- return content between two matched HTML tags
parsers.in_matched = function(s)
```

```
  return { parsers.openelt_exact(s)
         * (V(1) + parsers.displaytext
           + (parsers.less - parsers.closeelt_exact(s)))^0
         * parsers.closeelt_exact(s) }
end

local function parse_matched_tags(s,pos)
  local t = string.lower(lpeg.match(C(parsers.keyword),s,pos))
  return lpeg.match(parsers.in_matched(t),s,pos-1)
end

parsers.in_matched_block_tags = parsers.less
                              * Cmt(#parsers.openelt_block, parse_matched_tags)

parsers.displayhtml = parsers.htmlcomment
                    + parsers.emptyelt_block
                    + parsers.openelt_exact("hr")
                    + parsers.in_matched_block_tags
                    + parsers.htmlinstruction

parsers.inlinehtml  = parsers.emptyelt_any
                    + parsers.htmlcomment
                    + parsers.htmlinstruction
                    + parsers.openelt_any
                    + parsers.closeelt_any
```

3.1.4.11 Parsers Used for HTML Entities

```
parsers.hexentity = parsers.ampersand * parsers.hash * S("Xx")
                  * C(parsers.hexdigit^1) * parsers.semicolon
parsers.decentity = parsers.ampersand * parsers.hash
                  * C(parsers.digit^1) * parsers.semicolon
parsers.tagentity = parsers.ampersand * C(parsers.alphanumeric^1)
                  * parsers.semicolon
```

3.1.4.12 Helpers for References

```
-- parse a reference definition:  [foo]: /bar "title"
parsers.define_reference_parser = parsers.leader * parsers.tag * parsers.colon
                                * parsers.spacechar^0 * parsers.url
                                * parsers.optionaltitle * parsers.blankline^1
```

3.1.4.13 Inline Elements

```
parsers.Inline         = V("Inline")
parsers.IndentedInline = V("IndentedInline")

-- parse many p between starter and ender
```

```
parsers.between = function(p, starter, ender)
  local ender2 = B(parsers.nonspacechar) * ender
  return (starter * #parsers.nonspacechar * Ct(p * (p - ender2)^0) * ender2)
end

parsers.urlchar      = parsers.anyescaped - parsers.newline - parsers.more
```

3.1.4.14 Block Elements

```
parsers.Block        = V("Block")

parsers.OnlineImageURL
                     = parsers.leader
                     * parsers.onlineimageurl
                     * parsers.optionaltitle

parsers.LocalFilePath
                     = parsers.leader
                     * parsers.localfilepath
                     * parsers.optionaltitle

parsers.TildeFencedCode
                     = parsers.fencehead(parsers.tilde)
                     * Cs(parsers.fencedline(parsers.tilde)^0)
                     * parsers.fencetail(parsers.tilde)

parsers.BacktickFencedCode
                     = parsers.fencehead(parsers.backtick)
                     * Cs(parsers.fencedline(parsers.backtick)^0)
                     * parsers.fencetail(parsers.backtick)

parsers.lineof = function(c)
    return (parsers.leader * (P(c) * parsers.optionalspace)^3
            * (parsers.newline * parsers.blankline^1
              + parsers.newline^-1 * parsers.eof))
end
```

3.1.4.15 Lists

```
parsers.defstartchar = S("~:")
parsers.defstart     = ( parsers.defstartchar * #parsers.spacing
                                              * (parsers.tab + parsers.space^-
3)
                     + parsers.space * parsers.defstartchar * #parsers.spacing
                                     * (parsers.tab + parsers.space^-2)
                     + parsers.space * parsers.space * parsers.defstartchar
                                     * #parsers.spacing
                                     * (parsers.tab + parsers.space^-1)
```

```
                      + parsers.space * parsers.space * parsers.space
                                      * parsers.defstartchar * #parsers.spacing
                      )

parsers.dlchunk = Cs(parsers.line * (parsers.indentedline - parsers.blankline)^0)
```

3.1.4.16 Headings

```
parsers.heading_attribute = C(parsers.css_identifier)
                          + C((parsers.attribute_name_char
                             - parsers.rbrace)^1
                             * parsers.equal
                             * (parsers.attribute_value_char
                               - parsers.rbrace)^1)
parsers.HeadingAttributes = parsers.lbrace
                          * parsers.heading_attribute
                          * (parsers.spacechar^1
                            * parsers.heading_attribute)^0
                          * parsers.rbrace

-- parse Atx heading start and return level
parsers.HeadingStart = #parsers.hash * C(parsers.hash^-6)
                     * -parsers.hash / length

-- parse setext header ending and return level
parsers.HeadingLevel = parsers.equal^1 * Cc(1) + parsers.dash^1 * Cc(2)

local function strip_atx_end(s)
  return s:gsub("[#%s]*\n$","")
end
```

3.1.5 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.

Although not specified in the Lua interface (see Section 2.1), the `reader` object is exported, so that the curious user could easily tinker with the methods of the objects produced by the `reader.new` method described below. The user should be aware, however, that the implementation may change in a future revision.

The `reader.new` method creates and returns a new TEX reader object associated with the Lua interface options (see Section 2.1.2) `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*⟩.

```
M.reader = {}
function M.reader.new(writer, options)
  local self = {}
  options = options or {}
```

Make the `options` table inherit from the `defaultOptions` table.

```
  setmetatable(options, { __index = function (_, key)
    return defaultOptions[key] end })
```

3.1.5.1 Top-Level Helper Functions

Define `normalize_tag` as a function that normalizes a markdown reference tag by lowercasing it, and by collapsing any adjacent whitespace characters.

```
  local function normalize_tag(tag)
    return unicode.utf8.lower(
      gsub(util.rope_to_string(tag), "[ \n\r\t]+", " "))
  end
```

Define `expandtabs` either as an identity function, when the `preserveTabs` Lua inrerface option is `true`, or to a function that expands tabs into spaces otherwise.

```
  local expandtabs
  if options.preserveTabs then
    expandtabs = function(s) return s end
  else
    expandtabs = function(s)
                   if s:find("\t") then
                     return s:gsub("[^\n]*", util.expand_tabs_in_line)
                   else
                     return s
                   end
                 end
  end
```

The `larsers` (as in ‘`local \luam{parsers}'') hash table stores \acro{peg} patterns th` tions‘, which impedes their reuse between different `reader` objects.

```
  local larsers    = {}
```

3.1.5.2 Top-Level Parser Functions

```
  local function create_parser(name, grammar)
    return function(str)
      local res = lpeg.match(grammar(), str)
      if res == nil then
        error(format("%s failed on:\n%s", name, str:sub(1,20)))
      else
```

```
      return res
    end
  end
end

local parse_blocks
  = create_parser("parse_blocks",
                  function()
                    return larsers.blocks
                  end)

local parse_blocks_toplevel
  = create_parser("parse_blocks_toplevel",
                  function()
                    return larsers.blocks_toplevel
                  end)

local parse_inlines
  = create_parser("parse_inlines",
                  function()
                    return larsers.inlines
                  end)

local parse_inlines_no_link
  = create_parser("parse_inlines_no_link",
                  function()
                    return larsers.inlines_no_link
                  end)

local parse_inlines_no_inline_note
  = create_parser("parse_inlines_no_inline_note",
                  function()
                    return larsers.inlines_no_inline_note
                  end)

local parse_inlines_nbsp
  = create_parser("parse_inlines_nbsp",
                  function()
                    return larsers.inlines_nbsp
                  end)
```

3.1.5.3 Parsers Used for Markdown Lists (local)

```
if options.hashEnumerators then
  larsers.dig = parsers.digit + parsers.hash
else
  larsers.dig = parsers.digit
```

```
  end

  larsers.enumerator = C(larsers.dig^3 * parsers.period) * #parsers.spacing
                     + C(larsers.dig^2 * parsers.period) * #parsers.spacing
                                         * (parsers.tab + parsers.space^1)
                     + C(larsers.dig * parsers.period) * #parsers.spacing
                                        * (parsers.tab + parsers.space^-2)
                     + parsers.space * C(larsers.dig^2 * parsers.period)
                                        * #parsers.spacing
                     + parsers.space * C(larsers.dig * parsers.period)
                                        * #parsers.spacing
                                        * (parsers.tab + parsers.space^-1)
                     + parsers.space * parsers.space * C(larsers.dig^1
                                        * parsers.period) * #parsers.spacing
```

3.1.5.4 Parsers Used for Blockquotes (local)

```
  -- strip off leading > and indents, and run through blocks
  larsers.blockquote_body = ((parsers.leader * parsers.more * parsers.space^-
1)/""
                             * parsers.linechar^0 * parsers.newline)^1
                           * (-(parsers.leader * parsers.more
                               + parsers.blankline) * parsers.linechar^1
                             * parsers.newline)^0

  if not options.breakableBlockquotes then
    larsers.blockquote_body = larsers.blockquote_body
                           * (parsers.blankline^0 / "")
  end
```

3.1.5.5 Parsers Used for Citations (local)

```
  larsers.citations = function(text_cites, raw_cites)
      local function normalize(str)
          if str == "" then
              str = nil
          else
              str = (options.citationNbsps and parse_inlines_nbsp or
                parse_inlines)(str)
          end
          return str
      end

      local cites = {}
      for i = 1,#raw_cites,4 do
          cites[#cites+1] = {
              prenote = normalize(raw_cites[i]),
              suppress_author = raw_cites[i+1] == "-",
```

```
              name = writer.citation(raw_cites[i+2]),
              postnote = normalize(raw_cites[i+3]),
          }
      end
      return writer.citations(text_cites, cites)
  end
```

3.1.5.6 Parsers Used for Footnotes (local)

```
  local rawnotes = {}

  -- like indirect_link
  local function lookup_note(ref)
    return function()
      local found = rawnotes[normalize_tag(ref)]
      if found then
        return writer.note(parse_blocks_toplevel(found))
      else
        return {"[", parse_inlines("^" .. ref), "]"}
      end
    end
  end

  local function register_note(ref,rawnote)
    rawnotes[normalize_tag(ref)] = rawnote
    return ""
  end

  larsers.NoteRef    = parsers.RawNoteRef / lookup_note


  larsers.NoteBlock  = parsers.leader * parsers.RawNoteRef * parsers.colon
                     * parsers.spnl * parsers.indented_blocks(parsers.chunk)
                     / register_note

  larsers.InlineNote = parsers.circumflex
                     * (parsers.tag / parse_inlines_no_inline_note) -- no notes inside n
                     / writer.note
```

3.1.5.7 Parsers Used for Tables (local)

```
larsers.table_row = pipe_table_row(true
                                   , (C((parsers.linechar - parsers.pipe)^1)
                                     / parse_inlines)
                                   , parsers.pipe
                                   , (C((parsers.linechar - parsers.pipe)^0)
                                     / parse_inlines))

```

```
if options.tableCaptions then
  larsers.table_caption = #parsers.table_caption_beginning
                        * parsers.table_caption_beginning
                        * Ct(parsers.IndentedInline^1)
                        * parsers.newline
else
  larsers.table_caption = parsers.fail
end

larsers.PipeTable = Ct(larsers.table_row * parsers.newline
                    * parsers.table_hline
                    * (parsers.newline * larsers.table_row)^0)
                  / make_pipe_table_rectangular
                  * larsers.table_caption^-1
                  / writer.table
```

3.1.5.8 Helpers for Links and References (local)

```
  -- List of references defined in the document
  local references

  -- add a reference to the list
  local function register_link(tag,url,title)
      references[normalize_tag(tag)] = { url = url, title = title }
      return ""
  end

  -- lookup link reference and return either
  -- the link or nil and fallback text.
  local function lookup_reference(label,sps,tag)
      local tagpart
      if not tag then
          tag = label
          tagpart = ""
      elseif tag == "" then
          tag = label
          tagpart = "[]"
      else
          tagpart = {"[", parse_inlines(tag), "]"}
      end
      if sps then
        tagpart = {sps, tagpart}
      end
      local r = references[normalize_tag(tag)]
      if r then
        return r
      else
```

```
      return nil, {"[", parse_inlines(label), "]", tagpart}
    end
end

-- lookup link reference and return a link, if the reference is found,
-- or a bracketed label otherwise.
local function indirect_link(label,sps,tag)
  return function()
    local r,fallback = lookup_reference(label,sps,tag)
    if r then
      return writer.link(parse_inlines_no_link(label), r.url, r.title)
    else
      return fallback
    end
  end
end

-- lookup image reference and return an image, if the reference is found,
-- or a bracketed label otherwise.
local function indirect_image(label,sps,tag)
  return function()
    local r,fallback = lookup_reference(label,sps,tag)
    if r then
      return writer.image(writer.string(label), r.url, r.title)
    else
      return {"!", fallback}
    end
  end
end
```

3.1.5.9 Inline Elements (local)

```
larsers.Str      = parsers.normalchar^1 / writer.string

larsers.Symbol   = (parsers.specialchar - parsers.tightblocksep)
                 / writer.string

larsers.Ellipsis = P("...") / writer.ellipsis

larsers.Smart    = larsers.Ellipsis

larsers.Code     = parsers.inticks / writer.code

if options.blankBeforeBlockquote then
  larsers.bqstart = parsers.fail
else
  larsers.bqstart = parsers.more
```

```
4091  end
4092
4093  if options.blankBeforeHeading then
4094    larsers.headerstart = parsers.fail
4095  else
4096    larsers.headerstart = parsers.hash
4097                        + (parsers.line * (parsers.equal^1 + parsers.dash^1)
4098                        * parsers.optionalspace * parsers.newline)
4099  end
4100
4101  if not options.fencedCode or options.blankBeforeCodeFence then
4102    larsers.fencestart = parsers.fail
4103  else
4104    larsers.fencestart = parsers.fencehead(parsers.backtick)
4105                       + parsers.fencehead(parsers.tilde)
4106  end
4107
4108  larsers.Endline   = parsers.newline * -( -- newline, but not before...
4109                        parsers.blankline -- paragraph break
4110                      + parsers.tightblocksep  -- nested list
4111                      + parsers.eof       -- end of document
4112                      + larsers.bqstart
4113                      + larsers.headerstart
4114                      + larsers.fencestart
4115                    ) * parsers.spacechar^0 / writer.space
4116
4117  larsers.OptionalIndent
4118                     = parsers.spacechar^1 / writer.space
4119
4120  larsers.Space      = parsers.spacechar^2 * larsers.Endline / writer.linebreak
4121                     + parsers.spacechar^1 * larsers.Endline^-1 * parsers.eof / ""
4122                     + parsers.spacechar^1 * larsers.Endline^-1
4123                                           * parsers.optionalspace / writer.space
4124
4125  larsers.NonbreakingEndline
4126                    = parsers.newline * -( -- newline, but not before...
4127                        parsers.blankline -- paragraph break
4128                      + parsers.tightblocksep  -- nested list
4129                      + parsers.eof       -- end of document
4130                      + larsers.bqstart
4131                      + larsers.headerstart
4132                      + larsers.fencestart
4133                    ) * parsers.spacechar^0 / writer.nbsp
4134
4135  larsers.NonbreakingSpace
4136                  = parsers.spacechar^2 * larsers.Endline / writer.linebreak
4137                  + parsers.spacechar^1 * larsers.Endline^-1 * parsers.eof / ""
```

```
                  + parsers.spacechar^1 * larsers.Endline^-1
                                        * parsers.optionalspace / writer.nbsp

if options.underscores then
  larsers.Strong = ( parsers.between(parsers.Inline, parsers.doubleasterisks,
                                     parsers.doubleasterisks)
                   + parsers.between(parsers.Inline, parsers.doubleunderscores,
                                     parsers.doubleunderscores)
                   ) / writer.strong

  larsers.Emph   = ( parsers.between(parsers.Inline, parsers.asterisk,
                                     parsers.asterisk)
                   + parsers.between(parsers.Inline, parsers.underscore,
                                     parsers.underscore)
                   ) / writer.emphasis
else
  larsers.Strong = ( parsers.between(parsers.Inline, parsers.doubleasterisks,
                                     parsers.doubleasterisks)
                   ) / writer.strong

  larsers.Emph   = ( parsers.between(parsers.Inline, parsers.asterisk,
                                     parsers.asterisk)
                   ) / writer.emphasis
end

larsers.AutoLinkUrl    = parsers.less
                         * C(parsers.alphanumeric^1 * P("://") * parsers.urlchar^1)
                         * parsers.more
                         / function(url)
                             return writer.link(writer.string(url), url)
                           end

larsers.AutoLinkEmail = parsers.less
                        * C((parsers.alphanumeric + S("-._+"))^1
                        * P("@") * parsers.urlchar^1)
                        * parsers.more
                        / function(email)
                            return writer.link(writer.string(email),
                                               "mailto:"..email)
                          end

larsers.DirectLink    = (parsers.tag / parse_inlines_no_link)  -- no links inside link
                        * parsers.spnl
                        * parsers.lparent
                        * (parsers.url + Cc(""))  -- link can be empty [foo]()
                        * parsers.optionaltitle
                        * parsers.rparent
```

```
                        / writer.link

  larsers.IndirectLink  = parsers.tag * (C(parsers.spnl) * parsers.tag)^-
1
                        / indirect_link

  -- parse a link or image (direct or indirect)
  larsers.Link          = larsers.DirectLink + larsers.IndirectLink

  larsers.DirectImage   = parsers.exclamation
                        * (parsers.tag / parse_inlines)
                        * parsers.spnl
                        * parsers.lparent
                        * (parsers.url + Cc(""))  -- link can be empty [foo]()
                        * parsers.optionaltitle
                        * parsers.rparent
                        / writer.image

  larsers.IndirectImage = parsers.exclamation * parsers.tag
                        * (C(parsers.spnl) * parsers.tag)^-1 / indirect_image

  larsers.Image         = larsers.DirectImage + larsers.IndirectImage

  larsers.TextCitations = Ct(Cc("")
                        * parsers.citation_name
                        * ((parsers.spnl
                            * parsers.lbracket
                            * parsers.citation_headless_body
                            * parsers.rbracket) + Cc("")))
                        / function(raw_cites)
                            return larsers.citations(true, raw_cites)
                          end

  larsers.ParenthesizedCitations
                        = Ct(parsers.lbracket
                        * parsers.citation_body
                        * parsers.rbracket)
                        / function(raw_cites)
                            return larsers.citations(false, raw_cites)
                          end

  larsers.Citations     = larsers.TextCitations + larsers.ParenthesizedCitations

  -- avoid parsing long strings of * or _ as emph/strong
  larsers.UlOrStarLine  = parsers.asterisk^4 + parsers.underscore^4
                        / writer.string

```

```
4231  larsers.EscapedChar   = S("\\") * C(parsers.escapable) / writer.string
4232
4233  larsers.InlineHtml    = C(parsers.inlinehtml) / writer.inline_html
4234
4235  larsers.HtmlEntity    = parsers.hexentity / entities.hex_entity  / writer.string
4236                        + parsers.decentity / entities.dec_entity  / writer.string
4237                        + parsers.tagentity / entities.char_entity / writer.string
```

3.1.5.10 Block Elements (local)

```
4238  larsers.ContentBlock = parsers.leader
4239                       * (parsers.localfilepath + parsers.onlineimageurl)
4240                       * parsers.contentblock_tail
4241                       / writer.contentblock
4242
4243  larsers.DisplayHtml  = C(parsers.displayhtml)
4244                       / expandtabs / writer.display_html
4245
4246  larsers.Verbatim     = Cs( (parsers.blanklines
4247                          * ((parsers.indentedline - parsers.blankline))^1)^1
4248                          ) / expandtabs / writer.verbatim
4249
4250  larsers.FencedCode   = (parsers.TildeFencedCode
4251                        + parsers.BacktickFencedCode)
4252                       / function(infostring, code)
4253                          return writer.fencedCode(writer.string(infostring),
4254                                                   expandtabs(code))
4255                        end
4256
4257  larsers.Blockquote   = Cs(larsers.blockquote_body^1)
4258                       / parse_blocks_toplevel / writer.blockquote
4259
4260  larsers.HorizontalRule = ( parsers.lineof(parsers.asterisk)
4261                           + parsers.lineof(parsers.dash)
4262                           + parsers.lineof(parsers.underscore)
4263                           ) / writer.hrule
4264
4265  larsers.Reference    = parsers.define_reference_parser / register_link
4266
4267  larsers.Paragraph    = parsers.nonindentspace * Ct(parsers.Inline^1)
4268                       * parsers.newline
4269                       * ( parsers.blankline^1
4270                         + #parsers.hash
4271                         + #(parsers.leader * parsers.more * parsers.space^-
    1)
4272                         )
4273                       / writer.paragraph
```

```
4274
4275  larsers.ToplevelParagraph
4276                        = parsers.nonindentspace * Ct(parsers.Inline^1)
4277                        * ( parsers.newline
4278                        * ( parsers.blankline^1
4279                          + #parsers.hash
4280                          + #(parsers.leader * parsers.more * parsers.space^-
    1)
4281                          + parsers.eof
4282                          )
4283                        + parsers.eof )
4284                        / writer.paragraph
4285
4286  larsers.Plain         = parsers.nonindentspace * Ct(parsers.Inline^1)
4287                        / writer.plain
```

3.1.5.11 Lists (local)

```
4288  larsers.starter = parsers.bullet + larsers.enumerator
4289
4290  -- we use \001 as a separator between a tight list item and a
4291  -- nested list under it.
4292  larsers.NestedList            = Cs((parsers.optionallyindentedline
4293                                      - larsers.starter)^1)
4294                                / function(a) return "\001"..a end
4295
4296  larsers.ListBlockLine         = parsers.optionallyindentedline
4297                                - parsers.blankline - (parsers.indent^-1
4298                                                     * larsers.starter)
4299
4300  larsers.ListBlock             = parsers.line * larsers.ListBlockLine^0
4301
4302  larsers.ListContinuationBlock = parsers.blanklines * (parsers.indent / "")
4303                                * larsers.ListBlock
4304
4305  larsers.TightListItem = function(starter)
4306      return -larsers.HorizontalRule
4307             * (Cs(starter / "" * larsers.ListBlock * larsers.NestedList^-
    1)
4308               / parse_blocks)
4309             * -(parsers.blanklines * parsers.indent)
4310  end
4311
4312  larsers.LooseListItem = function(starter)
4313      return -larsers.HorizontalRule
4314             * Cs( starter / "" * larsers.ListBlock * Cc("\n")
4315               * (larsers.NestedList + larsers.ListContinuationBlock^0)
```

```
4316                * (parsers.blanklines / "\n\n")
4317                ) / parse_blocks
4318  end
4319
4320  larsers.BulletList = ( Ct(larsers.TightListItem(parsers.bullet)^1) * Cc(true)
4321                       * parsers.skipblanklines * -parsers.bullet
4322                       + Ct(larsers.LooseListItem(parsers.bullet)^1) * Cc(false)
4323                       * parsers.skipblanklines )
4324                     / writer.bulletlist
4325
4326  local function ordered_list(items,tight,startNumber)
4327    if options.startNumber then
4328      startNumber = tonumber(startNumber) or 1  -- fallback for '#'
4329      if startNumber ~= nil then
4330        startNumber = math.floor(startNumber)
4331      end
4332    else
4333      startNumber = nil
4334    end
4335    return writer.orderedlist(items,tight,startNumber)
4336  end
4337
4338  larsers.OrderedList = Cg(larsers.enumerator, "listtype") *
4339                        ( Ct(larsers.TightListItem(Cb("listtype"))
4340                            * larsers.TightListItem(larsers.enumerator)^0)
4341                        * Cc(true) * parsers.skipblanklines * -larsers.enumerator
4342                        + Ct(larsers.LooseListItem(Cb("listtype"))
4343                            * larsers.LooseListItem(larsers.enumerator)^0)
4344                        * Cc(false) * parsers.skipblanklines
4345                        ) * Cb("listtype") / ordered_list
4346
4347  local function definition_list_item(term, defs, tight)
4348    return { term = parse_inlines(term), definitions = defs }
4349  end
4350
4351  larsers.DefinitionListItemLoose = C(parsers.line) * parsers.skipblanklines
4352                                  * Ct((parsers.defstart
4353                                       * parsers.indented_blocks(parsers.dlchunk)
4354                                       / parse_blocks_toplevel)^1)
4355                                  * Cc(false) / definition_list_item
4356
4357  larsers.DefinitionListItemTight = C(parsers.line)
4358                                  * Ct((parsers.defstart * parsers.dlchunk
4359                                       / parse_blocks)^1)
4360                                  * Cc(true) / definition_list_item
4361
4362  larsers.DefinitionList = ( Ct(larsers.DefinitionListItemLoose^1) * Cc(false)
```

```
                            + Ct(larsers.DefinitionListItemTight^1)
                            * (parsers.skipblanklines
                              * -larsers.DefinitionListItemLoose * Cc(true))
                            ) / writer.definitionlist
```

3.1.5.12 Blank (local)

```
larsers.Blank        = parsers.blankline / ""
                     + larsers.NoteBlock
                     + larsers.Reference
                     + (parsers.tightblocksep / "\n")
```

3.1.5.13 Headings (local)

```
-- parse atx header
if options.headerAttributes then
  larsers.AtxHeading = Cg(parsers.HeadingStart,"level")
                     * parsers.optionalspace
                     * (C(((parsers.linechar
                           - ((parsers.hash^1
                              * parsers.optionalspace
                              * parsers.HeadingAttributes^-1
                              + parsers.HeadingAttributes)
                             * parsers.optionalspace
                             * parsers.newline))
                          * (parsers.linechar
                            - parsers.hash
                            - parsers.lbrace)^0)^1)
                         / parse_inlines)
                     * Cg(Ct(parsers.newline
                           + (parsers.hash^1
                             * parsers.optionalspace
                             * parsers.HeadingAttributes^-1
                             + parsers.HeadingAttributes)
                           * parsers.optionalspace
                           * parsers.newline), "attributes")
                     * Cb("level")
                     * Cb("attributes")
                     / writer.heading

  larsers.SetextHeading = #(parsers.line * S("=-"))
                        * (C(((parsers.linechar
                              - (parsers.HeadingAttributes
                                * parsers.optionalspace
                                * parsers.newline))
                             * (parsers.linechar
                               - parsers.lbrace)^0)^1)
                           / parse_inlines)
```

```
                          * Cg(Ct(parsers.newline
                                + (parsers.HeadingAttributes
                                  * parsers.optionalspace
                                  * parsers.newline)), "attributes")
                          * parsers.HeadingLevel
                          * Cb("attributes")
                          * parsers.optionalspace
                          * parsers.newline
                          / writer.heading
  else
    larsers.AtxHeading = Cg(parsers.HeadingStart,"level")
                         * parsers.optionalspace
                         * (C(parsers.line) / strip_atx_end / parse_inlines)
                         * Cb("level")
                         / writer.heading

    larsers.SetextHeading = #(parsers.line * S("=-"))
                          * Ct(parsers.linechar^1 / parse_inlines)
                          * parsers.newline
                          * parsers.HeadingLevel
                          * parsers.optionalspace
                          * parsers.newline
                          / writer.heading
  end

  larsers.Heading = larsers.AtxHeading + larsers.SetextHeading
```

3.1.5.14 Syntax Specification

```
  local syntax =
    { "Blocks",

      Blocks                = larsers.Blank^0 * parsers.Block^-1
                            * (larsers.Blank^0 / writer.interblocksep
                              * parsers.Block)^0
                            * larsers.Blank^0 * parsers.eof,

      Blank                 = larsers.Blank,

      Block                 = V("ContentBlock")
                            + V("Blockquote")
                            + V("PipeTable")
                            + V("Verbatim")
                            + V("FencedCode")
                            + V("HorizontalRule")
                            + V("BulletList")
                            + V("OrderedList")
```

```
                        + V("Heading")
                        + V("DefinitionList")
                        + V("DisplayHtml")
                        + V("Paragraph")
                        + V("Plain"),

    ContentBlock        = larsers.ContentBlock,
    Blockquote          = larsers.Blockquote,
    Verbatim            = larsers.Verbatim,
    FencedCode          = larsers.FencedCode,
    HorizontalRule      = larsers.HorizontalRule,
    BulletList          = larsers.BulletList,
    OrderedList         = larsers.OrderedList,
    Heading             = larsers.Heading,
    DefinitionList      = larsers.DefinitionList,
    DisplayHtml         = larsers.DisplayHtml,
    Paragraph           = larsers.Paragraph,
    PipeTable           = larsers.PipeTable,
    Plain               = larsers.Plain,

    Inline              = V("Str")
                        + V("Space")
                        + V("Endline")
                        + V("UlOrStarLine")
                        + V("Strong")
                        + V("Emph")
                        + V("InlineNote")
                        + V("NoteRef")
                        + V("Citations")
                        + V("Link")
                        + V("Image")
                        + V("Code")
                        + V("AutoLinkUrl")
                        + V("AutoLinkEmail")
                        + V("InlineHtml")
                        + V("HtmlEntity")
                        + V("EscapedChar")
                        + V("Smart")
                        + V("Symbol"),

    IndentedInline      = V("Str")
                        + V("OptionalIndent")
                        + V("Endline")
                        + V("UlOrStarLine")
                        + V("Strong")
                        + V("Emph")
                        + V("InlineNote")
```

```
                              + V("NoteRef")
                              + V("Citations")
                              + V("Link")
                              + V("Image")
                              + V("Code")
                              + V("AutoLinkUrl")
                              + V("AutoLinkEmail")
                              + V("InlineHtml")
                              + V("HtmlEntity")
                              + V("EscapedChar")
                              + V("Smart")
                              + V("Symbol"),

    Str                     = larsers.Str,
    Space                   = larsers.Space,
    OptionalIndent          = larsers.OptionalIndent,
    Endline                 = larsers.Endline,
    UlOrStarLine            = larsers.UlOrStarLine,
    Strong                  = larsers.Strong,
    Emph                    = larsers.Emph,
    InlineNote              = larsers.InlineNote,
    NoteRef                 = larsers.NoteRef,
    Citations               = larsers.Citations,
    Link                    = larsers.Link,
    Image                   = larsers.Image,
    Code                    = larsers.Code,
    AutoLinkUrl             = larsers.AutoLinkUrl,
    AutoLinkEmail           = larsers.AutoLinkEmail,
    InlineHtml              = larsers.InlineHtml,
    HtmlEntity              = larsers.HtmlEntity,
    EscapedChar             = larsers.EscapedChar,
    Smart                   = larsers.Smart,
    Symbol                  = larsers.Symbol,
  }

if not options.citations then
  syntax.Citations = parsers.fail
end

if not options.contentBlocks then
  syntax.ContentBlock = parsers.fail
end

if not options.codeSpans then
  syntax.Code = parsers.fail
end

```

```
4543  if not options.definitionLists then
4544    syntax.DefinitionList = parsers.fail
4545  end
4546
4547  if not options.fencedCode then
4548    syntax.FencedCode = parsers.fail
4549  end
4550
4551  if not options.footnotes then
4552    syntax.NoteRef = parsers.fail
4553  end
4554
4555  if not options.html then
4556    syntax.DisplayHtml = parsers.fail
4557    syntax.InlineHtml = parsers.fail
4558    syntax.HtmlEntity  = parsers.fail
4559  end
4560
4561  if not options.inlineFootnotes then
4562    syntax.InlineNote = parsers.fail
4563  end
4564
4565  if not options.smartEllipses then
4566    syntax.Smart = parsers.fail
4567  end
4568
4569  if not options.pipeTables then
4570    syntax.PipeTable = parsers.fail
4571  end
4572
4573  local blocks_toplevel_t = util.table_copy(syntax)
4574  blocks_toplevel_t.Paragraph = larsers.ToplevelParagraph
4575  larsers.blocks_toplevel = Ct(blocks_toplevel_t)
4576
4577  larsers.blocks = Ct(syntax)
4578
4579  local inlines_t = util.table_copy(syntax)
4580  inlines_t[1] = "Inlines"
4581  inlines_t.Inlines = parsers.Inline^0 * (parsers.spacing^0 * parsers.eof / "")
4582  larsers.inlines = Ct(inlines_t)
4583
4584  local inlines_no_link_t = util.table_copy(inlines_t)
4585  inlines_no_link_t.Link = parsers.fail
4586  larsers.inlines_no_link = Ct(inlines_no_link_t)
4587
4588  local inlines_no_inline_note_t = util.table_copy(inlines_t)
4589  inlines_no_inline_note_t.InlineNote = parsers.fail
```

```
  larsers.inlines_no_inline_note = Ct(inlines_no_inline_note_t)

  local inlines_nbsp_t = util.table_copy(inlines_t)
  inlines_nbsp_t.Endline = larsers.NonbreakingEndline
  inlines_nbsp_t.Space = larsers.NonbreakingSpace
  larsers.inlines_nbsp = Ct(inlines_nbsp_t)
```

3.1.5.15 Exported Conversion Function

Define `reader->convert` as a function that converts markdown string `input` into a plain TEX output and returns it. Note that the converter assumes that the input has UNIX line endings.

```
  function self.convert(input)
    references = {}
```

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 2.1.2). The `cacheDir` option is disregarded.

```
    local opt_string = {}
    for k,_ in pairs(defaultOptions) do
      local v = options[k]
      if k ~= "cacheDir" then
        opt_string[#opt_string+1] = k .. "=" .. tostring(v)
      end
    end
    table.sort(opt_string)
    local salt = table.concat(opt_string, ",") .. "," .. metadata.version
```

Produce the cache file, transform its filename via the `writer->pack` method, and return the result.

```
    local name = util.cache(options.cacheDir, input, salt, function(input)
        return util.rope_to_string(parse_blocks_toplevel(input)) .. writer.eof
      end, ".md" .. writer.suffix)
    return writer.pack(name)
  end
  return self
end
```

3.1.6 Conversion from Markdown to Plain TEX

The `new` method returns the `reader->convert` function of a reader object associated with the Lua interface options (see Section 2.1.2) `options` and with a writer object associated with `options`.

```
function M.new(options)
  local writer = M.writer.new(options)
  local reader = M.reader.new(writer, options)
  return reader.convert
end
```

```
4619
4620 return M
```

3.1.7 Command-Line Implementation

The command-line implementation provides the actual conversion routine for the command-line interface described in Section 2.1.5.

```
4621
4622 local input
4623 if input_filename then
4624   local input_file = io.open(input_filename, "r")
4625   input = assert(input_file:read("*a"))
4626   input_file:close()
4627 else
4628   input = assert(io.read("*a"))
4629 end
4630
```

First, ensure that the `options.cacheDir` directory exists.

```
4631 local lfs = require("lfs")
4632 if options.cacheDir and not lfs.isdir(options.cacheDir) then
4633   assert(lfs.mkdir(options["cacheDir"]))
4634 end
4635
4636 local kpse = require("kpse")
4637 kpse.set_program_name("luatex")
4638 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.

```
4639 if metadata.version ~= md.metadata.version then
4640   warn("markdown-cli.lua " .. metadata.version .. " used with " ..
4641        "markdown.lua " .. md.metadata.version .. ".")
4642 end
4643 local convert = md.new(options)
4644 local output = convert(input:gsub("\r\n?", "\n"))
4645
4646 if output_filename then
4647   local output_file = io.open(output_filename, "w")
4648   assert(output_file:write(output))
4649   assert(output_file:close())
4650 else
4651   assert(io.write(output))
4652 end
```

3.2 Plain TEX Implementation

The plain TEX implementation provides macros for the interfacing between TEX 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 TEX exposed by the plain TEX interface (see Section 2.2).

3.2.1 Logging Facilities

```
\def\markdownInfo#1{%
  \immediate\write-1{(l.\the\inputlineno) markdown.tex info: #1.}}%
\def\markdownWarning#1{%
  \immediate\write16{(l.\the\inputlineno) markdown.tex warning: #1}}%
\def\markdownError#1#2{%
  \errhelp{#2.}%
  \errmessage{(l.\the\inputlineno) markdown.tex error: #1}}%
```

3.2.2 Token Renderer Prototypes

The following definitions should be considered placeholder.

```
\def\markdownRendererInterblockSeparatorPrototype{\par}%
\def\markdownRendererLineBreakPrototype{\hfil\break}%
\let\markdownRendererEllipsisPrototype\dots
\def\markdownRendererNbspPrototype{~}%
\def\markdownRendererLeftBracePrototype{\char`\{}%
\def\markdownRendererRightBracePrototype{\char`\}}%
\def\markdownRendererDollarSignPrototype{\char`$}%
\def\markdownRendererPercentSignPrototype{\char`\%}%
\def\markdownRendererAmpersandPrototype{\char`&}%
\def\markdownRendererUnderscorePrototype{\char`_}%
\def\markdownRendererHashPrototype{\char`\#}%
\def\markdownRendererCircumflexPrototype{\char`^}%
\def\markdownRendererBackslashPrototype{\char`\\}%
\def\markdownRendererTildePrototype{\char`~}%
\def\markdownRendererPipePrototype{|}%
\def\markdownRendererCodeSpanPrototype#1{{\tt#1}}%
\def\markdownRendererLinkPrototype#1#2#3#4{#2}%
\def\markdownRendererContentBlockPrototype#1#2#3#4{%
  \markdownInput{#3}}%
\def\markdownRendererContentBlockOnlineImagePrototype{%
  \markdownRendererImage}%
\def\markdownRendererContentBlockCodePrototype#1#2#3#4#5{%
  \markdownRendererInputFencedCode{#3}{#2}}%
\def\markdownRendererImagePrototype#1#2#3#4{#2}%
\def\markdownRendererUlBeginPrototype{}%
\def\markdownRendererUlBeginTightPrototype{}%
\def\markdownRendererUlItemPrototype{}%
```

```
\def\markdownRendererUlItemEndPrototype{}%
\def\markdownRendererUlEndPrototype{}%
\def\markdownRendererUlEndTightPrototype{}%
\def\markdownRendererOlBeginPrototype{}%
\def\markdownRendererOlBeginTightPrototype{}%
\def\markdownRendererOlItemPrototype{}%
\def\markdownRendererOlItemWithNumberPrototype#1{}%
\def\markdownRendererOlItemEndPrototype{}%
\def\markdownRendererOlEndPrototype{}%
\def\markdownRendererOlEndTightPrototype{}%
\def\markdownRendererDlBeginPrototype{}%
\def\markdownRendererDlBeginTightPrototype{}%
\def\markdownRendererDlItemPrototype#1{#1}%
\def\markdownRendererDlItemEndPrototype{}%
\def\markdownRendererDlDefinitionBeginPrototype{}%
\def\markdownRendererDlDefinitionEndPrototype{\par}%
\def\markdownRendererDlEndPrototype{}%
\def\markdownRendererDlEndTightPrototype{}%
\def\markdownRendererEmphasisPrototype#1{{\it#1}}%
\def\markdownRendererStrongEmphasisPrototype#1{{\bf#1}}%
\def\markdownRendererBlockQuoteBeginPrototype{\par\begingroup\it}%
\def\markdownRendererBlockQuoteEndPrototype{\endgroup\par}%
\def\markdownRendererInputVerbatimPrototype#1{%
  \par{\tt\input#1\relax{}}\par}%
\def\markdownRendererInputFencedCodePrototype#1#2{%
  \markdownRendererInputVerbatimPrototype{#1}}%
\def\markdownRendererHeadingOnePrototype#1{#1}%
\def\markdownRendererHeadingTwoPrototype#1{#1}%
\def\markdownRendererHeadingThreePrototype#1{#1}%
\def\markdownRendererHeadingFourPrototype#1{#1}%
\def\markdownRendererHeadingFivePrototype#1{#1}%
\def\markdownRendererHeadingSixPrototype#1{#1}%
\def\markdownRendererHorizontalRulePrototype{}%
\def\markdownRendererFootnotePrototype#1{#1}%
\def\markdownRendererCitePrototype#1{}%
\def\markdownRendererTextCitePrototype#1{}%
```

3.2.3 Lua Snippets

The `\markdownLuaOptions` macro expands to a Lua table that contains the plain TEX options (see Section 2.2.2) in a format recognized by Lua (see Section 2.1.2).

```
\def\markdownLuaOptions{{%
\ifx\markdownOptionBlankBeforeBlockquote\undefined\else
  blankBeforeBlockquote = \markdownOptionBlankBeforeBlockquote,
\fi
\ifx\markdownOptionBlankBeforeCodeFence\undefined\else
  blankBeforeCodeFence = \markdownOptionBlankBeforeCodeFence,
```

```
\fi
\ifx\markdownOptionBlankBeforeHeading\undefined\else
  blankBeforeHeading = \markdownOptionBlankBeforeHeading,
\fi
\ifx\markdownOptionBreakableBlockquotes\undefined\else
  breakableBlockquotes = \markdownOptionBreakableBlockquotes,
\fi
  cacheDir = "\markdownOptionCacheDir",
\ifx\markdownOptionCitations\undefined\else
  citations = \markdownOptionCitations,
\fi
\ifx\markdownOptionCitationNbsps\undefined\else
  citationNbsps = \markdownOptionCitationNbsps,
\fi
\ifx\markdownOptionCodeSpans\undefined\else
  codeSpans = \markdownOptionCodeSpans,
\fi
\ifx\markdownOptionContentBlocks\undefined\else
  contentBlocks = \markdownOptionContentBlocks,
\fi
\ifx\markdownOptionContentBlocksLanguageMap\undefined\else
  contentBlocksLanguageMap =
    "\markdownOptionContentBlocksLanguageMap",
\fi
\ifx\markdownOptionDefinitionLists\undefined\else
  definitionLists = \markdownOptionDefinitionLists,
\fi
\ifx\markdownOptionFootnotes\undefined\else
  footnotes = \markdownOptionFootnotes,
\fi
\ifx\markdownOptionFencedCode\undefined\else
  fencedCode = \markdownOptionFencedCode,
\fi
\ifx\markdownOptionHashEnumerators\undefined\else
  hashEnumerators = \markdownOptionHashEnumerators,
\fi
\ifx\markdownOptionHeaderAttributes\undefined\else
  headerAttributes = \markdownOptionHeaderAttributes,
\fi
\ifx\markdownOptionHtml\undefined\else
  html = \markdownOptionHtml,
\fi
\ifx\markdownOptionHybrid\undefined\else
  hybrid = \markdownOptionHybrid,
\fi
\ifx\markdownOptionInlineFootnotes\undefined\else
  inlineFootnotes = \markdownOptionInlineFootnotes,
```

```
\fi
\ifx\markdownOptionPipeTables\undefined\else
  pipeTables = \markdownOptionPipeTables,
\fi
\ifx\markdownOptionPreserveTabs\undefined\else
  preserveTabs = \markdownOptionPreserveTabs,
\fi
\ifx\markdownOptionShiftHeadings\undefined\else
  shiftHeadings = "\markdownOptionShiftHeadings",
\fi
\ifx\markdownOptionSlice\undefined\else
  slice = "\markdownOptionSlice",
\fi
\ifx\markdownOptionSmartEllipses\undefined\else
  smartEllipses = \markdownOptionSmartEllipses,
\fi
\ifx\markdownOptionStartNumber\undefined\else
  startNumber = \markdownOptionStartNumber,
\fi
\ifx\markdownOptionTableCaptions\undefined\else
  tableCaptions = \markdownOptionTableCaptions,
\fi
\ifx\markdownOptionTightLists\undefined\else
  tightLists = \markdownOptionTightLists,
\fi
\ifx\markdownOptionUnderscores\undefined\else
  underscores = \markdownOptionUnderscores,
\fi}
}%
```

The `\markdownPrepare` macro contains the Lua code that is executed prior to any conversion from markdown to plain TEX. It exposes the `convert` function for the use by any further Lua code.

```
\def\markdownPrepare{%
```

First, ensure that the `\markdownOptionCacheDir` directory exists.

```
local lfs = require("lfs")
local cacheDir = "\markdownOptionCacheDir"
if not lfs.isdir(cacheDir) then
  assert(lfs.mkdir(cacheDir))
end
```

Next, load the `markdown` module and create a converter function using the plain TEX options, which were serialized to a Lua table via the `\markdownLuaOptions` macro.

```
local md = require("markdown")
local convert = md.new(\markdownLuaOptions)
}%
```

3.2.4 Buffering 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.

```
\csname newread\endcsname\markdownInputFileStream
\csname newwrite\endcsname\markdownOutputFileStream
```

The `\markdownReadAndConvertTab` macro contains the tab character literal.

```
\begingroup
  \catcode`\^^I=12%
  \gdef\markdownReadAndConvertTab{^^I}%
\endgroup
```

The `\markdownReadAndConvert` macro is largely a rewrite of the LaTeX 2_ε `\filecontents` macro to plain TeX.

```
\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 `\markdownOptionStripPercentSigns` is `true`.

```
  \catcode`\^^M=13%
  \catcode`\^^I=13%
  \catcode`|=0%
  \catcode`\\=12%
  |catcode`@=14%
  |catcode`|%=12@
  |gdef|markdownReadAndConvert#1#2{@
    |begingroup@
```

Open the `\markdownOptionInputTempFileName` file for writing.

```
    |immediate|openout|markdownOutputFileStream@
      |markdownOptionInputTempFileName|relax@
    |markdownInfo{Buffering markdown input into the temporary @
      input file "|markdownOptionInputTempFileName" and scanning @
      for the closing token sequence "#1"}@
```

Locally change the category of the special plain TeX 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.

```
    |def|do##1{|catcode`##1=12}|dospecials@
    |catcode`| =12@
    |markdownMakeOther@
```

The `\markdownReadAndConvertStripPercentSigns` macro will process the individual lines of output, stipping away leading percent signs (`%`) when

`\markdownOptionStripPercentSigns` is `true`. 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.

```
4837      |def|markdownReadAndConvertStripPercentSign##1{@
4838        |markdownIfOption{StripPercentSigns}@
4839          |if##1%@
4840            |expandafter|expandafter|expandafter@
4841              |markdownReadAndConvertProcessLine@
4842          |else@
4843            |expandafter|expandafter|expandafter@
4844              |markdownReadAndConvertProcessLine@
4845              |expandafter|expandafter|expandafter##1@
4846          |fi@
4847        |else@
4848          |expandafter@
4849            |markdownReadAndConvertProcessLine@
4850            |expandafter##1@
4851        |fi}@
```

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.

```
4852      |def|markdownReadAndConvertProcessLine##1#1##2#1##3|relax{@
```

When the ending token sequence does not appear in the line, store the line in the `\markdownOptionInputTempFileName` file.

```
4853        |ifx|relax##3|relax@
4854          |immediate|write|markdownOutputFileStream{##1}@
4855        |else@
```

When the ending token sequence appears in the line, make the next newline character close the `\markdownOptionInputTempFileName` file, return the character categories back to the former state, convert the `\markdownOptionInputTempFileName` file from markdown to plain TEX, `\input` the result of the conversion, and expand the ending control sequence.

```
4856          |def^^M{@
4857            |markdownInfo{The ending token sequence was found}@
4858            |immediate|closeout|markdownOutputFileStream@
4859            |endgroup@
4860            |markdownInput|markdownOptionInputTempFileName@
4861            #2}@
4862        |fi@
```

Repeat with the next line.

```
4863        ^^M}@
```

Make the tab character active at expansion time and make it expand to a literal tab character.

```
    |catcode`|^^I=13@
    |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.

```
    |catcode`|^^M=13@
    |def^^M##1^^M{@
      |def^^M####1^^M{@
        |markdownReadAndConvertStripPercentSign####1#1#1|relax}@
      ^^M}@
    ^^M}@
```

Reset the character categories back to the former state.

```
|endgroup
```

3.2.5 Lua Shell Escape Bridge

The following TEX code is intended for TEX engines that do not provide direct access to Lua, but expose the shell of the operating system. This corresponds to the `\markdownMode` values of `0` and `1`.

The `\markdownLuaExecute` macro defined here and in Section 3.2.6 are meant to be indistinguishable to the remaining code.

The package assumes that although the user is not using the LuaTEX engine, their TEX distribution contains it, and uses shell access to produce and execute Lua scripts using the TEXLua interpreter [2, Section 3.1.1].

```
\ifnum\markdownMode<2\relax
\ifnum\markdownMode=0\relax
  \markdownInfo{Using mode 0: Shell escape via write18}%
\else
  \markdownInfo{Using mode 1: Shell escape via os.execute}%
\fi
```

The `\markdownExecuteShellEscape` macro contains the numeric value indicating whether the shell access is enabled (`1`), disabled (`0`), or restricted (`2`).

Inherit the value of the the `\pdfshellescape` (LuaTEX, PdfTEX) or the `\shellescape` (XETEX) commands. If neither of these commands is defined and Lua is available, attempt to access the `status.shell_escape` configuration item.

If you cannot detect, whether the shell access is enabled, act as if it were.

```
\ifx\pdfshellescape\undefined
  \ifx\shellescape\undefined
    \ifnum\markdownMode=0\relax
      \def\markdownExecuteShellEscape{1}%
    \else
      \def\markdownExecuteShellEscape{%
        \directlua{tex.sprint(status.shell_escape or "1")}}%
```

```
    \fi
  \else
    \let\markdownExecuteShellEscape\shellescape
  \fi
\else
  \let\markdownExecuteShellEscape\pdfshellescape
\fi
```

The `\markdownExecuteDirect` macro executes the code it has received as its first argument by writing it to the output file stream 18, if Lua is unavailable, or by using the Lua `os.execute` method otherwise.

```
\ifnum\markdownMode=0\relax
  \def\markdownExecuteDirect#1{\immediate\write18{#1}}%
\else
  \def\markdownExecuteDirect#1{%
    \directlua{os.execute("\luaescapestring{#1}")}}%
\fi
```

The `\markdownExecute` macro is a wrapper on top of `\markdownExecuteDirect` that checks the value of `\markdownExecuteShellEscape` and prints an error message if the shell is inaccessible.

```
\def\markdownExecute#1{%
  \ifnum\markdownExecuteShellEscape=1\relax
    \markdownExecuteDirect{#1}%
  \else
    \markdownError{I can not access the shell}{Either run the TeX
      compiler with the --shell-escape or the --enable-write18 flag,
      or set shell_escape=t in the texmf.cnf file}%
  \fi}%
```

The `\markdownLuaExecute` macro executes the Lua code it has received as its first argument. The Lua code may not directly interact with the TEX engine, but it can use the `print` function in the same manner it would use the `tex.print` method.

```
\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.

```
  \catcode`|=0%
  \catcode`\\=12%
  |gdef|markdownLuaExecute#1{%
```

Create the file `\markdownOptionHelperScriptFileName` and fill it with the input Lua code prepended with kpathsea initialization, so that Lua modules from the TEX distribution are available.

```
    |immediate|openout|markdownOutputFileStream=%
      |markdownOptionHelperScriptFileName
    |markdownInfo{Writing a helper Lua script to the file
      "|markdownOptionHelperScriptFileName"}%
```

```
    |immediate|write|markdownOutputFileStream{%
      local ran_ok, error = pcall(function()
        local kpse = require("kpse")
        kpse.set_program_name("luatex")
        #1
      end)
```

If there was an error, use the file `\markdownOptionErrorTempFileName` to store the error message.

```
      if not ran_ok then
        local file = io.open("%
          |markdownOptionOutputDir
          /|markdownOptionErrorTempFileName", "w")
        if file then
          file:write(error .. "\n")
          file:close()
        end
        print('\\markdownError{An error was encountered while executing
               Lua code}{For further clues, examine the file
               "|markdownOptionOutputDir
               /|markdownOptionErrorTempFileName"}')
      end}%
    |immediate|closeout|markdownOutputFileStream
```

Execute the generated `\markdownOptionHelperScriptFileName` Lua script using the TEXLua binary and store the output in the `\markdownOptionOutputTempFileName` file.

```
    |markdownInfo{Executing a helper Lua script from the file
      "|markdownOptionHelperScriptFileName" and storing the result in the
      file "|markdownOptionOutputTempFileName"}%
    |markdownExecute{texlua "|markdownOptionOutputDir
      /|markdownOptionHelperScriptFileName" > %
      "|markdownOptionOutputDir
      /|markdownOptionOutputTempFileName"}%
```

`\input` the generated `\markdownOptionOutputTempFileName` file.

```
    |input|markdownOptionOutputTempFileName|relax}%
|endgroup
```

3.2.6 Direct Lua Access

The following TEX code is intended for TEX engines that provide direct access to Lua (LuaTEX). The macro `\markdownLuaExecute` defined here and in Section 3.2.5 are meant to be indistinguishable to the remaining code. This corresponds to the `\markdownMode` value of 2.

```
\else
\markdownInfo{Using mode 2: Direct Lua access}%
```

The direct Lua access version of the `\markdownLuaExecute` macro is defined in terms of the `\directlua` primitive. The `print` function is set as an alias to the `\tex.print` method in order to mimic the behaviour of the `\markdownLuaExecute` definition from Section 3.2.5,

```
\def\markdownLuaExecute#1{\directlua{local print = tex.print #1}}%
\fi
```

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 TEX.

```
\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.

```
  \catcode`|=0%
  \catcode`\\=12%
  |gdef|markdownInput#1{%
    |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 LATEXMk to track changes to the markdown document.

```
    |openin|markdownInputFileStream#1
    |closein|markdownInputFileStream
    |markdownLuaExecute{%
      |markdownPrepare
      local input = assert(io.open("%
        |markdownOptionOutputDir
        /#1", "r"):read("*a"))
```

Since the Lua converter expects UNIX line endings, normalize the input.

```
      print(convert(input:gsub("\r\n?", "\n")))}}%
|endgroup
```

3.3 LATEX Implementation

The LATEX implemenation makes use of the fact that, apart from some subtle differences, LATEX implements the majority of the plain TEX format [7, Section 9]. As a consequence, we can directly reuse the existing plain TEX implementation.

```
\input markdown
\def\markdownVersionSpace{ }%
\ProvidesPackage{markdown}[\markdownLastModified\markdownVersionSpace v%
  \markdownVersion\markdownVersionSpace markdown renderer]%
```

3.3.1 Logging Facilities

The LaTeX implementation redefines the plain TeX logging macros (see Section 3.2.1) to use the LaTeX `\PackageInfo`, `\PackageWarning`, and `\PackageError` macros.

```
\renewcommand\markdownInfo[1]{\PackageInfo{markdown}{#1}}%
\renewcommand\markdownWarning[1]{\PackageWarning{markdown}{#1}}%
\renewcommand\markdownError[2]{\PackageError{markdown}{#1}{#2.}}%
```

3.3.2 Typesetting Markdown

The `\markdownInputPlainTeX` macro is used to store the original plain TeX implementation of the `\markdownInput` macro. The `\markdownInput` is then redefined to accept an optional argument with options recognized by the LaTeX interface (see Section 2.3.2).

```
\let\markdownInputPlainTeX\markdownInput
\renewcommand\markdownInput[2][]{%
  \begingroup
    \markdownSetup{#1}%
    \markdownInputPlainTeX{#2}%
  \endgroup}%
```

The `markdown`, and `markdown*` LaTeX environments are implemented using the `\markdownReadAndConvert` macro.

```
\renewenvironment{markdown}{%
  \markdownReadAndConvert@markdown{}}\relax
\renewenvironment{markdown*}[1]{%
  \markdownSetup{#1}%
  \markdownReadAndConvert@markdown*}\relax
\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*.

```
  \catcode`\|=0\catcode`\<=1\catcode`\>=2%
  \catcode`\\=12|catcode`|{=12|catcode`|}=12%
  |gdef|markdownReadAndConvert@markdown#1<%
    |markdownReadAndConvert<\end{markdown#1}>%
                           <|end<markdown#1>>>%
|endgroup
```

3.3.3 Options

The supplied package options are processed using the `\markdownSetup` macro.

```
\DeclareOption*{%
  \expandafter\markdownSetup\expandafter{\CurrentOption}}%
```

```
\ProcessOptions\relax
```

After processing the options, activate the `renderers` and `rendererPrototypes` keys.

```
\define@key{markdownOptions}{renderers}{%
  \setkeys{markdownRenderers}{#1}%
  \def\KV@prefix{KV@markdownOptions@}}%
\define@key{markdownOptions}{rendererPrototypes}{%
  \setkeys{markdownRendererPrototypes}{#1}%
  \def\KV@prefix{KV@markdownOptions@}}%
```

3.3.4 Token Renderer Prototypes

The following configuration should be considered placeholder.

If the `\markdownOptionTightLists` macro expands to `false`, do not load the paralist package. This is necessary for LaTeX 2$_\varepsilon$ document classes that do not play nice with paralist, such as beamer. If the `\markdownOptionTightLists` is undefined and the beamer document class is in use, then do not load the paralist package either.

```
\ifx\markdownOptionTightLists\undefined
  \@ifclassloaded{beamer}{}{
    \RequirePackage{paralist}}
\else
  \ifthenelse{\equal{\markdownOptionTightLists}{false}}{}{
    \RequirePackage{paralist}}
\fi
```

If we loaded the paralist package, define the respective renderer prototypes to make use of the capabilities of the package. Otherwise, define the renderer prototypes to fall back on the corresponding renderers for the non-tight lists.

```
\@ifpackageloaded{paralist}{
  \markdownSetup{rendererPrototypes={
    ulBeginTight = {\begin{compactitem}},
    ulEndTight = {\end{compactitem}},
    olBeginTight = {\begin{compactenum}},
    olEndTight = {\end{compactenum}},
    dlBeginTight = {\begin{compactdesc}},
    dlEndTight = {\end{compactdesc}}}}
}{
  \markdownSetup{rendererPrototypes={
    ulBeginTight = {\markdownRendererUlBegin},
    ulEndTight = {\markdownRendererUlEnd},
    olBeginTight = {\markdownRendererOlBegin},
    olEndTight = {\markdownRendererOlEnd},
    dlBeginTight = {\markdownRendererDlBegin},
    dlEndTight = {\markdownRendererDlEnd}}}
```

```
\markdownSetup{rendererPrototypes={
  lineBreak = {\\},
  leftBrace = {\textbraceleft},
  rightBrace = {\textbraceright},
  dollarSign = {\textdollar},
  underscore = {\textunderscore},
  circumflex = {\textasciicircum},
  backslash = {\textbackslash},
  tilde = {\textasciitilde},
  pipe = {\textbar},
  codeSpan = {\texttt{#1}},
  contentBlock = {%
    \ifthenelse{\equal{#1}{csv}}{%
      \begin{table}%
        \begin{center}%
          \csvautotabular{#3}%
        \end{center}
        \ifx\empty#4\empty\else
          \caption{#4}%
        \fi
        \label{tab:#1}%
      \end{table}}{%
      \markdownInput{#3}}},
  image = {%
    \begin{figure}%
      \begin{center}%
        \includegraphics{#3}%
      \end{center}%
      \ifx\empty#4\empty\else
        \caption{#4}%
      \fi
      \label{fig:#1}%
    \end{figure}},
  ulBegin = {\begin{itemize}},
  ulItem = {\item},
  ulEnd = {\end{itemize}},
  olBegin = {\begin{enumerate}},
  olItem = {\item},
  olItemWithNumber = {\item[#1.]},
  olEnd = {\end{enumerate}},
  dlBegin = {\begin{description}},
  dlItem = {\item[#1]},
  dlEnd = {\end{description}},
  emphasis = {\emph{#1}},
  blockQuoteBegin = {\begin{quotation}},
  blockQuoteEnd = {\end{quotation}},
  inputVerbatim = {\VerbatimInput{#1}},
```

```
  inputFencedCode = {%
    \ifx\relax#2\relax
      \VerbatimInput{#1}%
    \else
      \ifx\minted@code\undefined
        \ifx\lst@version\undefined
          \markdownRendererInputFencedCode{#1}{}%
```

When the listings package is loaded, use it for syntax highlighting.

```
        \else
          \lstinputlisting[language=#2]{#1}%
        \fi
```

When the minted package is loaded, use it for syntax highlighting. The minted package is preferred over listings.

```
      \else
        \inputminted{#2}{#1}%
      \fi
    \fi},
  horizontalRule = {\noindent\rule[0.5ex]{\linewidth}{1pt}},
  footnote = {\footnote{#1}}}}
```

Support the nesting of strong emphasis.

```
\newif\ifmarkdownLATEXStrongEmphasisNested
\markdownLATEXStrongEmphasisNestedfalse
\markdownSetup{rendererPrototypes={
  strongEmphasis = {%
    \ifmarkdownLATEXStrongEmphasisNested
      \markdownLATEXStrongEmphasisNestedfalse
      \textmd{#1}%
      \markdownLATEXStrongEmphasisNestedtrue
    \else
      \markdownLATEXStrongEmphasisNestedtrue
      \textbf{#1}%
      \markdownLATEXStrongEmphasisNestedfalse
    \fi}}}
```

Support LaTeX document classes that do not provide chapters.

```
\ifx\chapter\undefined
  \markdownSetup{rendererPrototypes = {
    headingOne = {\section{#1}},
    headingTwo = {\subsection{#1}},
    headingThree = {\subsubsection{#1}},
    headingFour = {\paragraph{#1}\leavevmode},
    headingFive = {\subparagraph{#1}\leavevmode}}}
\else
  \markdownSetup{rendererPrototypes = {
    headingOne = {\chapter{#1}},
    headingTwo = {\section{#1}},
```

```
    headingThree = {\subsection{#1}},
    headingFour = {\subsubsection{#1}},
    headingFive = {\paragraph{#1}\leavevmode},
    headingSix = {\subparagraph{#1}\leavevmode}}}
\fi
```

There is a basic implementation for citations that uses the LaTeX `\cite` macro. There are also implementations that use the natbib `\citep`, and `\citet` macros, and the BibLaTeX `\autocites` and `\textcites` macros. These implementations will be used, when the respective packages are loaded.

```
\newcount\markdownLaTeXCitationsCounter

% Basic implementation
\def\markdownLaTeXBasicCitations#1#2#3#4#5#6{%
  \advance\markdownLaTeXCitationsCounter by 1\relax
  \ifx\relax#4\relax
    \ifx\relax#5\relax
      \ifnum\markdownLaTeXCitationsCounter>\markdownLaTeXCitationsTotal\relax
        \cite{#1#2#6}%  Without prenotes and postnotes, just accumulate cites
        \expandafter\expandafter\expandafter
        \expandafter\expandafter\expandafter\expandafter
        \@gobblethree
      \fi
    \else%  Before a postnote (#5), dump the accumulator
      \ifx\relax#1\relax\else
        \cite{#1}%
      \fi
      \cite[#5]{#6}%
      \ifnum\markdownLaTeXCitationsCounter>\markdownLaTeXCitationsTotal\relax
      \else
        \expandafter\expandafter\expandafter
        \expandafter\expandafter\expandafter\expandafter
        \expandafter\expandafter\expandafter
        \expandafter\expandafter\expandafter\expandafter
        \markdownLaTeXBasicCitations
      \fi
      \expandafter\expandafter\expandafter
      \expandafter\expandafter\expandafter\expandafter{%
      \expandafter\expandafter\expandafter
      \expandafter\expandafter\expandafter\expandafter}%
      \expandafter\expandafter\expandafter
      \expandafter\expandafter\expandafter\expandafter{%
      \expandafter\expandafter\expandafter
      \expandafter\expandafter\expandafter\expandafter}%
      \expandafter\expandafter\expandafter
      \@gobblethree
    \fi
```

```
  \else%  Before a prenote (#4), dump the accumulator
    \ifx\relax#1\relax\else
      \cite{#1}%
    \fi
    \ifnum\markdownLaTeXCitationsCounter>1\relax
      \space  % Insert a space before the prenote in later citations
    \fi
    #4~\expandafter\cite\ifx\relax#5\relax{#6}\else[#5]{#6}\fi
    \ifnum\markdownLaTeXCitationsCounter>\markdownLaTeXCitationsTotal\relax
    \else
      \expandafter\expandafter\expandafter
      \expandafter\expandafter\expandafter\expandafter
      \markdownLaTeXBasicCitations
    \fi
    \expandafter\expandafter\expandafter{%
    \expandafter\expandafter\expandafter}%
    \expandafter\expandafter\expandafter{%
    \expandafter\expandafter\expandafter}%
    \expandafter
    \@gobblethree
  \fi\markdownLaTeXBasicCitations{#1#2#6},}
\let\markdownLaTeXBasicTextCitations\markdownLaTeXBasicCitations

% Natbib implementation
\def\markdownLaTeXNatbibCitations#1#2#3#4#5{%
  \advance\markdownLaTeXCitationsCounter by 1\relax
  \ifx\relax#3\relax
    \ifx\relax#4\relax
      \ifnum\markdownLaTeXCitationsCounter>\markdownLaTeXCitationsTotal\relax
        \citep{#1,#5}%  Without prenotes and postnotes, just accumulate cites
        \expandafter\expandafter\expandafter
        \expandafter\expandafter\expandafter\expandafter
        \@gobbletwo
      \fi
    \else%  Before a postnote (#4), dump the accumulator
      \ifx\relax#1\relax\else
        \citep{#1}%
      \fi
      \citep[][#4]{#5}%
      \ifnum\markdownLaTeXCitationsCounter>\markdownLaTeXCitationsTotal\relax
      \else
        \expandafter\expandafter\expandafter
        \expandafter\expandafter\expandafter\expandafter
        \expandafter\expandafter\expandafter
        \expandafter\expandafter\expandafter\expandafter
        \markdownLaTeXNatbibCitations
      \fi
```

```
      \expandafter\expandafter\expandafter
      \expandafter\expandafter\expandafter\expandafter{%
      \expandafter\expandafter\expandafter
      \expandafter\expandafter\expandafter\expandafter}%
      \expandafter\expandafter\expandafter
      \@gobbletwo
    \fi
  \else%  Before a prenote (#3), dump the accumulator
    \ifx\relax#1\relax\relax\else
      \citep{#1}%
    \fi
    \citep[#3][#4]{#5}%
    \ifnum\markdownLaTeXCitationsCounter>\markdownLaTeXCitationsTotal\relax
    \else
      \expandafter\expandafter\expandafter
      \expandafter\expandafter\expandafter\expandafter
      \markdownLaTeXNatbibCitations
    \fi
    \expandafter\expandafter\expandafter{%
    \expandafter\expandafter\expandafter}%
    \expandafter
    \@gobbletwo
  \fi\markdownLaTeXNatbibCitations{#1,#5}}
\def\markdownLaTeXNatbibTextCitations#1#2#3#4#5{%
  \advance\markdownLaTeXCitationsCounter by 1\relax
  \ifx\relax#3\relax
    \ifx\relax#4\relax
      \ifnum\markdownLaTeXCitationsCounter>\markdownLaTeXCitationsTotal\relax
        \citet{#1,#5}%  Without prenotes and postnotes, just accumulate cites
        \expandafter\expandafter\expandafter
        \expandafter\expandafter\expandafter\expandafter
        \@gobbletwo
      \fi
    \else%  After a prenote or a postnote, dump the accumulator
      \ifx\relax#1\relax\else
        \citet{#1}%
      \fi
      , \citet[#3][#4]{#5}%
      \ifnum\markdownLaTeXCitationsCounter<\markdownLaTeXCitationsTotal\relax
        ,
      \else
        \ifnum\markdownLaTeXCitationsCounter=\markdownLaTeXCitationsTotal\relax
          ,
        \fi
      \fi
      \expandafter\expandafter\expandafter
      \expandafter\expandafter\expandafter\expandafter
```

```
      \markdownLaTeXNatbibTextCitations
      \expandafter\expandafter\expandafter
      \expandafter\expandafter\expandafter\expandafter{%
      \expandafter\expandafter\expandafter
      \expandafter\expandafter\expandafter\expandafter}%
      \expandafter\expandafter\expandafter
      \@gobbletwo
    \fi
  \else%  After a prenote or a postnote, dump the accumulator
    \ifx\relax#1\relax\relax\else
      \citet{#1}%
    \fi
    , \citet[#3][#4]{#5}%
    \ifnum\markdownLaTeXCitationsCounter<\markdownLaTeXCitationsTotal\relax
      ,
    \else
      \ifnum\markdownLaTeXCitationsCounter=\markdownLaTeXCitationsTotal\relax
        ,
      \fi
    \fi
    \expandafter\expandafter\expandafter
    \markdownLaTeXNatbibTextCitations
    \expandafter\expandafter\expandafter{%
    \expandafter\expandafter\expandafter}%
    \expandafter
    \@gobbletwo
  \fi\markdownLaTeXNatbibTextCitations{#1,#5}}

% BibLaTeX implementation
\def\markdownLaTeXBibLaTeXCitations#1#2#3#4#5{%
  \advance\markdownLaTeXCitationsCounter by 1\relax
  \ifnum\markdownLaTeXCitationsCounter>\markdownLaTeXCitationsTotal\relax
    \autocites#1[#3][#4]{#5}%
    \expandafter\@gobbletwo
  \fi\markdownLaTeXBibLaTeXCitations{#1[#3][#4]{#5}}}
\def\markdownLaTeXBibLaTeXTextCitations#1#2#3#4#5{%
  \advance\markdownLaTeXCitationsCounter by 1\relax
  \ifnum\markdownLaTeXCitationsCounter>\markdownLaTeXCitationsTotal\relax
    \textcites#1[#3][#4]{#5}%
    \expandafter\@gobbletwo
  \fi\markdownLaTeXBibLaTeXTextCitations{#1[#3][#4]{#5}}}

\markdownSetup{rendererPrototypes = {
  cite = {%
    \markdownLaTeXCitationsCounter=1%
    \def\markdownLaTeXCitationsTotal{#1}%
    \ifx\autocites\undefined
```

```
      \ifx\citep\undefined
        \expandafter\expandafter\expandafter
        \markdownLaTeXBasicCitations
        \expandafter\expandafter\expandafter{%
        \expandafter\expandafter\expandafter}%
        \expandafter\expandafter\expandafter{%
        \expandafter\expandafter\expandafter}%
      \else
        \expandafter\expandafter\expandafter
        \markdownLaTeXNatbibCitations
        \expandafter\expandafter\expandafter{%
        \expandafter\expandafter\expandafter}%
      \fi
    \else
      \expandafter\expandafter\expandafter
      \markdownLaTeXBibLaTeXCitations
      \expandafter{\expandafter}%
    \fi},
  textCite = {%
    \markdownLaTeXCitationsCounter=1%
    \def\markdownLaTeXCitationsTotal{#1}%
    \ifx\autocites\undefined
      \ifx\citep\undefined
        \expandafter\expandafter\expandafter
        \markdownLaTeXBasicTextCitations
        \expandafter\expandafter\expandafter{%
        \expandafter\expandafter\expandafter}%
        \expandafter\expandafter\expandafter{%
        \expandafter\expandafter\expandafter}%
      \else
        \expandafter\expandafter\expandafter
        \markdownLaTeXNatbibTextCitations
        \expandafter\expandafter\expandafter{%
        \expandafter\expandafter\expandafter}%
      \fi
    \else
      \expandafter\expandafter\expandafter
      \markdownLaTeXBibLaTeXTextCitations
      \expandafter{\expandafter}%
    \fi}}
```

Before consuming the parameters for the hyperlink renderer, we change the category code of the hash sign (`#`) to other, so that it cannot be mistaken for a parameter character. After the hyperlink has been typeset, we restore the original catcode.

```
\def\markdownRendererLinkPrototype{%
  \begingroup
  \catcode`\#=12
```

```
  \def\next##1##2##3##4{%
    ##1\footnote{%
      \ifx\empty##4\empty\else##4: \fi\texttt<\url{##3}\texttt>}%
    \endgroup}%
  \next}
```

There is a basic implementation of tables. If the booktabs package is loaded, then it is used to produce horizontal lines.

```
\newcount\markdownLaTeXRowCounter
\newcount\markdownLaTeXRowTotal
\newcount\markdownLaTeXColumnCounter
\newcount\markdownLaTeXColumnTotal
\newtoks\markdownLaTeXTable
\newtoks\markdownLaTeXTableAlignment
\newtoks\markdownLaTeXTableEnd
\@ifpackageloaded{booktabs}{
  \let\markdownLaTeXTopRule\toprule
  \let\markdownLaTeXMidRule\midrule
  \let\markdownLaTeXBottomRule\bottomrule
}{
  \let\markdownLaTeXTopRule\hline
  \let\markdownLaTeXMidRule\hline
  \let\markdownLaTeXBottomRule\hline
}
\markdownSetup{rendererPrototypes={
  table = {%
    \markdownLaTeXTable={}%
    \markdownLaTeXTableAlignment={}%
    \markdownLaTeXTableEnd={%
      \markdownLaTeXBottomRule
      \end{tabular}}%
    \ifx\empty#1\empty\else
      \addto@hook\markdownLaTeXTable{%
        \begin{table}
        \centering}%
      \addto@hook\markdownLaTeXTableEnd{%
        \caption{#1}
        \end{table}}%
    \fi
    \addto@hook\markdownLaTeXTable{\begin{tabular}}%
    \markdownLaTeXRowCounter=0%
    \markdownLaTeXRowTotal=#2%
    \markdownLaTeXColumnTotal=#3%
    \markdownLaTeXRenderTableRow
  }
}}
\def\markdownLaTeXRenderTableRow#1{%
```

```
  \markdownLaTeXColumnCounter=0%
  \ifnum\markdownLaTeXRowCounter=0\relax
    \markdownLaTeXReadAlignments#1%
    \markdownLaTeXTable=\expandafter\expandafter\expandafter{%
      \expandafter\the\expandafter\markdownLaTeXTable\expandafter{%
        \the\markdownLaTeXTableAlignment}}%
    \addto@hook\markdownLaTeXTable{\markdownLaTeXTopRule}%
  \else
    \markdownLaTeXRenderTableCell#1%
  \fi
  \ifnum\markdownLaTeXRowCounter=1\relax
    \addto@hook\markdownLaTeXTable\markdownLaTeXMidRule
  \fi
  \advance\markdownLaTeXRowCounter by 1\relax
  \ifnum\markdownLaTeXRowCounter>\markdownLaTeXRowTotal\relax
    \markdownInfo{\the\markdownLaTeXTable}
    \markdownInfo{\the\markdownLaTeXTableEnd}
    \the\markdownLaTeXTable
    \the\markdownLaTeXTableEnd
    \expandafter\@gobble
  \fi\markdownLaTeXRenderTableRow}
\def\markdownLaTeXReadAlignments#1{%
  \advance\markdownLaTeXColumnCounter by 1\relax
  \if#1d%
    \addto@hook\markdownLaTeXTableAlignment{l}%
  \else
    \addto@hook\markdownLaTeXTableAlignment{#1}%
  \fi
  \ifnum\markdownLaTeXColumnCounter<\markdownLaTeXColumnTotal\relax\else
    \expandafter\@gobble
  \fi\markdownLaTeXReadAlignments}
\def\markdownLaTeXRenderTableCell#1{%
  \advance\markdownLaTeXColumnCounter by 1\relax
  \ifnum\markdownLaTeXColumnCounter<\markdownLaTeXColumnTotal\relax
    \addto@hook\markdownLaTeXTable{#1&}%
  \else
    \addto@hook\markdownLaTeXTable{#1\\}%
    \expandafter\@gobble
  \fi\markdownLaTeXRenderTableCell}
```

3.3.5 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.

```
\newcommand\markdownMakeOther{%
  \count0=128\relax
  \loop
    \catcode\count0=11\relax
    \advance\count0 by 1\relax
  \ifnum\count0<256\repeat}%
```

3.4 ConTEXt Implementation

The ConTEXt implementation makes use of the fact that, apart from some subtle differences, the Mark II and Mark IV ConTEXt formats *seem* to implement (the documentation is scarce) the majority of the plain TEX format required by the plain TEX implementation. As a consequence, we can directly reuse the existing plain TEX implementation after supplying the missing plain TEX macros.

```
\def\dospecials{\do\ \do\\\do\{\do\}\do\$\do\&%
  \do\#\do\^\do\_\do\%\do\~}%
\input markdown
```

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 LATEX package.

```
\def\markdownMakeOther{%
  \count0=128\relax
  \loop
    \catcode\count0=11\relax
    \advance\count0 by 1\relax
  \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 ConTEXt.

```
  \catcode`|=12}%
```

3.4.1 Logging Facilities

The ConTEXt implementation redefines the plain TEX logging macros (see Section 3.2.1) to use the ConTEXt `\writestatus` macro.

```
\def\markdownInfo#1{\writestatus{markdown}{#1.}}%
\def\markdownWarning#1{\writestatus{markdown\space warn}{#1.}}%
```

3.4.2 Typesetting Markdown

The `\startmarkdown` and `\stopmarkdown` macros are implemented using the `\markdownReadAndConvert` macro.

```
\begingroup
```

Locally swap the category code of the backslash symbol with the pipe symbol. 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*.

```
  \catcode`\|=0%
  \catcode`\\=12%
  |gdef|startmarkdown{%
    |markdownReadAndConvert{\stopmarkdown}%
                           {|stopmarkdown}}%
|endgroup
```

3.4.3 Token Renderer Prototypes

The following configuration should be considered placeholder.

```
\def\markdownRendererLineBreakPrototype{\blank}%
\def\markdownRendererLeftBracePrototype{\textbraceleft}%
\def\markdownRendererRightBracePrototype{\textbraceright}%
\def\markdownRendererDollarSignPrototype{\textdollar}%
\def\markdownRendererPercentSignPrototype{\percent}%
\def\markdownRendererUnderscorePrototype{\textunderscore}%
\def\markdownRendererCircumflexPrototype{\textcircumflex}%
\def\markdownRendererBackslashPrototype{\textbackslash}%
\def\markdownRendererTildePrototype{\textasciitilde}%
\def\markdownRendererPipePrototype{\char`|}%
\def\markdownRendererLinkPrototype#1#2#3#4{%
  \useURL[#1][#3][][#4]#1\footnote[#1]{\ifx\empty#4\empty\else#4:
  \fi\tt<\hyphenatedurl{#3}>}}%
\usemodule[database]
\defineseparatedlist
  [MarkdownConTeXtCSV]
  [separator={,},
   before=\bTABLE,after=\eTABLE,
   first=\bTR,last=\eTR,
   left=\bTD,right=\eTD]
\def\markdownConTeXtCSV{csv}
\def\markdownRendererContentBlockPrototype#1#2#3#4{%
  \def\markdownConTeXtCSV@arg{#1}%
\ifx\markdownConTeXtCSV@arg\markdownConTeXtCSV
    \placetable[][tab:#1]{#4}{%
      \processseparatedfile[MarkdownConTeXtCSV][#3]}%
\else
\markdownInput{#3}%
\fi}%
\def\markdownRendererImagePrototype#1#2#3#4{%
  \placefigure[][fig:#1]{#4}{\externalfigure[#3]}}%
\def\markdownRendererUlBeginPrototype{\startitemize}%
\def\markdownRendererUlBeginTightPrototype{\startitemize[packed]}%
```

```
\def\markdownRendererUlItemPrototype{\item}%
\def\markdownRendererUlEndPrototype{\stopitemize}%
\def\markdownRendererUlEndTightPrototype{\stopitemize}%
\def\markdownRendererOlBeginPrototype{\startitemize[n]}%
\def\markdownRendererOlBeginTightPrototype{\startitemize[packed,n]}%
\def\markdownRendererOlItemPrototype{\item}%
\def\markdownRendererOlItemWithNumberPrototype#1{\sym{#1.}}%
\def\markdownRendererOlEndPrototype{\stopitemize}%
\def\markdownRendererOlEndTightPrototype{\stopitemize}%
\definedescription
  [MarkdownConTeXtDlItemPrototype]
  [location=hanging,
   margin=standard,
   headstyle=bold]%
\definestartstop
  [MarkdownConTeXtDlPrototype]
  [before=\blank,
   after=\blank]%
\definestartstop
  [MarkdownConTeXtDlTightPrototype]
  [before=\blank\startpacked,
   after=\stoppacked\blank]%
\def\markdownRendererDlBeginPrototype{%
  \startMarkdownConTeXtDlPrototype}%
\def\markdownRendererDlBeginTightPrototype{%
  \startMarkdownConTeXtDlTightPrototype}%
\def\markdownRendererDlItemPrototype#1{%
  \startMarkdownConTeXtDlItemPrototype{#1}}%
\def\markdownRendererDlItemEndPrototype{%
  \stopMarkdownConTeXtDlItemPrototype}%
\def\markdownRendererDlEndPrototype{%
  \stopMarkdownConTeXtDlPrototype}%
\def\markdownRendererDlEndTightPrototype{%
  \stopMarkdownConTeXtDlTightPrototype}%
\def\markdownRendererEmphasisPrototype#1{{\em#1}}%
\def\markdownRendererStrongEmphasisPrototype#1{{\bf#1}}%
\def\markdownRendererBlockQuoteBeginPrototype{\startquotation}%
\def\markdownRendererBlockQuoteEndPrototype{\stopquotation}%
\def\markdownRendererInputVerbatimPrototype#1{\typefile{#1}}%
\def\markdownRendererInputFencedCodePrototype#1#2{%
  \ifx\relax#2\relax
    \typefile{#1}%
  \else
```

The code fence infostring is used as a name from the ConTEXt `\definetyping` macro. This allows the user to set up code highlighting mapping as follows:

```
% Map the `TEX` syntax highlighter to the `latex` infostring.
```

```
\definetyping [latex]
\setuptyping  [latex] [option=TEX]

\starttext
  \startmarkdown
~~~ latex
\documentclass{article}
\begin{document}
  Hello world!
\end{document}
~~~
  \stopmarkdown
\stoptext
```

```
    \typefile[#2][]{#1}%
  \fi}%
\def\markdownRendererHeadingOnePrototype#1{\chapter{#1}}%
\def\markdownRendererHeadingTwoPrototype#1{\section{#1}}%
\def\markdownRendererHeadingThreePrototype#1{\subsection{#1}}%
\def\markdownRendererHeadingFourPrototype#1{\subsubsection{#1}}%
\def\markdownRendererHeadingFivePrototype#1{\subsubsubsection{#1}}%
\def\markdownRendererHeadingSixPrototype#1{\subsubsubsubsection{#1}}%
\def\markdownRendererHorizontalRulePrototype{%
  \blackrule[height=1pt, width=\hsize]}%
\def\markdownRendererFootnotePrototype#1{\footnote{#1}}%
\stopmodule\protect
```

There is a basic implementation of tables.

```
\newcount\markdownConTeXtRowCounter
\newcount\markdownConTeXtRowTotal
\newcount\markdownConTeXtColumnCounter
\newcount\markdownConTeXtColumnTotal
\newtoks\markdownConTeXtTable
\newtoks\markdownConTeXtTableFloat
\def\markdownRendererTablePrototype#1#2#3{%
  \markdownConTeXtTable={}%
  \ifx\empty#1\empty
    \markdownConTeXtTableFloat={%
      \the\markdownConTeXtTable}%
  \else
    \markdownConTeXtTableFloat={%
      \placetable{#1}{\the\markdownConTeXtTable}}%
  \fi
  \begingroup
  \setupTABLE[r][each][topframe=off, bottomframe=off, leftframe=off, rightframe=off]
```

```
  \setupTABLE[c][each][topframe=off, bottomframe=off, leftframe=off, rightframe=off]
  \setupTABLE[r][1][topframe=on, bottomframe=on]
  \setupTABLE[r][#1][bottomframe=on]
  \markdownConTeXtRowCounter=0%
  \markdownConTeXtRowTotal=#2%
  \markdownConTeXtColumnTotal=#3%
  \markdownConTeXtRenderTableRow}
\def\markdownConTeXtRenderTableRow#1{%
  \markdownConTeXtColumnCounter=0%
  \ifnum\markdownConTeXtRowCounter=0\relax
    \markdownConTeXtReadAlignments#1%
    \markdownConTeXtTable={\bTABLE}%
  \else
    \markdownConTeXtTable=\expandafter{%
      \the\markdownConTeXtTable\bTR}%
    \markdownConTeXtRenderTableCell#1%
    \markdownConTeXtTable=\expandafter{%
      \the\markdownConTeXtTable\eTR}%
  \fi
  \advance\markdownConTeXtRowCounter by 1\relax
  \ifnum\markdownConTeXtRowCounter>\markdownConTeXtRowTotal\relax
    \markdownConTeXtTable=\expandafter{%
      \the\markdownConTeXtTable\eTABLE}%
    \the\markdownConTeXtTableFloat
    \endgroup
    \expandafter\gobbleoneargument
  \fi\markdownConTeXtRenderTableRow}
\def\markdownConTeXtReadAlignments#1{%
  \advance\markdownConTeXtColumnCounter by 1\relax
  \if#1d%
    \setupTABLE[c][\the\markdownConTeXtColumnCounter][align=right]
  \fi\if#1l%
    \setupTABLE[c][\the\markdownConTeXtColumnCounter][align=right]
  \fi\if#1c%
    \setupTABLE[c][\the\markdownConTeXtColumnCounter][align=middle]
  \fi\if#1r%
    \setupTABLE[c][\the\markdownConTeXtColumnCounter][align=left]
  \fi
  \ifnum\markdownConTeXtColumnCounter<\markdownConTeXtColumnTotal\relax\else
    \expandafter\gobbleoneargument
  \fi\markdownConTeXtReadAlignments}
\def\markdownConTeXtRenderTableCell#1{%
  \advance\markdownConTeXtColumnCounter by 1\relax
  \markdownConTeXtTable=\expandafter{%
    \the\markdownConTeXtTable\bTD#1\eTD}%
  \ifnum\markdownConTeXtColumnCounter<\markdownConTeXtColumnTotal\relax\else
    \expandafter\gobbleoneargument
```

```
\fi\markdownConTeXtRenderTableCell}
```

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