



FACULTY
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A Interpreter for T_EX

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<https://github.com/witiko/markdown>

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Contents

1. Introduction
 - 1.1 The Case for Lightweight Markup
 - 1.2 Existing Solutions
2. The Markdown Package
 - 2.1 Building a Parser
 - 2.2 Using Markdown from Within \LaTeX
3. Conclusion
4. Bibliography

Section 1

Introduction

The Case for Lightweight Markup

What is Wrong with $T_E X$?

1. High Markup to Text Ratio

- Knuth (1986) is 22 % markup.
- Downey et al. (2016) is 21 % markup.

2. Zero Sandboxing Support

- The document you are typesetting may not compile.
... a file named `\texttt{evil_underscores.tex}` ...
- The document you are typesetting may halt.
`\def\whiletrue{\whiletrue} \whiletrue`
- The document you are typesetting may access the system shell.
`\immediate\write18{sudo rm -rf /}`

3. Steep Learning Curve

The Case for Lightweight Markup

Comparison of \LaTeX and Markdown

```
\section{This is a level one heading}
```

This is a text paragraph with `\emph{emphasis}`.

```
\begin{quotation}This paragraph will show as a quote.\end{quotation}
```

```
\begin{verbatim}
```

This is is a source code example.

```
\end{verbatim}
```

```
\begin{itemize}
```

```
  \item First item with \alert{strong emphasis}
```

```
  \item Second item with a link%
```

```
    \footnote{See \url{http://link.com} (Title)}
```

```
\end{itemize}
```

```
\begin{enumerate}
```

```
  \item First item with \verb'inline code'.
```

```
  \item Second item with an \includegraphics{image.png}
```

```
\end{enumerate}
```

The Case for Lightweight Markup

Comparison of \LaTeX and Markdown

This is a level one heading

This is a text paragraph with *_emphasis_*.

> This paragraph will show as a quote.

```
~~~~~This is is a source code example.
```

* First item with ****strong emphasis****

* Second item with a [link](http://link.com/ "Title")

1. First item with 'inline code'.

2. Second item with an ![image](image.png "Title")

The Case for Lightweight Markup

How is Markdown Useful?

1. Minimal Markup to Text Ratio

- Recall: Knuth (1986) and Downey et al. (2016) are **~22 % markup**.
- Gillespie et al. (2016) is 5.5 % markup.
- Grolemond et al. (2016) is 3.8 % markup.

2. Sandboxing Support

- A Markdown document converted to $\text{T}_{\text{E}}\text{X}$ will always compile.
- The document may neither halt nor access the shell.

3. Hybrid Markup Support

- Markdown was designed to supplement HTML, not replace it.
- Structurally simple sections can use pure Markdown, complex sections may combine Markdown and the host markup.

4. Mild Learning Curve

Existing Solutions

The Swiss Army Knife of Pandoc

*If you need to **convert files from one markup format into another**, Pandoc is your swiss-army knife.*

— MacFarlane (2016b), emphasis mine

- A multi-target publishing software.
- Supports tens of markup languages (Markdown, \LaTeX , HTML, XML Docbook) and output formats (ODF, OOXML, PDF).
- The use of Pandoc for the preparation of \LaTeX documents has been described by Dominici (2014).

What is Wrong with Pandoc?

Heading {#link}

This is [a link](#link).

↓ ↓

`\hypertarget{link}{\section{Heading}\label{link}}`

This is `\protect\hyperlink{link}{a link}`.

- Markdown documents cannot be directly edited at collaborative \LaTeX platforms such as Share \LaTeX or Overleaf.

Existing Solutions

What is Wrong with Pandoc?

3. Half-hybrid, Half-sandboxed

- The input is heuristically parsed and sanitized:

This {will} 2^n \begin{get} s~nitized and \this{will}
not \begin{equation}2^n\end{equation} \$2^n\$.

↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓↓

This \{will\} 2^\{n \textbackslash{}begin\{get\}
s\textasciitilde{}nitized and \this{will} not
\begin{equation}2^n\end{equation} \((2^n\).

- Malicious input such as

```
\def\shell{18} \immediate\write\shell{sudo rm -rf /}
```

is left alone by Pandoc.

Section 2

The Markdown Package

Building a Parser

Is T_EX Up to the Task?

There exist formal language parsers written solely in T_EX. These parsers recognize regular (L^AT_EX3 Project, 2016) and context-free LL(1) languages (Carlisle, 2000). Markdown is not context-free:

`"There is a literal backtick (') here."`

and a parser needs to be able to backtrack over the entire input:

`[this is not a link](http://link.com/ "Title"`

Implementing a recursive-descent parser with backtracking in T_EX is possible, but generally a bad idea:

- Difficult to Maintain, Highly Unidiomatic
- Lack of Efficient Data Structures

Building a Parser

Can We Use Lua Instead of T_EX?

Lua is a powerful, efficient, lightweight, embeddable scripting language. It supports procedural programming, object-oriented programming, functional programming, data-driven programming, and data description.

— Lua Team (2016)

LuaT_EX is an extended version of pdfT_EX using Lua as an embedded scripting language.

— LuaT_EX Team (2016)

Building a Parser

Can We Use Lua Instead of \TeX ?

- With Lua \TeX , we can directly execute Lua code:

```
1 + 2 = \directlua{ tex.sprint(1 + 2) }
```

- With pdf \TeX and other modern \TeX engines, we can spawn a shell and execute the Lua code in a separate process:

```
1 + 2 = \newwrite\script
\immediate\openout\script=script.lua
\immediate\write\script{ print(1 + 2) }%
\immediate\closeout\script
\immediate\write18{texlua script.lua > output.tex}%
\input output.tex
```

Building a Parser

The Lunamark Library

- Lunamark (MacFarlane, 2016a) is a Markdown parser for Lua.
- The language is specified using a Parsing Expression Grammar (PEG) via the LPeg C library (with some cheating).
 - PEGs are CFGs with ordered choice; as a corollary, any PEG is unambiguous. (Ford, 2004) The parse tree for any PEG G and an input word u can be computed in linear time relative to $|u|$ via „packrat parsing“. (Ford, 2002) $\text{PEGs} \subset \text{CFGs}$ is conjectured.
- The dependencies of Lunamark were all either compiled into Lua \TeX (LPeg, Slnunicode), or unneeded (Cosmo, Alt-getopt).
- The library has been released under the Expat (MIT) License.

The Lunamark Library

- produces a parse tree rather than presentation markup:

This is [a link](#link).

```
\markdownRendererHeadingOne{Heading}
```

The Markdown T_FX package:

- 15/33

Using Markdown from Within \LaTeX

The Sandbox and Hybrid Modes

```
\documentclass{article}
\usepackage{markdown}
\begin{document}
\begin{markdown}
  Foo bar \TeX{}  $2^n$ .
\end{markdown}
\begin{markdown*}{hybrid}
  Foo bar \TeX{}  $2^n$ .
\end{markdown*}
\end{document}
```

Foo bar \TeX{} 2^n . Foo bar \TeX 2^n .

Using Markdown from Within \LaTeX

Mapping Markdown Tokens to \TeX Macros

```
\documentclass{article}
\usepackage{markdown}
\markdownSetup{renderers = {
  link = {#1\footnote{See \url{#3} (#4)}},
}}
\begin{document}
\begin{markdown}
  Foo [bar](http://link.com "Link").
\end{markdown}
\end{document}
```

Foo bar¹.

¹See <http://link.com> (Link)

Using Markdown from Within \LaTeX

Syntax Extensions

- Some syntax extensions were already supported by Lunamark:
 - footnotes,
 - definition lists,
- New syntax extensions were added as a part of the project:
 - citations,
 - fenced code blocks.

Using Markdown from Within \LaTeX

Syntax Extensions – `\markdownSetup{footnotes}`

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

^[^1]: Here is the footnote.

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

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

Here is a footnote reference,² and another.³

²Here is the footnote.

³Here's one with multiple paragraphs.

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

Using Markdown from Within \LaTeX

Syntax Extensions – `\markdownSetup{definitionLists}`

Term 1

: Definition

Term 2

: Definition with

multiple paragraphs

Term 1 Definition 1

Term 2 Definition
with multiple paragraphs

Using Markdown from Within \LaTeX

Syntax Extensions – `\markdownSetup{citations}`

Here is a parenthetical citation [`@knuth86`] and a string of several [`see @knuth86, pp. 33-35; also @gruber04, chap. 1`].

Here is a text citation `@knuth86` and a string of several `@knuth86 [pp. 33-35; @gruber04, chap. 1]`.

Here is a parenthetical citation (Knuth, 1986) and a string of several (see Knuth, 1986, pp. 33-35; also Gruber, 2004, chap. 1).

Here is a text citation Knuth (1986) and a string of several Knuth (1986, pp. 33-35) and Gruber (2004, chap. 1).

Using Markdown from Within \LaTeX

Syntax Extensions – `\markdownSetup{fencedCode}`

```
~~~ js
if (a > b)
  return c + 4;
else
  return d + 5;
~~~~~
```

```
if (a > b)
  return c + 4;
else
  return d + 5;
```

Section 3

Conclusion

Conclusion

The Missing Pieces of the Puzzle

- Apart from the \LaTeX interface, the package also exposes Lua, plain \TeX and $\text{Con}\text{\TeX}$ t interfaces.
- The package includes 82 pages of user and technical documentation. (Novotný, 2016a)
- A section on writing \LaTeX documents in Markdown was added to the `fithesis3` sample documents.
- The package was released under the \LaTeX Project Public License (LPPL) 1.3 on the Comprehensive \TeX Archive Network (CTAN), GitHub, and the faculty GitLab. (Novotný, 2016c) It is available in updated \TeX Live 2016.

Conclusion

Reception by the Community

- The syntax extensions were backported to Lunamark and merged by MacFarlane, resulting in a new minor version release of the library (0.5.0). (Novotný, 2016b)
- The package was featured on the twitter profile of Overleaf – a major online service for preparing \LaTeX documents – along with original example documents. (Overleaf, 2016)
- The package was reviewed in the bulletin of the German \TeX Users Group (DANTE e.V.). (Fenn, 2016, pp. 43)
- An article about the package has been accepted for publication in the bulletin of the Czechoslovak \TeX Users Group (CSTUG).

Section 4

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