

# L<sup>A</sup>T<sub>E</sub>X: The Bare Minimum

Paul E. Johnson<sup>1</sup> <sup>2</sup>

<sup>1</sup>Department of Political Science

<sup>2</sup>Center for Research Methods and Data Analysis, University of Kansas

2016

# Outline

1 Why?

2 Structure of a L<sup>A</sup>T<sub>E</sub>X Document

# Outline

1 Why?

2 Structure of a L<sup>A</sup>T<sub>E</sub>X Document

# MS Word is Finger Painting

- It is easier to write a letter to Mom with Word, more difficult to produce a systematic, uniformly formatted documents.
- Too easy to accidentally “reformat” particular pieces in inconsistent ways.
- Pasting imports inconsistent, hidden style & structure
- Equations are tedious, unpredictable when exported
- Non-reproducible documents.

# We've Lost the Separation of Content and Structure

- Word, and Word Perfect, were not always so GUI.
  - Text was created and marked by its style, and it stayed that way
  - Reformatting was done by revising the style sheet
    - Example: if you want to change all italicized words to bold italics, change the style, not the document
- The separation of “content” from “format” was possible, as late as 1992 (or so).

# The T<sub>E</sub>X Idea

- Donald Knuth, Stanford professor, developed T<sub>E</sub>X
- Stated objective: let authors focus on the content of their words and equations
- Publisher standards for margins, indentation, table placement, etc, were wrapped up in “Style” or “Class” packages.
- L<sup>A</sup>T<sub>E</sub>X is the newer edition of T<sub>E</sub>X (both name files \*.tex)

## Brief Historical Detour

Original workflow was

L<sup>A</sup>T<sub>E</sub>X → DVI → Postscript

- 1 DVI: “device independent format”
- 2 A program named “latex” converted “\*.tex” → “\*.dvi”
- 3 One would view the dvi, much the same as one views PS or PDF today
- 4 Follow up programs convert: DVI → PS

- Today, English speakers more likely use “pdflatex” L<sup>A</sup>T<sub>E</sub>X → PDF
- New development focus in on incorporation of international character sets (XeT<sub>E</sub>X and LuaT<sub>E</sub>X)

## Different from MS Word?

- The \*.tex document is plain text (has no hidden fields, markup)
- Blank lines separate paragraphs, etc
- Can edit with any “flat text editor” program (Emacs, TexMaker or TexWorks or TexShop or TexStudio ...)
- Does not “absorb” graphics to make on giant \*.tex file. Rather, the \*.tex file refers to other files.
- Authors “compile” the document into PDF or HTML or ...
- Word can be used more systematically, but most users never bother to learn how



# Most L<sup>A</sup>T<sub>E</sub>X Projects Begin with a Template

- As we will see, a L<sup>A</sup>T<sub>E</sub>X document has some “boilerplate” that is required.
- Because that boilerplate is difficult to produce and use, most users find example documents that meet their requirements and they revise from there.
- The KU Dissertation Thesis Template project is in that vein, providing a working document.

# A L<sup>A</sup>T<sub>E</sub>X Distribution

- Distribution is a *bigish* collection of programs and format files
- Consider “MikT<sub>E</sub>X”, a large, free distribution of L<sup>A</sup>T<sub>E</sub>X software for MS Windows
- Look under MikT<sub>E</sub>X’s install, eg  
“C:\Program Files(x86)\MikT<sub>E</sub>X”
- Folder MikT<sub>E</sub>X/miktex/bin:  
executables (exe files)
  - Processors: latex, pdftex, dvips, xetex, tex4ht, oolatex
  - Viewers: yap (for dvi and ps)
  - Editors: T<sub>E</sub>Xworks
- Folder “tex” is collection of packages.
- Look under tex/latex, one folder per addon package

# Extensible: The Good and the Bad

- CTAN: Comprehensive T<sub>E</sub>X Archive Network: 1000s of packages
  - There is no “corporate regulation” of the L<sup>A</sup>T<sub>E</sub>X “thing”. New compilers, packages, scripts, pop up all the time.
- **The Good:**
  - Packages for many specific purposes
  - Scholars/Universities/companies/journals can create customized document styles
  - Example: Beamer L<sup>A</sup>T<sub>E</sub>X framework (this document)
- **The Bad:**
  - Some packages don't work, are not up-to-date
  - User documents are “broken” by slapping together contradictory packages.
  - Some obvious features unavailable (nobody pays package developer).

# Outline

1 Why?

2 Structure of a L<sup>A</sup>T<sub>E</sub>X Document

# Simplest Possible LaTeX Document

- Beginning:
  - a document declaration
  - “Preamble”
- Middle:
  - content!
- End:

```
\documentclass{article}
%%1. This is the boiler-plate part, a preamble
%%Usually there will be many lines with \usepackage
{}
\makeatletter
\makeatother

%%2. middle
\begin{document}
\author{Paul Johnson}
\date{January 16, 2008}
\title{Very Short Document in \LaTeX{}}
\maketitle
Here's the smallest \LaTeX{} document I can provide
.

Type any crap you want here.
Use blank lines to separate paragraphs.
Test some math  $\pi R^2$ 
%%3.ending
\end{document}
```

# Macros, Environments, etc

- Comments prefixed by %
- A L<sup>A</sup>T<sub>E</sub>X Macro: `backslash-argument{content}`: `\author{Paul Johnson}`
- An environment is text bracketed by “begin” and “end” statements

```
\begin{frame}
\frametitle{Macros, Environments, etc}
\begin{itemize}
\item Comments prefixed by \%
\item A \LaTeX{} Macro: backslash-argument{content}: \author{\{
    Paul Johnson\}
\item An environment is text bracketed by “begin” and “end”
    statements
\end{itemize}
\end{frame}
```

# Save That, Compile it

- In the terminal, the user runs “`pdflatex example.tex`”
  - `latex`  $\implies$  `pdf`
- Looks like this, if you can see the input & output.

```
$ pdflatex example.tex
This is pdfTeX, Version 3.14159265-2.6-1.40.15 (TeX Live 2014/
  Debian) (preloaded format=pdflatex)
  restricted \write18 enabled.
entering extended mode
(./example.tex
LaTeX2e <2014/05/01>
Babel <3.9k> and hyphenation patterns for 4 languages loaded.
(/usr/share/texlive/texmf-dist/tex/latex/base/article.cls
Document Class: article 2007/10/19 v1.4h Standard LaTeX document
  class
(/usr/share/texlive/texmf-dist/tex/latex/base/size10.clo))
No file example.aux.
[1{/var/lib/texmf/fonts/map/pdftex/updmap/pdftex.map}] (./
  example.aux) </usr/s
hare/texlive/texmf-dist/fonts/type1/public/amsfonts/cm/cmami10.
  pfb></usr/share/t
```

## Save That, Compile it ...

```

exlive/texmf-dist/fonts/type1/public/amsfonts/cm/cmmt7.pfb></usr
/share/texlive/
texmf-dist/fonts/type1/public/amsfonts/cm/cmmt10.pfb></usr/share/
texlive/texmf-d
ist/fonts/type1/public/amsfonts/cm/cmmt12.pfb></usr/share/texlive
/texmf-dist/fon
ts/type1/public/amsfonts/cm/cmmt17.pfb></usr/share/texlive/texmf-
dist/fonts/type
1/public/amsfonts/cm/cmmt7.pfb>
Output written on example.pdf (1 page, 60271 bytes).
Transcript written on example.log.
```

- Running `pdflatex` produces several intermediate files:

```

-rw-rw-r-- 1      8 2015-04-17 13:39 example.aux
-rw-rw-r-- 1  3319 2015-04-17 13:39 example.log
-rw-r--r-- 1 60271 2015-04-17 13:39 example.pdf
```

- A more complicated document may require repeated runs of “`pdflatex`” and “`bibtex`” to make all of the separate pieces work together.
- To avoid manually running those separate bits, many people use a convenience scripts like “`texi2pdf`”



# Editors to Facilitate LaTeX Work

- TexShop, TextMate for Macintosh
- Multiplatform General Purpose Editors
  - Emacs (The editor of the gods) with “AucT<sub>E</sub>X” mode
  - Eclipse (a programming IDE)
- L<sup>A</sup>T<sub>E</sub>X Specific
  - TexMaker (I like that one)
  - TexStudio
- Windows
  - T<sub>E</sub>XWorks (delivered with MikT<sub>E</sub>X)

## Gotchas:

- Assumes user has medium/deep understanding of computer
- Editing: Lots of “boilerplate” details
- Preamble has `\usepackage{}` statement for each package
  - Each macro or environment comes from some package
  - Users must learn how to install packages (hassle...)

# Software to Facilitate Producing LaTeX Documents

- LyX (Open Source, Multiplatform): can export to LaTeX
  - a “document processor” with some point-and-click features
  - Allows to write “real LaTeX” as well inside LyX document
  - Version 2 introduced the “on the fly” spell-checking
- Scientific Word (Commercial, MS Windows)- A MS Word look-alike that can create LaTeX documents
- T<sub>E</sub>XMac<sub>s</sub> (Open Source) Similar in concept to LyX, developed by a smaller team of programmers

Generally, these provide

- Document “templates”, pre-formatted examples that work
- Facilitators for entry of formulae and special formatting
- I often use LyX, and export documents to LaTeX format.

## When Do I Edit with Emacs, not LyX?

- Some document types—multiple choice exams—have specialized  $\LaTeX$  classes for which LyX has no “customization” or “layout”
- My co-author is a  $\LaTeX$  writer who has invested years to learn how that works and refuses to try LyX
- LyX has a bug that I can't work around.
- LyX upgrades and I don't like their “enhancements” as much as raw  $\LaTeX$ .

## Raw TeX Exercise: Compile My Terminal-1 lecture

- Edit and Compile a L<sup>A</sup>T<sub>E</sub>X file. In my Guides repository, look for the folder `Computing_HOWTO/IntroTerminal-1`. Find the file `terminal-1.tex`.
  - Make a directory in your computer
  - Download `terminal-1.tex` and `beamerthemeKU.sty` in there.
  - You also need to copy the sub-directory `importfigs`. Those graphics were recently added to beautify this.
- Figure out how to open and compile the document.
  - Open a terminal, run `pdflatex terminal-1.tex`, for example.
- Because that file has a table of contents, it is necessary to run `pdflatex` twice
  - If your computer has a copy of the program `texi2pdf`, use that instead, it will run `pdflatex` as many times as necessary.

## What to do next? Followup Presentations Needed

- This will become the organizing location of L<sup>A</sup>T<sub>E</sub>X support documents. <http://crmda.ku.edu/guides/latex-help>
- In the past, and probably for a while, most of my L<sup>A</sup>T<sub>E</sub>X support material has been hosted at <http://pj.freefaculty.org/latex>
- Notes “LyX for Beginners”  
<http://pj.freefaculty.org/guides/Computing-HOWTO/LatexAndLyx/LyX-Beginner>
- Embarrassingly, I forgot I had written those notes and agreed to give a LyX presentation, so I made a new, possibly better version of the same (with a much more enticing title) “How to Cheat on Your L<sup>A</sup>T<sub>E</sub>X Homework”. This will be moved into the CRMDA guides soon.  
[http://pj.freefaculty.org/guides/Computing-HOWTO/LatexAndLyx/LyX-for\\_LaTeX\\_homework](http://pj.freefaculty.org/guides/Computing-HOWTO/LatexAndLyx/LyX-for_LaTeX_homework)

## What to do next? Followup Presentations Needed ...

- LyX-Intermediate!. You can monitor our progress here:  
<http://pj.freefaculty.org/guides/Computing-HOWTO/LatexAndLyx/LyX-Intermediate>
- KU Thesis class & example document  
<http://pj.freefaculty.org/guides/Computing-HOWTO/LatexAndLyx/KU-thesis>
- Developing your own LyX Template  
<http://pj.freefaculty.org/guides/Computing-HOWTO/LatexAndLyx/LyX-article-template>
- For “reproducible research” by the use of Sweave? Maybe knitr  
<http://pj.freefaculty.org/guides/Computing-HOWTO/LatexAndLyx/LyX-sweave-tutorial>

## What to do next? Followup Presentations Needed ...

- KUant guide templates
  - `http://pj.freefaculty.org/guides/Computing-HOWTO/LatexAndLyx/KUant_template`
  - `http://pj.freefaculty.org/guides/Computing-HOWTO/LatexAndLyx/KUant_template_sweave`