A Quick Introduction to LaTeX

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Outline

- Knuth, TEX and LATEX
- Comparisons with WYSIWY(D)G
- The structure of a document
- Modify the appearance of text
- Math mode
- Figures & Tables
- Citations
- Resources

Origins

- Knuth develops TEX in the early '80s
  - Current version is 3.14159
- Leslie Lamport writes a set of supporting macros in the mid-80's, called LATEX
  - Currently in version LATEX 2_ε, 3 coming "soon"
- LATEX is a *typesetter*
  - LATEX is not a text editor
  - LATEX is not a figure editor
  - LATEX is not a database
  - LATEX is not a spell checker
  - LATEX is not a display utility

Why Use LaTeX?

- Portability across machines, display devices, versions...
- Professional look of finished document
- Ease of typesetting math
- Sophisticated algorithms for word hyphenation, line breaking
- Encourages separation of content and presentation
- Price - initial purchase and support

Disadvantages

- Learning curve for using the more advanced features
- May have to use a variety of different tools
- Documents have to be *written* first, and then *compiled* - possibly multiple times
- May be viewed as a geek by other people

Document Structure

```
\documentclass[options]{class}

... preamble ...

\begin{document}

... contents of document

\end{document}
```

documentclass[option]{class}

- Defines the look of the document - page layout and organization
- predefined class files:
  - article
  - book
  - report
  - letter
  - others, provided by publisher
- options:
  - fontsize – 10pt, 12pt, etc
  - papersize – letter, legal, a4, a5, etc
  - page format – onecolumn, twocolumn
  - many more – oneside/twoside, openright/openany, leqno, fleqn, etc

preamble

- Add features, using commands or *packages*
- Packages can take options too:

  `\usepackage[option]{package}`
- Thousands of packages available! This presentation uses `color`, `geometry`, `pause`, `background`, `fancyhdr`, `skklist`...

document body

- Structure defined by documentclass: titlepage, abstract, sections, appendix, bibliography
- Sections can be part, chapter, section and can be nested - subsection, subsubsection, etc
- Change text attributes for small parts:
  - font size: tiny, small, ... , huge, Huge
  - font shape: **bold**, *italicized*, `typewriter`
  - indentation and justification: centered text, left-justified, right-justified, verse indentation, verbatim, etc.

document body (contd.)

- Various list environments available – simple lists, enumerated lists, descriptions
  - roll your own - like this one!
  - can be nested arbitrarily
  - can fine tune parameters e.g., `itemsep`, `leftmargin`, `rightmargin`, `listparindent`, `etc`

Math mode

- The *raison d'etre* of TEX
- Things are different in the math environment: `$ .. $` or `\begin{equation} ... \end{equation}`
- $\mathcal{AMS}$-LATEX from the American Mathematical Society
- Uses labelling/referencing scheme similar to the rest of TEX
- Intuitive – once you know how!

Math mode: example

▷

```
\begin{equation}\label{H-cycles}
 \biggl(\prod^n_{\,j=1}\hat x_j\biggr)H_c=
                \frac{1}{2}\hat k_{ij}\det
                \widehat{\mathbf{K}}(i|i),
\qquad i=1,\dots,n.
\end{equation}
```

▷

$$\left(\prod_{j=1}^{n}\hat{x}_j\right)H_c=\frac{1}{2}\hat{k}_{ij}\det\widehat{\mathbf{K}}(i|i),\qquad i=1,\dots,n. \tag{1}$$

Figure: example

```
\begin{figure}[ht]
\includegraphics[angle=-90,width=7.5cm]{circuit}
\caption{Delay-$C_{in}$ Calculation and Propagation
            Across Multiple Fanouts}
\label{fig:ckt}
\end{figure}
```

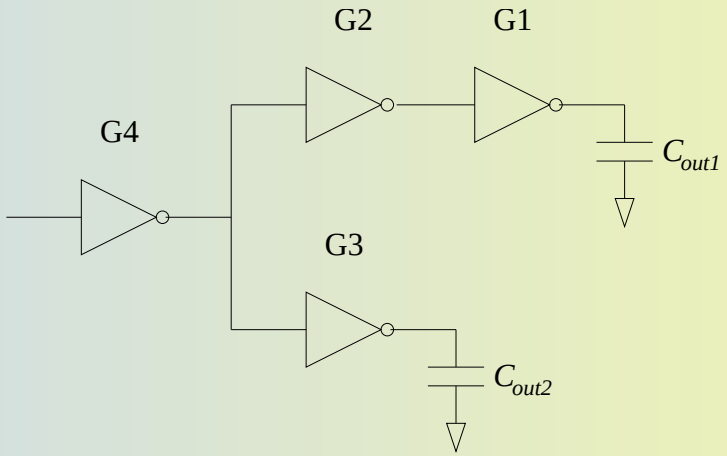

Figure 1: Delay-C_{in} Calculation and Propagation Across Multiple Fanouts

Figure

- I use `xfig` for drawing figures: vector drawing package that can export to different formats e.g., ps, eps, pdf, etc.
- Other options:
  - The `picture` environment
  - The `pstricks` package
  - Use commands such as

    ```
    \put(0, 0){\line(1, 0){6}}
    ```

    circles, ovals, curves, etc.

Table: example

Use the tabular environment, specify columns, rows, lines ...

```
\begin{tabular}{|l||c|c|c||c|c|c||c|} \hline
& \multicolumn{3}{|c||}{\texttt{Domino\_Map}}&
\multicolumn{3}{|c||}{\texttt{SOI\_Domino\_Map}}& \\ \cline{2-7}
\raisebox{1.5ex}[0pt]{Circuit} &$T_{logic}$&$T_{disch}$&$T_{total}$&
$T_{logic}$&$T_{disch}$&$T_{total}$&
\raisebox{1.5ex}[0pt]{$\Delta T_{disch}$}\\ \hline
f51m & 297 & 71 & 368 &309 & 31 & 340 &40 \\\hline
\end{tabular}
```

Circuit	Domino_Map			SOI_Domino_Map			ΔT_{disch}
	T_{logic}	T_{disch}	T_{total}	T_{logic}	T_{disch}	T_{total}	
f51m	297	71	368	309	31	340	40

Tables

- The one part of LaTeX that isn't too nice
- Needs plenty of tweaking, difficult to get right
- ... it helps to generate data using scripts

Using labels and references

- In most environments,

  `\label{labelname}`
- To refer to them,

  `\ref{labelname}`
- Automagically generates the correct number
- Maintains separate counters for different environments - tables, figures, sections, equations, etc.
- May need two compiles
- e.g. Figure 1 and Equation 1 obtained via

```
Figure \ref{fig:ckt} and Equation \ref{H-cycles}
```

Bibliography and citations

Write a single bibligraphy file

- Standard Entries: article, inproceedings, book, thesis, etc.
- Standard Fields: author, title, pages, date, etc.
- e.g.

```
@book{a92,
title     = "The Hitchhiker's Guide to the Galaxy",
author    = "Douglas Adams",
publisher = "Balantine Books"
}
```

produces the entry

Douglas Adams. *The Hitchhiker's Guide to the Galaxy*. Balantine Books.

Bibliography and citations

- Specify bibligraphy style in the LaTeX file
- Use BibTeX to generate bibligraphy listings
- Use

  `\cite{label}`

  to refer to the cited material

Putting it all together....

- Write your source file `source.tex`
- Run LaTeX on it: `latex source.tex`
- If you have a bibliography, run BibTeX: `bibtex source`
- Re-run LaTeX to fix references: `latex source.tex`
- View the results: `xdvi source.dvi`
- ..... or convert to pdf or ps

Resources

- Books
  - H. Kopka and P. W. Daly. *A Guide to LaTeX 2ε*
  - M. Goosens, F. Mittelbach and A. Samarin. *The LaTeX Companion*
  - A variety of books and tutorials on TeX and LaTeX online
- Websites
  - TeX Users Group: `http://www.tug.org`
    FAQ, books, tutorials
  - The Comprehensive TeX Archive Network: `http://www.ctan.org`
    package archive
  - The LaTeX Project Home page: `http://www.latex-project.org`
    info on LaTeX3
- Usenet: `comp.text.tex`, and the deja-google archive