Introduction to LaTeX

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6 October 2008 / Introduction to LaTeX

Outline

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- TeX was begun by Donald Knuth in 1977 because he did not like the appearance of his book *The art of computer programming, volume 1* when the type was reset. The language was more or less frozen in 1989, though development continues until today.
- TeX and its derivatives are still widely used for scientific content that contains mathematical formulas. You will write your dissertation using TeX.
- Working with TeXwill give you some idea of how old folks worked with computers. Typically one writes a file using a text editor and compiles it by a command-line interface to produce high-quality typeset mathematics.

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Features

- TeX is freely available. It is included in most Linux distributions.
- TeX includes a family of fonts that are available in most implementations and thus the result is independent of the computer where the document is produced. (Try sending an M$ Word document to your parents and watch the fonts disappear.)
- TeX includes a hyphenation algorithm that is written in fixed-point arithmetic so that the result is independent of the machine architecture.
- TeX includes a programming language that allows one to automate tedious tasks at the expense of some tedious programming. We may let other people write packages in this language for us to use.

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- If you have a Linux Desktop, fire up a terminal and use pdflatex to compile and evince to view your document.
- The typical workflow for producing a document in LaTeX is to steal an example from someone else, edit in a text editor(not M$ Word), compile, preview the result, and repeat the edit, compile, preview cycle until done or tired.

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Writing documents in the 21st century.

- We should endeavour to encode the meaning, rather then the format.
- If this is done well, LaTeX will let us use one source document and produce a webpage (with latex2html) or a pdf (with pdflatex).
- One may produce a test and solutions from the same source file.
- When you are writing your dissertation and your advisor asks you change notation, you should be able to do this by redefining your macros rather than by searching for every instance of a bit of notation.

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LaTeXand friends

- LaTeXis a package that is written in TeX. LaTeX includes various constructs such as automatic numbering of equations, special macros for setting theorems, sections and chapters to automate the writing of longer documents.
- AMSLaTeX and AMSTeX are packages that include additional macros for setting mathematics. We will not discuss these today. I have never used AMSLaTeX and have not used AMSTeX for many years. I think I have a co-author who uses AMSTeX.
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LaTeX the basics

- One or more spaces will be collapsed to one space.
- One or more blank lines indicates a new paragraph.
- The characters `# $ % ^ _ { } \` and the tilde have special meanings in TeX.
- The character ~ is a special space in TeX. One may obtain this character using `$\sim$`.
- The general structure of a command or macro in LaTeX is `\commandname[option1,option2,...]{argument1}`
- Blocks of specially formatted text are called environments and have the structure `\begin{environmentname}... \{environmentname}`

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Mathematics in LaTeX

- A pair of $ signs or \(...\) delimits inline mathematics.
- Pairs of double $$ signs of \[...\] delimit displayed mathematics.
- Use a caret for superscripts. Example: `$ a^{xy}$` produces a^{xy}. Use an underscore _ for subscripts.
- Use `\frac 1 2` to obtain the fraction $\frac{1}{2}$.
- Almost any mathematical symbol you can imagine is available in LaTeX. Examples `\alpha` for α, `\int` for $\int$, `\cup` for $\cup$.

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Example

```
\documentclass[12pt]{article}
%%Read the manual for other options.

\pagestyle{empty} %%Eliminates page numbers
%%\input rmb_macros
%%Collect your favorite macros in a
%%separate file

%\input amssym.def
%\input amssym
%\input mssymb
%%Defines additional symbols
```

Example, continued

```
\usepackage{graphics}
%%Use to include pictures.

%\newcommand{\comment}[1]{}
%\newcommand{\sobolev}[2]{W^{#1,#2}}
%\newcommand{\sobolev}[2]{L^#2_#1}
%%Some examples of macros or new commands.

\textwidth 6in \oddsidemargin 0.25in
\topmargin-0.25in
\textheight 8.5in
%%Set margins, defaults are ok.
```

Example, continued

```
\begin{document}
\begin{flushleft}
%%Paragraphs will not be indented in this
%%environment
{MA 999}\hfill
%%\hfill forces following text
%%to right margin
{Name \rule {2 in}{0.01in}}\\
%%gives a line of length 2in and
%%thickness 0.01in
{Quiz 1}\hfill {\today}

\medskip
\end{flushleft}
```

Example, continued

```
\begin{enumerate}
%%Environment for ordered lists
\item  Find the value of the integrals
$$ \int _0 ^ 1 x\sin(x^2)\, dx ,
 \qquad \int _ 0 ^1 \sin(x)\cos(x)\,dx.
%%\qquad and \, for spacing
$$

\vfill
%%Divides page evenly.
```

Example, continued

```
\item
A matrix  with mis-matched delimiters
and peculiar alignment
$\left(\begin{array}{rcl}
1 & 2 & 44 \\
321 & 22 &111 \end{array}
\right|$.
%%r c or l gives right, center or left
%%alignment in each column
%%In practice, use either r or c in every
%%column
\vfill
```

Example, continued

```
\item Some derivatives ${\displaystyle
\frac {df}{dx} = f'(x)}$.
%%\displaystyle forces larger typesize.
\vfill
\item Find the limit,
\[ \lim_{x\rightarrow\infty}
( \sqrt[3]{x^3+2x}-x)\]
\vfill
\end{enumerate}
\end{document}
```

Some no-no's

- Use \|, not ||.
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- Don't obsess over details.

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References

- Wikibooks, LaTeX, http://en.wikibooks.org/wiki/LaTeX
- Wikipedia, LaTeX, `http://en.wikipedia.org/wiki/LaTeX`
- *LaTeX: A Document Preparation System, 2nd edition*, Leslie Lamport, Addison-Wesley.
- Center for the Study of LaTeX Information System (CSLIS), `http://www.cslis.org/templates`. For the example from this talk and a few other templates.
- A short introduction to TeX `http://www.math.umn.edu/~garrett/shortest/tex.txt`

Assignment

- Write a quiz for the class you are teaching and on a separate sheet, give a brief statement of what you are trying to evaluate. Have a colleague criticize your quiz and objectives for readability, and appropriateness of the questions.
- Work on your resumé. You don't want to be here forever.

¿Questions?

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