Short Intro to LaTeX

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Goals:

- Introduce LaTeX
- ... so you can read/edit LaTeX source
- ... and use manual as reference rather than reading it

Outline:

1. A brief history of LaTeX
2. LaTeX commands and files
3. Structure of a LaTeX document
4. Special characters
5. Defining Macros
6. Environments and some common LaTeX commands
7. Math typesetting
8. Counters, labels, citations, and cross references
   ... but little on BibTeX or pictures

Why use LaTeX?

- Latex is a typesetting system that is especially good for typesetting mathematics.
- Customizable in many ways, and many publishers of journals or conference proceedings have their own LaTeXstyles.
- Many useful packages for preparing talks, letters, etc. etc.
- Powerful macro, cross referencing, and bibliography features
- "*The standard*" and in public domain

LaTeX History

- Knuth (Turing Award, National Medal of Sciences, etc.) writing *The Art of Computer Programming* (series of 9? volumes) but bothered by typesetting
- Designed TeX for typesetting and mathematics, and MetaFont for fonts (mid 1970's)
- In early 1980's popular LaTeX 2.09 macro package for TeX introduced by Lamport separates out typography (how it looks) from content via predefined class or style files
- LaTeX re-implemented as LaTeX 2ε in 1993 and unifies many extensions to LaTeX
- Many packages available for doing many different things in LaTeX2ε

Commands and Files

Unix Commands:

```
>  latex file.tex        runs latex, creates .dvi
>  xdvi file.dvi         previewer
>  dvips file.dvi        creates .ps
>  pdflatex file.tex     creates .pdf directly
>  bibtex file           only if bibliography needed
```

- `file.tex` is your source LaTeX document
- `file.aux` is created and read by LaTeX for cross references, etc. (and used by bibtex)
- `file.dvi` is the "device independent output" produced by LaTeX, this can be converted into postscript or other stuff (pdflatex produces pdf directly)
- `file.log` the log file created by LaTeX

- `bibfile.bib` a file of bibliography entries (created by you or group)
- `file.bbl` and `file.blg` are created by BibTeX, `file.bbl` is read by LaTeX to create bibliography, `file.blg` is the bibliography log file.

Structure of a LaTeX document

```
\documentclass[12pt]{article} % or book, theses, etc.

% this part is the preamble
% incorporate package or define macros here
\usepackage{color}
\usepackage{graphicx}
% some styles have you setting the title and author
% here and using a \maketitle below

\begin{document}

% this part is the body - stuff to be printed
% it can \include or \input other .tex files

\end{document}
```

Special Characters

- % comment character
- \ macro command
- # macro parameter
- some dinosaurs use $ ... $ or $$ ... $$ to enter/leave math mode, but \(... \) or \[... \] is better
- & column character
- ~ unbreakable space
- _ subscript (in math mode)
- ^ superscript (in math mode)
- { and } grouping/scoping symbols
- some others: @, and "quotes" vs "quotes", <> give ¡¿, blank line or \par means new paragraph, otherwise multiple whitespace collapsed to space

Can usually get these special characters with backslash prefix, like `\{` prints as {

Can also use a verbatim command: `\verb+\+` prints as \

Note `\\` forces a new line in the output (use `\backslash`)
some like `\~` have special meaning (`ni\~na` gives "niña")

Macros

Very useful for shorthand and notation

Definition:

```
\newcommand{\macroname}{meaning}
\newcommand{\macroname}[numparams]{meaning}
```

Macros can take arguments:

```
\newcommand{\norm}[1]{|| #1 ||_{2}}
\newcommand{\anynorm}[2]{|| #1 ||_{#2}}
```

now `\( \norm{xy} \)` prints as $||xy||_2$ and
`\( \anynorm{x}{\infty} \)` prints as $||x||_\infty$ (note math mode)

More on macros

`\renewcommand` like `\newcommand` for re-defining macros (plain TEX uses a `\def` command)

Macro names containing `\@` are usually class/package internal

Use `\mbox{ }` to ensure in paragraph mode (rather than math mode)

Macro name "eats" the trailing spaces:
`\newcommand{\from}{from}` causes
"`\from one to five`" to print as "fromone to five"

but "`{\from} one to five`" prints as "from one to five"

With `\newcommand{\froms}[1]{from #1}`
"`\froms{sea} to shining sea`" prints as
"from sea to shining sea"

Standard environments

Usage:

```
\begin{env-name}
stuff
\end{env-name}
```

env-name can be: document, centering, quote, verbatim, itemize, enumerate, tabular, tabbing, etc.

itemize, enumerate use `\item` commands to start items

Example:

```
\begin{enumerate}
\item  first item
\item and another
\end{enumerate}
```

1. first item
2. and another

Builtin Macros

use	to get	comments
`a \emph{text} b`	a *text* b	can nest
`\textbf{text}`	**text**	`\textit` `\texttt` etc
`{\normalsize text}`	text	
`{\Huge text}`	text	many sizes
`a\hspace{0.2in}b`	a b	
`\"o{o}`	ö	`\'` `\‘` `\.` `\~` etc

Other useful commands:

`\section` `\subsection` `\subsubsection` `\paragraph` `\chapter`

`\newpage` `\hspace{15pt}` `\vspace{2ex}` `\hfill` `\vfill`

`*` versions of commands

Typesetting Math

Use `\( ... \)` for in-line and `\[ ... \]` for displayed math

Spaces ignored, operator/relation spacing automatic :
`\( 3 a+c =2\)` is $3a + c = 2$

use `\mbox{}` for words inside math, compare:
"$caffeine = 100mg \times shots$" "caffeine $= 100$mg $\times$ shots"

example input	produces
`x_i \leq \sqrt{10}`	$x_i \leq \sqrt{10}$
`2 {x \choose 3}`	$2\binom{x}{3}$
`\sum_{i=1}^{10} i^{2}`	$\sum_{i=1}^{10} i^2$
`\frac{\gamma}{\lambda+\frac{1}{2}}`	$\frac{\gamma}{\lambda + \frac{1}{2}}$

Some Predefined Commands

like `\sum` are: `\prod` `\int`

elipses: `\cdots` `\ldots`

symbols: `\forall` `\exists` `\infty` `\emptyset` `\Re`

relations: `\geq` `\leq` `=` `\neq` `\subset` `\in` `\approx`
often used with `\not`

functions: `\log` `\ln` `\min` `\sin` `\cos` `\lim` `\gcd`

accents: `\tilde{a}` `\hat{a}` `a'` get $\tilde{a}$ $\hat{a}$ a'

lots of arrows, etc.

Fancy Example

Uses `\left \right` for delimiters and array environment for alignment (use tabular environment in text)

```
\[
f(n,k) = \left\{ \begin{array}{ll}
                    n-k^2      & \mbox{if \(n>0\)} \\
                    0          & \mbox{otherwise}
                    \end{array}
          \right.
\]
```

$$f(n,k) = \begin{cases} n-k^2 & \text{if } n>0 \\ 0 & \text{otherwise} \end{cases}$$

`\begin{equation} \end{equation}` produces numbered equation, `eqnarray` gives 3-column alignment

```
\begin{eqnarray}
3ab  &=& 9a^2 \\
  b    &=& 3a
\end{eqnarray}
```

$$3ab = 9a^2 \tag{1}$$
$$b = 3a \tag{2}$$

star forms (e.g. `\begin{eqnarray*}`) suppress numbering

Figure 1: A Rock

Cross Referencing

Enumerate, figure (caption), theorem, equation environments generate numbers. Access with `\label` and `\ref`

```
\begin{figure}
\begin{center}
\resizebox{1.0in}{!}{\includegraphics{ROCK.jpg}}
\end{center}
\caption{A Rock}
\label{f:rock}
\end{figure}

In Figure~\ref{f:rock} we see a rock.
```

In Figure 1 we see a rock.

Bibliography

Use `\bibliographystyle{plain}` and `\bibliography{mybib}` commands (usually at end of file) after making a `mybib.bib` file with references (See BibTex sections of manuals for more info)

Then in document you can use `\cite{key}` to cite the paper associated with `key` in `mybib.bib`

Bibliography and numbers generated automatically by bibtex program

Run bibtex, and then run LaTeX twice

References

- "The Not So Short Introduction to LATEX 2e" and other guides, see:
  `http://www.latex-project.org/guides/`
- *LaTeX Users Guide and Reference Manual* by Leslie Lamport
- *The LaTeX Companion* by Goossens, Mittelbach, Samarin
- google "Latex documentation"
- This document prepared using Doug Nychka's LaTeX template (8/13/2004).