

L^AT_EX

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TEX and L^ATEX

- TEX is a typesetting system written by Don Knuth at Stanford
 - * A check from Knuth is a rarely bestowed badge of honor
 - “If you do succeed in finding a previously undiscovered bug in the programs for either TeX or METAFONT, I shall gladly pay you a reward of \$327.68”
 - * He invented the concept of Literate Programming
 - * His books “The Art of Computer Programming” are the computer science equivalent of Feller Volume 1-2
- Leslie Lamport in 1985 took TEX and wrote a series of macros called L^ATEX

L^AT_EX getting started

- There are introductions to L^AT_EX at www.latex-project.org
- Use `Auctex` add-ons to emacs' latex-mode (at GNU)
- Winedit has modes for L^AT_EX if you don't like emacs
- L^AT_EX is a typesetting program, like html and unlike Word
- A text file, usually named *.tex, contains all of the instructions for marking up the document
- After running L^AT_EX you will have a .dvi file (as well as other files) that you can view
- L^AT_EX has a steep learning curve, but after you learn it, you will find it was well worth the effort

A really short \LaTeX document

```
\documentclass{article}

\title{My First \LaTeX Document}
\author{Father Guido Sarduchi}

\begin{document}
\maketitle
\LaTeX, it's all downhill from here
\end{document}
```

- Save this file in test.tex
- In emacs/Auctex type C-c C-c latex
- Otherwise at the DOS, Unix or Linux prompt type
latex test.tex

Then what?

- If you're lucky this will produce a document called `test.dvi`
- Errors are found in the `test.log` file
- You can view the log file with `C-c C-l` in emacs/Auctex
- Open `test.dvi` with
 1. `C-c C-c view` in emacs/Auctex
 2. Command line use `xdvi test.dvi` in Linux/Unix
 3. `yap test.dvi` in Windows (or double-click your way to victory)
- If you want a postscript file
 1. `C-c C-c file` in emacs/Auctex,
 2. `dvips test.dvi -o` at DOS, Unix or Linux prompt

My First \LaTeX Document

Father Guido Sarducci

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\LaTeX , it's all downhill from here

The preamble

- Document classes: article, report, book, letter, seminar
- `documentclass` takes optional arguments
- point size: 10pt, 11pt or 12pt

```
\documentclass[12pt]{article}
```

- Everything from the `documentclass` statement until the `begin{document}` statement is called the preamble
- The preamble controls the document format
- By the way, a % sign is a comment in a \LaTeX document
- All commands begin with a backslash \

More preamble madness

In the preamble you can

- Load packages, I often load

```
\usepackage{amsmath, amsymb}
```

- Define new commands

```
\newcommand{\bone}{\bf 1}
```

- Redefine already defined commands

```
\renewcommand{\baselinestretch}{1.5}
```

- Give your article a title, author, date

Sectioning commands

```
\documentclass{article}
```

```
\begin{document}
```

```
\section{A section heading}
```

```
\section*{A section heading, no number}
```

```
\subsection{A subsection}
```

```
\label{mysub}
```

```
\subsubsection{A sub-subsection}
```

we can reference sections, like

Subsection `\ref{mysub}`, provided

we labeled them and ran `\LaTeX` twice

```
\end{document}
```

1 A section heading

A section heading, no number

1.1 A subsection

1.1.1 A sub-subsection

we can reference sections, like Subsection 1.1, provided we labeled them and ran `\TeXtwice`

Tips

- Some symbols are reserved by \LaTeX

`& $ % ^ { } _ \ ~`

- `\LaTeX` produces \LaTeX , which is pretty much only useful if you're writing a document about \LaTeX
- \LaTeX is a markup language (like html) and so doesn't care much about white space. (Think of your \LaTeX document as a program, not a Word document.)

Why a space here,
and here

what about here

- Produces

Why a space here, and here
what about here

LATEX commands

- Commands can work in different ways
- There's more than one way to do it

```
A {\bf bold} word \\
```

```
An {\it italicized} word \\
```

```
A \textbf{bold} word \\
```

```
An \textit{italicized} word \\
```

- Produces

A bold word

An italicized word

A bold word

An italicized word

Environments

- \LaTeX has many different environments
- Every environment begins with a `begin` and ends with an `end`
- Eg the quote environment

```
\begin{quote}
this stuff will all appear
offset as a quote
\end{quote}
```

 this stuff will all appear offset as a quote

- The equation environment

```
\begin{equation}
x^2 = 5y + 6z^3
\end{equation}
```

$$x^2 = 5y + 6z^3 \tag{1}$$

Letter sizes

```
\tiny tiny  
\scriptsize scriptsize  
\footnotesize footnotesize  
\small small  
\normalsize normalsize  
\large large  
\Large Large  
\LARGE LARGE  
\huge huge  
\Huge Huge
```

tiny scriptsize footnotesize small normalsize large Large LARGE huge Huge

Getting Mathish

- \LaTeX is really good at typesetting math equations
- Enclose inline math equations with $\$$ or $\langle \dots \rangle$

A really fancy equation
is $\$a^2 + b^2 = c^2\$,$ another is
 $\langle f = ma \rangle$

- produces

A really fancy equation is $a^2 + b^2 = c^2,$ another is $f = ma$

Displayed math

- Display math mode is obtained by `$$` or `\[... \]`
- Centers and offsets the equation, but does not number it

A really fancy equation
is `$$ a^2 + b^2 = c^2 $$` another
is `\[f = ma \]`

produces

A really fancy equation is

$$a^2 + b^2 = c^2$$

another is

$$f = ma$$

Numbered equations

- You can number and refer back to equations

blah, blah, blah

```
\begin{equation}
```

```
\label{eq:geo}
```

```
\sum_{i=0}^{\infty} p^i = 1 / (1 - p) .
```

```
\end{equation}
```

In Equation `\ref{eq:geo}` which is
the same as `\eqref{eq:geo}`

- Produces

blah, blah, blah

$$\sum_{i=0}^{\infty} p^i = 1/(1 - p). \quad (2)$$

In Equation 2 which is the same as (2)

- Have to \LaTeX twice and load `amsmath` to use `eqref`

Systems of equations

- **Load** `amsmath`

- **Use** `eqnarray`

```
\begin{eqnarray*}
f(y|x)f(x) & = & f(y, x) \\
& = & f(x|y)f(y) \\
& = & 4
\end{eqnarray*}
```

- **Produces**

$$\begin{aligned} f(y|x)f(x) &= f(y, x) \\ &= f(x|y)f(y) \\ &= 4 \end{aligned}$$

Matrices

- To get a 2×2 matrix

```
$$  
\left (  
\begin{array}{cc}  
a & b \\ c & d \\ \end{array}  
\end{array}  
\right )  
= 5  
$$
```

- Produces

$$\begin{pmatrix} a & b \\ c & d \end{pmatrix} = 5$$

Input

Scripts $x_1, x^2, x_{1^2}, x_{12}$ \\

Integral $\int_0^1 f(x) dx$ \\

Sum $\sum_i i^2$ \\

Prod $\prod_i \pi_i$ \\

Greek σ Σ \\

Bold Greek $\mathbf{\Sigma}$ \\

Bar/Hat \bar{x} and $\hat{\theta}$ \\

Fraction $\frac{x}{y}$ \\

SQRT $\sqrt{b^2 - 4ac}$

output

Scripts x_1, x^2, x_1^2, x_{12}

Integral $\int_0^1 f(x)dx$

Sum $\sum_i i^2$

Prod $\prod_i \pi_i$

Greek $\sigma\Sigma$

Bold Greek Σ

Bar/Hat \bar{x} and $\hat{\theta}$

Fraction $\frac{x}{y}$

SQRT $\sqrt{b^2 - 4ac}$

Tables

```
\begin{tabular}{|l|cc|}  
\hline  
Time & 1 & 2 \\ \hline  
      & 3 & 4 \\  
      & 5 & 6 \\ \hline  
\end{tabular}
```

Produces

Time	1	2
	3	4
	5	6

Lists

```
\begin{list}{\bullet}{}  
\item My first item  
\item My Second item  
\end{list}
```

Which produces

- My first item
- My Second item

Enumerate

```
\begin{enumerate}  
\item Enumerate  
\item is useful too  
\end{enumerate}
```

Produces

1. Enumerate
2. is useful too

Bibtex

```
\documentclass{article}
\usepackage{natbib}

\begin{document}
In his seminal work,
\cite{bozo:2003} showed that
the Reiman Zeta conjecture
\citep[see][among others.]{bozo:2003}

\bibliographystyle{apalike}
\bibliography{database.bib}

\end{document}
```

.bib file

In database.bib

```
@Article{bozo:2003,  
  author = {Bozo, C and Jingles, C and  
           Sasquatch, S},  
  title = {On the Reiman Zeta Conjecture},  
  journal = {Annals of Statistics},  
  year = {2003},  
  volume = {45},  
  pages = {1--200}  
}
```

In his seminal work, Bozo et al. (2003) showed that the Reiman Zeta conjecture (see Bozo et al., 2003, among others.)

References

Bozo, C., Jingles, C., and Sasquatch, S. (2003). On the reiman zeta conjecture. *Annals of Statistics*, 45:1–200.

Getting it to work

- Have to \LaTeX , BibTeX, \LaTeX , \LaTeX
- Type `bibtex` at the command line
- Or use `C-c C-c bibtex` in emacs/Auctex
- Can get BibTeX entries directly off of CIS
- Auctex has several utilities for editing `.bib` files
- `apalike` is only one bibliography style for author parentheses

Importing graphics

- The package `graphicx` can be used to include postscript graphics into text
- You can shrink or magnify the graphic
- The following loads `file.ps` and forces the height of the figure to be 4 inches

```
\begin{center}  
\includegraphics[height=4in]{file.ps}  
\end{center}
```

Defining new commands

- Use the `newcommand` command

```
\newcommand{\bone}{\{\bf 1\}}  
$\bone' (X'X)^{-1} X' y$
```

Produces $\mathbf{1}'(X'X)^{-1}X'y$

- Can take arguments

```
\newcommand{\seq}[1]{%  
\{\#1_i\}_{i=1}^{\infty}}  
$\seq{x}$ then $\seq{y}$
```

Produces $\{x_i\}_{i=1}^{\infty}$ then $\{y_i\}_{i=1}^{\infty}$

- Put all of your `newcommand` statements in the preamble or in a separate file. (load separate files with `input`)

Getting a pdf document

- `dvipdf myfile.dvi`
- You can also convert ps to pdf `ps2pdf myfile.ps` (and pdf to ps `pdf2ps myfile.pdf`)
- Another solution is to use `pdflatex`
 - ▶ Instead of typing `latex myfile.tex` type `pdflatex myfile.tex`
 - ▶ In Auctex type `C-c C-c latex pdf`
 - ▶ Produces a pdf file instead of a dvi file
 - ▶ When importing graphics, import pdf files instead of ps files!

Color

- Use the `color` package part of the `graphics` bundle

```
\usepackage[usenames]{color}
```

```
{\color{red} This text is red} while  
\textcolor{blue}{This text is blue}  
it works for  $\{\color{red} \lambda\}$   
symbols too
```

- **This text is red** while **This text is blue** it works for λ symbols too
- Defining some new commands is helpful

Defining new colors

- Example commands

```
\definecolor{light-blue}{rgb}{.8,.85,1}
```

```
\definecolor{mgrey}{gray}{.75}
```

```
{\color{light-blue} light-blue, no good}
```

```
{\color{mgrey} medium grey, no good}
```

- light-blue, no good medium grey, no good
- Often, colors don't appear in your dvi file, but they do in your ps or pdf file

Some concluding remarks about \LaTeX

- It is impossible to cover all of \LaTeX in two classes
- Try the web site to get documentation for some of the packages
- Some of the ones I like are:
 - ▶ the `geometry` package for setting page margins
 - ▶ the `pstricks` package for drawing within a \LaTeX document
 - ▶ the `psfrag` package for adding \LaTeX symbols to an externally loaded ps file
 - ▶ the `graphics` packages