

# 2007 CSGSA Refresher Series

## So, You Still Haven't Learned LaTeX Yet

Mark Crowley

13th September 2007

# By the end of this talk...

- You should understand the basics of how  $\text{\LaTeX}$  works
- how to start using it
- and why you should.

But first, a question

What is your *favourite* word processor?

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What is your *favourite* word processor?

# Outline

- 1 The Basics
  - Background and History
  - Document Structure
  - Text Formatting
  - References
- 2 Environments and Math
  - Figures
  - Tables
  - Theorem Environment
  - Basic Math Notation
- 3 And Much Much More
  - Bibliographies
  - You Are Here
  - Tips, Tricks and Tools

# L<sup>A</sup>T<sub>E</sub>X – What? When? Who?

- a universal document generation system
- created by Leslie Lamport in 1984, based on earlier *Tex*
- markup language, like HTML, with CSS, on steroids
- typeset papers, thesis', books, presentations
- highly customizable, can be programmed and it needs to be compiled
- very powerful support for math, citations, figures, tables and keeping track of them all



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# L<sup>A</sup>T<sub>E</sub>X – Why? (or “what’s wrong with Word?”)

- **Have you ever *used* Word?**
- Focus on content - L<sup>A</sup>T<sub>E</sub>X handles making it look good (*i.e.* don't reinvent the wheel)
- Easy to create standards using style packages
- No spell check, version control, calendar, instant messaging, or helpful talking paperclips (this is a *good* thing)
- Open, regular format that is human readable compiles to postscript or pdf
  - many L<sup>A</sup>T<sub>E</sub>X-aware tools spellchecking, conversion to HTML, ...
- Because we're programmers, we love compiling things

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# The $\text{\LaTeX}$ Philosophy: Say it direct and simple

Buttons and widgets are replaced with simple, usually intuitive, commands:

**footnotes** `\footnote{Text of footnote}`

`sections` `\section{Introduction}`

`references` `\ref{name of figure}`

`table of contents` `\tableofcontents`

`citations` `\cite{turing45}`

`math` `\sum` `\prod` `\pi` `\epsilon`

`text` `\large{big word}` `\emph{italic text}` `{\bf bold text}` ...

`tables` `\begin{table}[c|c|c]\hline col1 & col2 & col3`  
`\end{table}`

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`\end{table}`

# The Bare Necessities - Starting Template

Lets go back a step, you start with this:

```
\documentclass[10pt]{article}
\usepackage{graphicx}
\usepackage{times}
\title{A Proof that  $P=NP$ }
\author{Z. Brainiac}
\date{\today{}}
\begin{document}
\maketitle
% Place your text here
I can't wait to compile this!
\end{document}
```

# Compiling

Two main approaches:

- 1 Postscript -
  - `latex mydoc.tex` → `mydoc.dvi`
  - errors – “badness 10000”
  - `dvips -o mydoc.ps mydoc.dvi` → `mydoc.ps`
  - `ps2pdf mydoc.ps` → `mydoc.pdf`
- 2 PDF -
  - `pdflatex mydoc.tex` → `mydoc.pdf`
  - errors – “badness 10000”

# Simple Creation of Headings

## A Proof that $P=NP$

Z. Brainiac

September 13, 2007

### Abstract

We will outline a proof that  $P = NP$  by substituting the usual walk tojl bookjs mont ahat

## 1 Background

### 1.1 Early Work

#### 1.1.1 Failures

## 2 Proof Outline

### Definitions

```
\title{A Proof that P=NP}
\author{Z. Brainiac}
\date{\today{}}
\begin{document}
\maketitle
\abstract{We will outline a
proof ... }
\section{Background}
\subsection{Early Work}
\subsubsection{Failures}
\section{Proof Outline}
\subsection*{Definitions}
```

# Lists

## • Bulleted Lists

- something
- something else
- and another thing

```
\begin{itemize}
  \item Bulleted Lists
  \begin{itemize}
    \item something
    \item something else
    \item and another thing
  \end{itemize}
\end{itemize}
```

## 1. Enumerated List

- (a) first thing
- (b) penultimate thing
  - first sub-thing
  - second sub-thing
- (c) last thing

```
\end{itemize}
\begin{enumerate}
  \item Enumerated List
  \begin{enumerate}
    \item first thing
    \item penultimate thing
    \begin{itemize}
      \item first sub-thing
```



# Descriptions

**first** Lorum ipsum fredo

**second** In ultrices porta lacus. Sed urna felis, consequat ut, interdum sit amet, aliquet tincidunt, sapien.

**third** In at felis. In fermentum libero eget elit. In aliquet magna vel diam. Suspendisse fringilla.

```
\begin{description}  
  \item[first] Lorum ipsum fredo  
  \item[second] In ultrices porta ...  
  \item[third] In at felis. ...  
\end{description}
```

# Type faces

	Text Mode	Math Mode
<i>Emphasized</i>	<code>\emph{ ... } or { \em ... }</code>	
Typewriter	<code>\texttt{ ... } or { \tt ... }</code>	<code>\mathtt{ ... }</code>
<b>Bold</b>	<code>\textbf{ ... } or { \bf ... }</code>	<code>\mathbf{ ... }</code>
Roman	<code>\textrm{ ... } or { \rm ... }</code>	<code>\mathrm{ ... }</code>
<i>Italicized</i>	<code>\textit{ ... }</code>	<code>\mathit{ ... }</code>
SMALL CAPS	<code>\textsc{ ... }</code>	
Sans Serif	<code>\textsf{ ... }</code>	
<i>CALLIGRAPHIC</i>		<code>\mathcal{...}</code>
<i>FRaktur</i>		<code>\mathcal{...}</code>
BLACKBOARD		<code>\mathbb{...}</code>

# Type sizes

- Tiny - `{\tiny ...}`
- Script - `{\scriptsize ...}`
- Footnote - `{\footnotesize ...}`
- Small - `{\small ...}`
- normal - `{\normalsize ...}`
- large - `{\large ...}`
- Large - `{\Large ...}`
- LARGE - `{\LARGE ...}`
- huge - `{\huge ...}`
- Huge - `{\Huge ...}`

# References are Easy

To refer to a table, figure, section or equation in your document you need two elements, a **label** and a **reference**:

put `\label{labelName}` after the entity

<code>\section{Definitions}</code>	or	<code>\begin{equation}</code>
<code>\label{sec:defn}</code>		<code>\label{eq:bellman}</code>

use `\ref{labelName}` in your text

“The set  $S_{\pi}$ , see section `\ref{sec:defn}` ...”  
 becomes

The set  $S_{\pi}$ , see section 2.1 ...

# Figure Environment

Environments define a block of content with different properties

## 1 The Ice Age

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Mauris est nunc, pharetra nec, aliquam bibendum, adipiscing a, neque.

In ultrices porta lacus. Sed urna felis, consequat ut, interdum sit amet, aliquet tincidunt, sapien. In at felis. In fermentum libero eget elit. In aliquet magna vel diam. Suspendisse fringilla.



Figure 1: A Mammoth

The mammoth, see Figure 1, is aliquam et enim. Duis eget pede sit amet libero vulputate vestibulum. Duis ultricies felis vel ipsum. Aliquam ligula. Nulla tortor. Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos hymenaeos. Mauris luctus felis vel urna.

```
\begin{figure}[h]
  \begin{center}
    \includegraphics[height=.75in]
      {mammoth.png}
    \caption{A Mammoth}
    \label{fig:mammoth}
  \end{center}
\end{figure}
```

The mammoth, see Figure `\ref{fig:mammoth}` is ...

# Table Environment

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Mauris est nunc, pharetra nec, aliquam bibendum, adipiscing a, neque.

In ultrices porta lacus. Sed urna felis, consequat ut, interdum sit amet, aliquet tincidunt, sapien. In at felis. In fermentum libero eget elit. In aliquet magna vel diam. Suspendisse fringilla.

Name	ID	Score
Peter	3297	3.0
John	2719	3.3
Sarah	9172	3.7

Table 1: Score Tables for Today

The scores, see Table 1, is aliquam et enim. Duis eget pede sit amet libero vulputate vestibulum. Duis ultricies felis vel ipsum. Aliquam ligula. Nulla tortor. Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos hymenaeos. Mauris luctus felis vel urna. Donec sem. Nunc fermentum, augue id nonummy feugiat, sapien lacus varius lacus, a semper mauris nunc vitae elit.

```
\begin{table}[h]
  \begin{center}
    \begin{tabular}{|l|cr|}
      \hline
        {\bf Name} & ID & Score \\
      \hline
        Peter      & 3297 & 3.0\\
        John       & 2719 & 3.3\\
        Sarah      & 9172 & 3.7\\
      \hline
    \end{tabular}
  \end{center}
  \caption{Score Tables for Today}
  \label{tab:numbers}
\end{table}
```

# Theorems

In ultrices porta lacus. Sed urna felis, consequat ut, interdum sit amet, aliquet tincidunt, sapien. In at felis. In fermentum libero eget elit. In aliquet magna vel diam. Suspendisse fringilla.

**Rule 1** *Bayes rule states that sed urna felis, consequat ut, interdum sit amet, aliquet tincidunt, sapien.*

In theorem 1 we see that pede sit amet libero vulputate vestibulum. Duis ultricies felis vel ipsum. Aliquam ligula. Nulla tortor. Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos hymenaeos. Mauris luctus felis vel urna. Donec sem. Nunc fermentum, augue id nonummy feugiat, sapien lacus varius lacus, a semper mauris nunc vitae elit.

**Rule 2** *Sed urna felis, consequat ut, interdum sit amet, aliquet tincidunt, sapien.*

```
\newtheorem{thm}{Rule}
...
\begin{thm}
  \label{th:bayes}
  Bayes rule states ...
\end{thm}
```

In theorem `\ref{th:bayes}`  
 we see...

# Math in its bones

The best thing about  $\text{\LaTeX}$  is how it deals with math:

**super-scripts**

$$a^2$$

$$a^2$$

$$e^{f(x^2+x+z)}$$

$$e^{f(x^2+x+z)}$$

**sub-scripts**

$$V_{\pi}(x)$$

$$V_{\pi}(x)$$

**both**

$$\int_a^b$$

$$\int_a^b$$

$$\sum_{i=0}^N$$

$$\sum_{i=0}^N$$

$$\prod_{s=1}^{\infty}$$

$$\prod_{s=1}^{\infty}$$

**fractions**

$$\frac{1}{x}$$

$$\frac{1}{x}$$

**large brackets**

$$\left[ \dots \right]$$

$$\left[ \frac{\frac{a+b}{N}}{\sum_x x+y+z} \right]^{\frac{1}{x}}$$

$\Gamma \tau \epsilon \epsilon \kappa$

$\pi \phi \delta \delta \aleph$

$\pi \phi \delta \delta \aleph$



## Two ways to invoke math mode

**inline** - We write

`\mathcal{T} : S \times A \mapsto \mathbb{R}`  
to get  $\mathcal{T} : S \times A \mapsto \mathbb{R}$

**equation** - An equation environment shows up on a different line

`\begin{equation}`  
`\sum_{i=0}^N V_{\pi}(x)`  
`\end{equation}`

$$\sum_{i=0}^N V_{\pi}(x) \quad (1)$$

# Other Equation Layouts

Add `\usepackage{amsmath}` to top of your document for more equation fun:

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Mauris est nunc, pharetra nec, aliquam bibendum, adipiscing a, neque.

In ultrices porta lacus. Sed urna felis, consequat ut, interdum sit amet, aliquet tincidunt, sapien. In at felis. In fermentum libero eget elit. In aliquet magna vel diam. Suspendisse fringilla.

$$\begin{aligned} p(A) &= \sum_B p(A|B) \sum_C p(B|C)p(C) \\ &= \sum_B p(A|B)f_1(B) \\ &= f_2(A) \end{aligned} \quad (1)$$

Duis eget pede sit amet libero vulputate vestibulum. Duis ultricies felis vel ipsum. Aliquam ligula. Nulla tor-tor. Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos hymenaeos. Mauris luctus felis vel urna. Donec sem. Nunc fermentum, augue id nonummy feugiat, sapien lacus varius lacus, a semper mauris nunc vitae elit.

```
\begin{align}
p(A) &= \sum_B p(A|B) \\
&\sum_C p(B|C) p(C) \\
\notag &= \sum_B p(A|B) f_1(B) \\
&= f_2(A)
\end{align}
```

# Bibliographies – BibTeX

Create a .bib file, say references.bib

```
@article{pearl:1993za,  
  Author = {Judea Pearl},  
  Journal = {Statistical Science},  
  Pages = {266-269},  
  Title = {Graphical models, causality and interventi  
  Volume = {8},  
  Year = {1993}}  
}
```

# Add it to your paper

**Add bibliography:** Before `\end{document}` add:

```
\bibliographystyle{plain}  
\bibliography{references}  
\end{document}
```

**Add citation:** In your text simply write `\cite{pearl:1993za}`

**Compile:** You need to add another step:

- `pslatex yourdoc.tex`
- `bibtex yourdoc`
- `pslatex yourdoc.tex`
- `pslatex yourdoc.tex` (yes, you have to do it twice)

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# Bibliography

In ultrices porta lacus. Sed urna felis, consequat ut, interdum sit amet, aliquet tincidunt, sapien. In at felis. In fermentum libero eget elit. In aliquet magna vel diam. Suspendisse fringilla.

Pearl showed [1] that pede sit amet libero vulputate vestibulum. Duis ultricies felis vel ipsum. Aliquam ligula. Nulla tortor. Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos hymenaeos. Mauris luctus felis vel urna. Donec sem. Nunc fermentum, augue id nonummy feugiat, sapien lacus varius lacus, a semper mauris nunc vitae elit.

## References

- [1] Judea Pearl. Graphical models, causality and intervention. *Statistical Science*, 8:266–269, 1993.



# Making $\text{\LaTeX}$ presentations is easy

$\text{\LaTeX}$  can do presentations as well

**Beamer:** This presentation, many styles, simple `frame` environment for each slide

**Prosper:** Very popular, few years old, lots of standard slide styles (example)

**Seminar:** 15 years old, not updated, basis for new ones. Don't use it.

# Customization

$\text{\LaTeX}$  allows you to define your own commands and environments

- `\newcommand{\comment}[1]{}`  
**You type:** `\comment{Text you don't want seen}`
- `\newcommand{\ms}[2]{\sum_{i=#1}^{#2} X_i}`  
**You type:** `\ms{0}{N}`  
**You get:**  $\sum_{i=0}^N X_i$
- `\newenvironment[#args]{begin}{end}`

# Packages...gotta collect them all!

`\usepackage{usefulpackage}`

`times`, `palatino`, and `charter`: different fonts to use

`algorithm2e` : for laying out pseudocode

`hyperref` and `url`: for inserting hypertext references

`multirow`: for spanning multiple rows in tables, `\multicol`  
built in

`pdflatex`: why bother with an intermediate? Also has the  
advantage that hyphenated words are searchable  
un-hyphenated.

`listings`: for flexible typesetting of code fragments

`savetrees`: for squeezing more goodness out of that 6-page  
limit

`geometry`: for simple ways to set pagelayouts

`fancyhdr`: for setting headers and footers

## Other tools

**convert:** convert image formats

**ispell:** interactive spell check, understands  $\text{\LaTeX}$

**make:** if you're really keen

**xfig + psfrag:** a match made in heaven, leave text tags in image, save as eps, `\psfrag{tag}{ $\$x^n\$$ }` replaces the tags in the image

**fig2dev:** convert for xfig images

**gnuplot:** do you gnuplot?

**lgrind:** (on cascade) convert program code files to  $\text{\LaTeX}$  formatting, include with one simple tag

# Distributions

There are lots of  $\text{\LaTeX}$  editors out there and different ways to install it

**At school:** You're in luck, its built in, just type `latex` on the command line to compile. Add private packages to your `.texmf\` directory

**MaxOSX:** use *i*-installer to get it going. TeXShop is a good WYSIWYG editor with a nice previewer.

**Windows:** MiKTeX is the standard distribution, comes with a dvi-viewer.

**editors:** Vim and Emacs have  $\text{\LaTeX}$  modes to colour code it and check spelling, what more do you need?

## Useful links

- **Hypertext Help with LaTeX**  
<http://tex.loria.fr/general/latex2e.html>
- **LaTeX on the department wiki** [bugs.cs.ubc.ca/  
cgi-bin/twiki/view/Grads/WritingTools](http://bugs.cs.ubc.ca/cgi-bin/twiki/view/Grads/WritingTools)
- **Local installation**  
[/cs/local/generic/lib/pkg/teTeX-2.0.2/](http://cs/local/generic/lib/pkg/teTeX-2.0.2/)
- **Local LaTeX info**  
[http://www.cs.ubc.ca/~edmonds/ubc/lg/  
local-guide.html](http://www.cs.ubc.ca/~edmonds/ubc/lg/local-guide.html)
- **CS department ubc-thesis style**  
[/cs/local/generic/share/texmf/tex/latex/  
contrib/ubc/cs/ubc-thesis](http://cs/local/generic/share/texmf/tex/latex/contrib/ubc/cs/ubc-thesis)
- **BibTeX template**  
<http://www.cs.ubc.ca/~bsd/tex/templates.bib>

# Summary

L<sup>A</sup>T<sub>E</sub>X ...

- uses an open, declarative markup
- allows a standard layout that conforms to a style sheet
- lets you focus on content, not style and layout
- lets you write any mathematical expression easily
- provides easy support for chapters, tables of contents, bib...
- lets you use your favourite text editor
- makes you crazy, geeky cool...use L<sup>A</sup>T<sub>E</sub>X!

Any questions?

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