Using \LaTeX

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Wednesday, September 17, 2014
What is LaTeX?

Powerful (Mathematical) Typesetting Software

Developed by Donald Knuth, 1977

Very Light Programming Language

Easiest Way to Type Professional Looking Mathematics

The Standard for Typing Math

Other sciences and economics?
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Where do I get \LaTeX? 

Get your Own Free Copy

Mac: Download ‘MacTex’
PC: Download ‘MikTex’

Instructions and Links on Math Webpage

http://www.plu.edu/math/latex/
Probably 1-2 hours download and install time

Use Online Source

http://www.writelatex.com
http://cloud.sagemath.com
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How do I use \LaTeX?  

General Tips:

Copy existing templates.

Use online resources to answer questions.
  - Google
  - Stackexchange
  - Detexify

Consult \LaTeX\ help books.

Ask others (including me).

Spend a little time messing around.
Necessary Overhead

\documentclass[12pt]{article}
\usepackage{amsmath, ulem, graphicx, amsthm, marvosym}
\begin{document}
"Writing Goes in Here"
\end{document}

Change margins, define shortcuts, general setup. We have provided a basic header with necessary packages and useful shortcuts.
How do I use LaTeX? (Specifics)

Necessary Overhead

\documentclass[12pt]{article}
\usepackage{amsmath, ulem, graphicx, amsthm, marvosym}
\begin{document}
"Writing Goes in Here"
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Change margins, define shortcuts, general setup. We have provided a basic header with necessary packages and useful shortcuts.
How do I use \LaTeX? (Specifics)

Typing:

With header in place, now you can type just as you would a word document. But there are a few differences (since \LaTeX is a programming language).

<table>
<thead>
<tr>
<th>Typed</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tommy used to work on the docks.</td>
<td>Tommy used to work on the docks.</td>
</tr>
<tr>
<td>Tommy used to work on the docks.</td>
<td>Tommy used to work on the docks.</td>
</tr>
</tbody>
</table>
\LaTeX{} has 10 special characters that are used for "programming."

- \ - calls most commands
- \{\} - used for grouping
- $\ - used to enter inline mathematics mode
- &\ - used as a divider
- \# - used for programming purposes and defining macros
- ^ - used in for superscript
- _ - used for subscript
- \% - used for making comments in the source code
- ~ - Non-linebreaking space
How do I use \LaTeX? (Specifics)

Commands used in text

<table>
<thead>
<tr>
<th>Typed</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>\textbf{Hi}</td>
<td>Hi</td>
</tr>
<tr>
<td>\small size</td>
<td>size</td>
</tr>
<tr>
<td>\large size</td>
<td>size</td>
</tr>
<tr>
<td>\Large size</td>
<td>size</td>
</tr>
<tr>
<td>\underline{Capstone}</td>
<td>Capstone</td>
</tr>
<tr>
<td>\textit{Italics}</td>
<td>Italic</td>
</tr>
<tr>
<td>\sc Small caps</td>
<td>Small caps</td>
</tr>
<tr>
<td>{Where are the braces?}</td>
<td>Where are the braces?</td>
</tr>
<tr>
<td>\begin{center}Math\end{center}</td>
<td>Math</td>
</tr>
</tbody>
</table>
How do I use \LaTeX? (Specifics)

Nice Features (lists)

Typed

\begin{enumerate}
\item This
\item is
\item a
\item list.
\end{enumerate}

Output

1. This
2. is
3. a
4. list.

Replace enumerate with itemize for unordered list.
How do I use LaTeX? (Specifics)

Nice Features (lists)

Typed

\begin{itemize}
\item This
\item is
\item a
\item list.
\end{itemize}

Output

▶ This
▶ is
▶ a
▶ list.
How do I use \LaTeX? (Specifics)

Nice Features (images)

\usepackage{graphicx} (in header)
\includegraphics[width=1in]{mobius3.jpg}
\includegraphics[height=1in]{mobius3.jpg}
\begin{center}
\includegraphics[width=.5in]{mobius3.jpg}
\end{center}
Nice Features (tables)

Typed

\begin{tabular}{|c|c|c|}
\hline
P & Q & R \\
\hline
T & T & T \\
\hline
T & T & F \\
\hline
T & F & T \\
\hline
T & F & F \\
\hline
T & T & T \\
\hline
T & T & F \\
\hline
T & F & T \\
\hline
T & F & F \\
\end{tabular}

Output

<table>
<thead>
<tr>
<th>P</th>
<th>Q</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>T</td>
<td>T</td>
</tr>
<tr>
<td>T</td>
<td>T</td>
<td>F</td>
</tr>
<tr>
<td>T</td>
<td>F</td>
<td>T</td>
</tr>
<tr>
<td>T</td>
<td>F</td>
<td>F</td>
</tr>
<tr>
<td>T</td>
<td>T</td>
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<td>T</td>
<td>T</td>
<td>F</td>
</tr>
<tr>
<td>T</td>
<td>F</td>
<td>T</td>
</tr>
<tr>
<td>T</td>
<td>F</td>
<td>F</td>
</tr>
</tbody>
</table>
## How do I use $\LaTeX$? (Specifics)

### Nice Features (Theorems, Definitions, Examples)

<table>
<thead>
<tr>
<th>Typed</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>in header:</strong></td>
<td></td>
</tr>
<tr>
<td>\usepackage{amsthm}</td>
<td></td>
</tr>
<tr>
<td>\newtheorem{theorem}{Theorem}</td>
<td></td>
</tr>
<tr>
<td>\theoremstyle{definition}</td>
<td></td>
</tr>
<tr>
<td>\newtheorem{definition}{Definition}</td>
<td></td>
</tr>
<tr>
<td>\newtheorem{example}{Example}</td>
<td></td>
</tr>
<tr>
<td><strong>in writing area:</strong></td>
<td></td>
</tr>
<tr>
<td>\begin{theorem}</td>
<td>\textbf{Theorem 1.} There are infinitely many primes</td>
</tr>
<tr>
<td>There are infinitely many primes</td>
<td></td>
</tr>
<tr>
<td>\end{theorem}</td>
<td></td>
</tr>
<tr>
<td>\begin{example}</td>
<td>\textbf{Example 1.} 2, 3, 5 are prime numbers.</td>
</tr>
<tr>
<td>2, 3, 5 are prime numbers.</td>
<td></td>
</tr>
<tr>
<td>\end{example}</td>
<td></td>
</tr>
<tr>
<td>\begin{definition}</td>
<td>\textbf{Definition 1.} A prime number is a number...</td>
</tr>
<tr>
<td>A prime number is a number...</td>
<td></td>
</tr>
</tbody>
</table>
How do I use \LaTeX? (Specifics)

Mathematics

**Typed**

\[
\alpha, \beta, \gamma, \delta
\]

\[
\lim_{x \to 0} \frac{f(x)}{g(x)}
\]

\[
\int_0^1 x^2 dx = \frac{x^3}{3} \bigg|_0^1 = \frac{1}{3} - \frac{0}{3} = \frac{1}{3}
\]

**Output**

$$\alpha, \beta, \gamma, \delta$$

$$\lim_{x \to 0} \frac{f(x)}{g(x)}$$

$$\int_0^1 x^2 dx = \frac{x^3}{3} \bigg|_0^1 = \frac{1}{3} - \frac{0}{3} = \frac{1}{3}$$
How do I use LaTeX? (Specifics)

Mathematics

**Typed**

$$\sum_{k=0}^{\infty} \frac{1}{2^k} = 2$$

$$A=\begin{pmatrix} 1 & 0 & 4 & -1 \\ 0 & 1 & -3 & 1 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

**Output**

$$\sum_{k=0}^{\infty} \frac{1}{2^k} = 2$$

$$A = \begin{pmatrix} 1 & 0 & 4 & -1 \\ 0 & 1 & -3 & 1 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

\texttt{\newcommand\Z{\mathbb{Z}}} (header)

$\Z$

$\mathbb{R}$
How do I use \LaTeX? (Specifics)

Mathematics (an example)

\begin{theorem}
\label{irrational}
For any $n \in \mathbb{N}$ with $n \geq 3$, $\sqrt[n]{2}$ is irrational.
\end{theorem}

\begin{proof}
Assume that $\sqrt[n]{2}$ is rational, then $\sqrt[n]{2} = \frac{p}{q}$ with $p, q \in \mathbb{Z}$.
So, we have
\begin{aligned}
2 &= \left(\frac{p}{q}\right)^n \\
&= \frac{p^n}{q^n}
\end{aligned}
and so $q^n + q^n = p^n$, which contradicts Fermat’s Last Theorem.
\end{proof}

\textbf{Theorem 1.} For any $n \in \mathbb{N}$ with $n \geq 3$, $\sqrt{2}$ is irrational.

\textit{Proof.} Assume that $\sqrt{2}$ is rational, then $\sqrt{2} = \frac{p}{q}$ with $p, q \in \mathbb{Z}$. So, we have

\[2 = \left(\frac{p}{q}\right)^n = \frac{p^n}{q^n}\]

and so $q^n + q^n = p^n$, which contradicts Fermat’s Last Theorem. \qed
How do I use \LaTeX? 

Much more functionality
   Page Numbering and Page Layout
   Bibliography
   Macros and commands
   Figures
   Packages
   Slides

Basics are easy to use to get started

Learning Curve

Knowing commands

Copy/paste

Speed and Professionalism

Alternatives

Programming
Concluding Remarks

Use on blogs:
$\text{\texttt{\LaTeX}} \ F(\alpha) = \beta$

Use on websites with MathJax (Wikipedia, etc.)

Why do we care?

Can you use something else?

Questions?
Concluding Remarks

Use on blogs:
$\texttt{latex}\ F(\alpha)=\beta$

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Why do we care?

Can you use something else?

Questions?
Interesting Reads about $\LaTeX$

Good Twitter feed: @TeXtip

https://twitter.com/#!/TeXtip

Essay about the Beauty of $\LaTeX$ over others

http://nitens.org/taraborelli/latex

Interview with Donald Knuth

https://github.com/kragen/knuth-interview-2006

These slides will be available on http://www.plu.edu/math/latex