Introduction to \LaTeX

Aravind Ranganathan

Graduate Assistant
Engineering Library
University of Cincinnati
r.aravind@gmail.com
Workshop Objectives

- Introduction to \LaTeX
- “Hands-on”
  - Hello World!
  - Basic Document
  - Math Environments & basic math commands
  - Including Graphics
  - Using BibTeX
  - Changing document styles
- Helpful hints and resources
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LaTeX is like MS Word, only better!

What is \LaTeX? 

\LaTeX\textsuperscript{\textregistered} (‘lay-tech’ or ‘lah-tech’)

- Document preparation system for high-quality typesetting
- Uses markup commands and a typesetting program \TeX
- Used for publishing reports, books, scientific docs, etc.
Why use \LaTeX?  

Concentrate on writing (content), NOT on formatting (appearance)

**Demo 1: Why \LaTeX?**

- Notice how separation of content & formatting simplifies re-formatting.
- Also notice different font-size, font-family, alignment, etc in content.
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- Also notice different font-size, font-family, alignment, etc in content.
What does LaTeX do?

1. Input: (.tex) source file
2. Processes its contents & decides how best to typeset the document
3. Output: Device Independent (.dvi) file

Device Independent files (.dvi):
- Designed so that output can be printed / viewed on any device
- Can be converted easily to PS or PDF
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How does LaTeX work?

- Source text marked up with logical structure (like in HTML)
- Document classes tell LaTeX how to format the content
How does \LaTeX\ work?

- Source text marked up with logical structure (like in HTML)
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\LaTeX\ Architecture
LaTeX Output Formats: .ps & .pdf

Relationships btwn (La)TeX source code & all formats you can create from it
Markup Pluses & Minuses

+ves:
  - Separation of form and content
  - Consistent presentation
  - Can easily change document styles

-ves:
  - Need to learn the markup commands
  - Sometimes seems more tedious than visual approach (Eg: tables)
Setting up LaTeX

Two software components:

1. \LaTeX system
2. \LaTeX-friendly text editor

Operating Systems:

- Linux
  - Most distributions have a TeX system including \LaTeX. Check software source for a TeX package.

- MacOS X
  - MacTeX: A full TeX system including \LaTeX (with i-Installer)

- Windows
  - proTeXt: Easy-to-install TeX distribution based on MiKTeX.
  - (or) Download MikTeX and TeXnicCenter individually.
TeXnicCenter - First Time ToDos

- Tools -> Options -> Spelling
- Build -> Define Output profile
  - C:\Program Files\MiKTeX 2.7\miktex\bin
- Select Output profile: LaTeX => PDF

PS 1: MikTeX is the actual \LaTeX\ compiler. TeXnicCenter is just a text editor which knows where MikTeX is installed in your machine.

PS 2: Save your .tex document in a separate folder (coz of temp files).
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Hello World!

**hello.tex**

%%% hello.tex - Our first LaTeX example!
\documentclass{article}
\begin{document}
Hello World!
\end{document}

**Demo 2: Hello World**

- Compile your first LaTeX document!
Hello World!

hello.tex

\% hello.tex - Our first LaTeX example!
\documentclass{article}
\begin{document}
Hello World!
\end{document}

Demo 2: Hello World

Compile your first LaTeX document!
Demo 3: Simply Text

- Re-create from sample.html
- Notice the preamble, front matter, document body.
- Does this document have back matter?
\documentclass{article}
\usepackage{babel}

\begin{document}
\maketitle
\tableofcontents
\begin{itemize}
\item Contents
\item \begin{enumerate}
\item \begin{itemize}
\item \begin{itemize}
\item \begin{itemize}
\end{itemize}
\end{itemize}
\end{itemize}
\end{enumerate}
\item \begin{enumerate}
\item \begin{itemize}
\item \begin{itemize}
\item \begin{itemize}
\end{itemize}
\end{itemize}
\end{enumerate}
\end{enumerate}
\begin{thebibliography}{99}
\end{thebibliography}
\end{itemize}
\end{document}

Preamble

Front matter

Body

Back matter

Demo 3: Simply Text

- Re-create from sample.html
- Notice the preamble, front matter, document body.
- Does this document have back matter?
Defn: Environment sets formatting styles for its content

What are “Environments”?  
- \begin{env-name} ... \end{env-name}  
- Specify different special paragraph styles and general formatting  
- Examples: document, abstract, center, etc.
Defn: Environment sets formatting styles for its content

What are “Environments”?

- `\begin{env-name} ... \end{env-name}`
- Specify different special paragraph styles and general formatting
- Examples: `document`, `abstract`, `center`, etc.
Math Environments: Inline & Newline

Two math environments:

1. Text: $\begin{math}\ldots\end{math}$
   - Text formulae displayed inline
   - Latex shorthand: $\left(\ldots\right)$
   - Tex shorthand: \$\ldots\$

   **Example:** The formula \((a + b)^2 = a^2 + b^2 + 2ab\) is inline.

2. Displayed: $\begin{displaymath}\ldots\end{displaymath}$
   - Displayed formulae separate from the main text
   - Latex shorthand: $\left[\ldots\right]$\]
   - Tex shorthand: $$\ldots$$

   **Example:** The same formula
   \[(a + b)^2 = a^2 + b^2 + 2ab\]

   in displaymath environment.
Two math environments:

1. **Text:** \begin{math}...\end{math}
   - Text formulae displayed inline
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   - Tex shorthand: \$...\$

   **Example:** The formula \((a + b)^2 = a^2 + b^2 + 2ab\) is inline.

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   - Tex shorthand: $$...$$

   **Example:** The same formula
   
   \[(a + b)^2 = a^2 + b^2 + 2ab\]

   in displaymath environment.
Math Commands: Use only inside math environment

Symbols accessible directly: $+ - = ! / ( ) [ ] <> | ^$: 

Fractions:
- $\frac{x+y}{y-z}$: $\frac{x+y}{y-z}$
- $\frac{\frac{1}{x} + \frac{1}{y}}{y-z}$: $\frac{\frac{1}{x} + \frac{1}{y}}{y-z}$

Powers and indices:
- Power: $x^n$: $x^n$, $x^{2n}$: $x^{2n}$
- Index: $n_i$: $n_i$, $n_{ij}$: $n_{ij}$

Roots:
- $\sqrt[5]{\frac{x+y}{y-z}}$: $\sqrt[5]{\frac{x+y}{y-z}}$

Brackets:
- $\left(\frac{x^2}{y^3}\right) \times \left(\frac{x^2}{y^3}\right)$: $\left(\frac{x^2}{y^3}\right) \times \left(\frac{x^2}{y^3}\right)$
Math Commands: Use only inside math environment

Symbols accessible directly: $\pm \div \times \% \rangle \langle \wedge \vee$

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Roots:
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Brackets:
- $(\frac{x^2}{y^3}) \times \left(\frac{x^2}{y^3}\right) = (\frac{x^2}{y^3}) \times \left(\frac{x^2}{y^3}\right)$
Symbols accessible directly: \( + - =!/(\)\] \(<> |':

Fractions:

\[
\frac{x+y}{y-z}: \frac{x+y}{y-z}
\]

\[
\frac{\frac{1}{x}+\frac{1}{y}}{y-z}: \frac{1}{x+y} \left(\frac{1}{y} - \frac{1}{z}\right)
\]

Powers and indices:

- Power: \( x^n: x^n, x^{2n}: x^{2n} \)
- Index: \( n_i : n_i, n_{ij} : n_{ij} \)

Roots:

- \( \sqrt[5]{\frac{x+y}{y-z}} : \sqrt[5]{{\frac{x+y}{y-z}}} \)

Brackets:

- \( (\frac{x^2}{y^3}) \times \left(\frac{x^2}{y^3}\right) \)

\[
\left(\frac{x^2}{y^3}\right) \times \left(\frac{x^2}{y^3}\right)
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Math Commands: Use only inside math environment

Symbols accessible directly: $+-=!/()[]<>|'-$

Fractions:
- $\frac{x+y}{y-z}$: \frac{x+y}{y-z}
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- $\sqrt[5]{\frac{x+y}{y-z}}$: \sqrt[5]{\frac{x+y}{y-z}}

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Math Commands: Use only inside math environment

Symbols accessible directly: $+-=!/(\ )[]<>|'$:

Fractions:

- $\frac{x+y}{y-z}$: \frac{x+y}{y-z}
- $\frac{\frac{1}{x}+\frac{1}{y}}{y-z}$: \frac{\frac{1}{x}+\frac{1}{y}}{y-z}

Powers and indices:

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- Index: $n_i$: n_i, $n_{\{ij\}}$: n_{ij}

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- $\sqrt[5]{\frac{x+y}{y-z}}$: \sqrt[5]{\frac{x+y}{y-z}}

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Math Environment has its own rules

Remember:

- \( x_y = x_y \) and \( x_{\{\text{max}\}} = x_{\text{max}} \)
- LaTeX ignores the spaces in math environment. Four commands for use in math mode:
  - \( ; \) - a thick space
  - \( : \) - a medium space
  - \( , \) - a thin space
  - \( ! \) - a negative thin space
  - E.g.: This is in mathmode
- \( \text{mbox}{...} \) creates a text box with just enough width to contain the text

PS: \LaTeX{} usually has several ways for the same thing [ :) :( :/ ]
Basic Math - Exercises

Exercises:

1. Buzz Lightyear: *To $\infty$, and beyond!*

2. \[ nC_r = \frac{n!}{r!(n-r)!} \]

3. \[ \sum_{i=1}^{n} \alpha^\beta + \gamma_{\text{max}} + \Delta \]

4. 50 apples \times 100 apples = lots of apples

Demo 4.1: Math Text

- Try math environments & symbols from previous slides
- Split each exercise problem and work on easier parts first
Solutions:

1. Buzz Lightyear: \{\textit{To }\infty, \text{ and beyond!}\}

2. \[\binom{n}{r} = \frac{n!}{r!(n-r)!}\]

3. \[\sum_{i=1}^{n} \alpha^{\beta} + \gamma_{\text{max}} + \Delta\]

4. \[50 \text{ apples} \times 100 \textbf{ apples} = \textit{lots of apples}\]
Including Images — Using packages in LaTeX

- .eps, .jpeg, .png
- \texttt{\usepackage{graphicx}} in the preamble
- Syntax: \texttt{\includegraphics[attr1=val1,...]{image}}

PS: By adding the “graphicx” package in Preamble, you can use commands from the package.
Images - Exercise

Exercise:

1. \includegraphics{image}
2. \includegraphics[scale=0.5]{image}
3. \includegraphics[width=2.5cm]{image}
4. \includegraphics[scale=0.5, angle =180]{image}
5. \includegraphics[trim = 15mm 40mm 15mm 5mm, clip]{image}

Demo 4.2: Images

- Use chick.png image inside the Demo 4 folder
- What does \input{images} inside math.tex do?
Exercise:

1. \includegraphics{image}
2. \includegraphics[scale=0.5]{image}
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**Demo 4.2: Images**

- Use chick.png image inside the Demo 4 folder
- What does \input{images} inside math.tex do?
Images - Solutions

Output:

![Yellow Chick](image1.png)

Original:
Images - Solutions

Output:

Scale=0.5:
Images - Solutions

Output:

Width = 2.5 cm:
Images - Solutions

Output:

Scale=0.5, Angle=180:
Output:

Trimmed L15 B40 R15 T5:
Including Bibliography - Bibitems & BibTeX

Two ways to include bibliography:

1. Bibitems: Add each reference within the document
2. BibTeX: Store in an external file and link it in the .tex document
Using Bibitems - Requires more manual formatting

- Add references at end of document (Demo1: Why LaTeX?)
- Cross-referenced & automatically numbered
- Requires manual formatting
- References are not portable

\begin{thebibliography}{9}

\bibitem{lamport94}
Leslie Lamport,
\texttt{LaTeX: A Document Preparation System}.
Addison Wesley, Massachusetts,
2nd Edition,
1994.

\end{thebibliography}
Using BibTeX - Simpler and Easier

- Uses a structured bibliography .bib file to be included in .tex
  - Write Once, Use many approach
- Generates bibliography according to specified style
BibTeX entry format

```latex
@ref_type{uniq_key, 
  field1 = "...",
  field2 = "...",
  ... 
}
```

- **ref_type**: article, book, inproceedings, phdthesis, etc.
- **field**: author, title, volume, year, publisher, etc.
- **uniq_key**: user-defined key to cite this reference
BibTeX Example

@book{goossens93,
  author    = "Michel Goossens and Frank Mittlebach and Alexander Samarin",
  title     = "The LaTeX Companion",
  year      = "1993",
  publisher = "Addison-Wesley",
  address   = "Reading, Massachusetts"
}

Note: Order of fields is not important
Using the BibTeX database

- To tell the compiler which .bib file to use
  - \texttt{\textbackslash bibliography\{bibfile\_name\}} (without .bib extension)
- To select the bibliographic style (.bst)
  - \texttt{\textbackslash bibliographystyle\{style\}}
  - Standard Styles: plain, alpha, abbrv, unsort
  - Publishers often supply their own style files (.bst)
- Citing references
  - \texttt{\textbackslash cite\{ref\_key1, ref\_key2,...\}}

PS 1: Compile 2 - 3 times to get the cross-references.
PS 2: Delete temp files if changing bibliography style.
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BibTeX & Document Class Demos

Note: BibTeX entries easily available for references

- Google Scholar - “Preferences → Bibliography Manager”
- IEEE Xplore
- ACM Digital Library
- Citeseer

Demo 5: Bibliography - BibTeX

- Notice \cite{} command inside the document.

Demo 6: Document Class

- Same as Demo1?
- Notice use of ieee document style.
BibTeX & Document Class Demos

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**Demo 5: Bibliography - BibTeX**

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Packages — Re-visited!

- \texttt{\usepackage[package-opts]\{package-name\}}
- Always declared in the preamble
- Extends core \LaTeX\ functionalities (simplifies complex tasks)
- Provides new commands / environments
- Examples: \texttt{algorithm2e, graphicx, hyperref, etc.}
Packages for almost all necessary options

- Math options: Equations, multi-line functions, labeling, etc.
- Tables
- Floats
- Algorithms
- Drawing / Animations
- Language support
- Power-point like Presentations (Beamer)
Benefits of \LaTeX

- Author remains an author
  - Separation of style and content
- Portable
- Flexible - Can do anything
- Provides superior output than Word Processors
- Scalable - Large documents can be split
- Stable - Never crashes / gets corrupted
- Free of cost!
Online tutorials & Resources

- **Engr Library \LaTeX resources:**
  
  http://engrlib.uc.edu/workshops/latex/

- Online \LaTeX Links & Tutorials:
  
  - Basic Tutorials by Andrew Roberts
  - \LaTeX help by Subject, Command, or Environment
  - TeX FAQ
  - The \LaTeX wiki book
  - \LaTeX Project: http://www.latex-project.org/
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  - Basic Tutorials by Andrew Roberts
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  - TeX FAQ
  - The \LaTeX wiki book
  - \LaTeX Project: http://www.latex-project.org/
Questions??
Thank you for attending the workshop

Remember to take the survey !!