

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

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## Introduction

# What is LaTeX?

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- Special version of TeX.
- Produces high-quality documents.
- Mathematical text especially nice.
- Easier for beginners than TeX.
- Difference between LaTeX2e and LaTeX2.09

# Features of LaTeX

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- Predefined document formats
- Footnotes
- Sectioning commands
- Table of Contents, List of Figures, List of Tables, and Bibliographies
- Cross references
- Mathematical formula generation

# Objectives

- Setup for your LaTeX installation
- Standard Class, Options, and Packages
- Basics of text mode
- Basics of math mode
- Environments
- Sectioning
- Figures, Tables, Cross-Referencing
- Graphics

# Steps

- Create input file "*filename.tex*"
- Build (typeset) the input file "*filename.tex*" to create output depending on the format selected to build
- Preview is mostly PDF based converting the DVI (DeVice Independent) file to PS (PostScript) using LaTeX->PS->PDF or PDF directly using LaTeX->PDF

# Minimum Requirements

```
\documentclass [options] {class}  
% preamble  
\begin{document}  
  
% body of document (text) or  
% files to include  
  
\end{document}
```

# Including Files

```
\documentclass [options] {class}  
% preamble  
\begin{document}  
\include{file1}  
\include{file2}  
...  
\include{filen}  
\end{document}
```

# Including Files

```
\documentclass [options] {class}  
% preamble  
\includeonly{file1,file4}  
\begin{document}  
\include{file1}  
\include{file2}  
...  
\include{filen}  
\end{document}
```



# Classes

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- article
- report
- book
- letters
- slides

# Options

- 10pt | 11pt | 12pt
- letterpaper | legalpaper | executivepaper  
|a4paper | a5paper| b5paper
- landscape
- final | draft
- oneside | twoside

# More Options

- openright | openany
- onecolumn | twocolumn
- notitlepage | titlepage
- openbib
- leqno
- fleqn

# Packages

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In the preamble, you can include packages to provide additional functionality

```
\usepackage [options] {package_name}
```

# Packages

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- alltt
- amstex
- babel
- color
- graphicx

# More Packages

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- ifthen
- latexsym
- makeidx
- pict2e
- showidx

# Text Mode

- Words and sentences are marked by spaces.
- Extras spaces between words are ignored.
- One or more blank lines denotes the end of a paragraph.
- By default all paragraphs are justified.

# Special Characters

- `$ % # & _ { } ~ ^ \`
- `\$ \% \# \& \_ \{ \}`
- Use `\verb+~ ^ \+`
- `\begin{verbatim} ... \end{verbatim}`



# Quotation Marks

- Double

- left = ` `

- right = ' '

“Double quote”

- Single

- left = `

- right = '

'Single quote'

# Dashes

- Inter-word as in X-ray

X-ray

- Medium as in number ranges 1--2

1-2

- Punctuation as in---like this.

long—dash

# Changing Type Style

- shape

- \textup, \textit, \textsl, \textsc
- \upshape, \itshape, \slshape, \scshape

Upright shape. Usually the default.

*Italic shape. Often used for emphasized text.*

*Slanted shape. A bit different from italic.*

**SMALL CAPS SHAPE. USE SPARINGLY.**

# Changing Type Style

- **series**

- `\textmd`, `\textbf`
- `\mdseries`, `\bfseries`

Medium series. Usually the default.

**Boldface series. Often used for headings.**

# Changing Type Style

- family

- `\textrm`, `\textsf`, `\texttt`
- `\rmfamily`, `\sffamily`, `\ttfamily`

Roman family. Usually the default.

Sans serif family. Often used in ads.

Typewriter family. Popular with hackers.

# Changing Size

- Declaration
- Sizes
  - `\tiny \footnotesize \small \normalsize`
  - `\large \Large \LARGE`
  - `\huge \Huge`
- Example: `{\small word}`

Normal word  
Small word

# Reminder about Changing Style and Size

Remember:

If you have a specific concept/word that needs to be represented in a different font or size, then consider defining a command rather than using a type style and/or size command directly.

```
\newcommand{\boldit}[1]{\textit{\textbf{#1}}}
```

```
\newcommand{\tinyboldit}[1]{\{\tiny\textit{\textbf{#1}}\}}
```

Example: changes to produce `\tinyboldit{tiny bold italicized words}`

```
changes to produce tiny bold italicized words
```

# Footnotes

- `\footnote{text of footnote}`
  - Don't put a space before `\footnote`
  - Try not to use too many footnotes
  - Example

```
The miracle1 happened one night.
```

```
The miracle\footnote{Definition of a  
miracle.} happened one night.
```

---

```
1Definition of a miracle.
```



# Basic Math

- In line
  - $\$ \dots \$$
  - $\backslash( \dots \backslash)$
  - $\backslashbegin{math} \dots \backslashend{math}$
- Displayed (unnumbered)
  - $\backslash[ \dots \backslash]$
  - $\backslashbegin{displaymath} \dots \backslashend{displaymath}$
  - $\backslashbegin{eqnarray*} \dots \backslashend{eqnarray*}$

# Basic Math

- Displayed (numbered)
  - `\begin{equation} ... \end{equation}`
  - `\begin{eqnarray} ... \end{eqnarray}`
- Arrays
  - `\begin{array}{columns} ... \end{array}`
    - columns = c (centered), l (flush left), r (flush right), | (vertical bar)

# Subscripts ( \_ ) and Superscripts ( ^ )

- $x_1$   
 $x^1$
- $x_{2y}$   
 $x^{2y}$
- $x^{y^2}$   
 $x_{y_2}$
- $x^y_1$   
 $x^1_y$

$x_1x^1$

$x_{2y}x^{2y}$

$x^{y^2}x_{y_2}$

$x^y_1x^1_y$

# Fractions and Square Roots

- `\frac{top}{bottom}`

$$\frac{\text{y + z/2}}{\text{y}^2 + 1}$$

*top*      *bottom*

$$\frac{y + z/2}{y^2 + 1}$$

- `\sqrt[root]{formula}`

$$\sqrt{2}$$

$$\sqrt{2} \text{ or } \sqrt[3]{z}$$

$$\sqrt[3]{z}$$

# Delimiters

- `\left delimiter`
- `\right delimiter`

$$A = \left( \begin{array}{ccc} x - \lambda & 1 & 0 \\ 0 & x - \lambda & 1 \\ 0 & 0 & x - \lambda \end{array} \right)$$

*delimiter* = ( ), { }, [ ], . (null)

- Note: must have matching `\left` and `\right` on one line

# Delimiter Example

```
\[ f(x) =  
\left\{\renewcommand{\arraystretch}{1.2}  
\begin{array}{l}  
\frac{1}{3} & \mbox{if } 0 \leq x \leq 1; \\  
\frac{2}{3} & \mbox{if } 3 \leq x \leq 4; \\  
0 & \mbox{elsewhere}.  
\end{array}\right. \]
```

$$f(x) = \begin{cases} \frac{1}{3} & \text{if } 0 \leq x \leq 1; \\ \frac{2}{3} & \text{if } 3 \leq x \leq 4; \\ 0 & \text{elsewhere.} \end{cases}$$

# Changing Style in Math Mode

- commands

- `\mathit{ }`
- `\mathrm{ }`
- `\mathbf{ }`
- `\mathsf{ }`
- `\mathtt{ }`
- `\mathcal{ }`

```
italic + 2ftΨ log|ψ|  
  
roman + 2ftΨ log|ψ|  
  
bold + 2ftΨ log|ψ|  
  
sans serif + 2ftΨ log|ψ|  
  
typewriter + 2ftΨ log|ψ|  
  
CAL UPPERCASE LETTERS ONLY
```

- only style of letters, numbers and uppercase Greek letters are changed.

# Mathematical Symbols

- Extension of mathematical symbols

```
\usepackage{latexsym}
```

- `\lhd`, `\rhd`, `\unlhd`, `\unrhd`  
`\sqsubset`, `\sqsupset`, `\Join`  
`\leadsto`, `\mho`, `\Box`, `\Diamond`



`\lhd` `\rhd` `\sqsubset` `\sqsupset` `\Box` `\Diamond` `\Join` `\leadsto` `\mho` `\circ`



# Reminders about Math Mode

- Spaces are ignored and you may need to put a space at the end of a command.
- Special commands must be used to add or remove space.
  - $\,$  = a thin space
  - $\!$  = a negative thin space
  - $\:$  = a medium space
  - $\;$  = a thick space
- No blank lines.

# Reminders about Math Mode

- `\boldmath`
  - Causes everything in a formula to be bold, including symbols
  - Cannot be used in math mode
- `\_`
  - Inter-word space in math mode
- `$$`
  - Does not work properly use `\[ \]` instead

# Helpful Commands

- `\providecommand{cmd}[args][opt]{def}`

Same as `\newcommand` unless *cmd* is already defined, in which case it does nothing and the old definition is retained.

- `\ensuremath{formula}`

Equivalent to `$ formula $` when used in paragraph or LR mode; equivalent to *formula* when used in math mode.

# Environments

- `\begin{center} ... \end{center}`\*\*

\*\*uses `\\` to separate lines

- `\begin{itemize} ... \end{itemize}`\*
- `\begin{enumerate} ... \end{enumerate}`\*

\*requires `\item`

# Environments

- `\begin{tabular}{columns} ... \end{tabular}`

*columns* = c (centered), l (flush left),  
r (flush right), | (vertical bar), p{length}  
(paragraph)

& = separate columns

\\ = separate rows

\hline, \cline{*i-j*}, \multicolumn{*n*}{*pos*}{*item*}

# Section Commands

- `\sec_cmd [toc_entry] {heading}`
- `\sec_cmd*{heading}`
  - `sec_cmd` = `\part` `\chapter` `\section` `\subsection` `\subsubsection` `\paragraph` `\subparagraph`
  - `toc_entry` = table of contents entry; if missing `heading` is used
  - `heading` = section heading
  - `*` = unnumbered section

# Helpful Hints for Section Commands

- Adding a title to the table of contents for unnumbered sections
  - `\addcontentsline{toc}{section type}{title}`
- Breaking a long title
  - use `\protect\linebreak`

# Spacing and Line Breaking

- Spacing
  - `\hspace{length}` or `\hspace*{length}`
  - `\vspace{length}` or `\vspace*{length}`
  - *length* = a dimensional unit; e.g. 1in, 2pt
- Line Breaking
  - `\linebreak` = break line and justify
  - `\\` or `\newline` = break line and don't justify



# Figures and Tables

- Figures

```
\begin{figure}  
  body  
\caption{caption title}  
\end{figure}
```

- Tables

```
\begin{table}  
\caption{caption title}  
  body  
\end{table}
```

# Hints: Figures and Tables

- More than one `\caption` can appear within a figure or table environment.
- Use the option with `\caption` to produce a shortened entry in the List of Figures or Tables.

`\caption[what appears in the list.]{what appears in the document.}`

# Cross Referencing

- Define a key
  - `\label{key}`
- Reference a key
  - `\ref{key}`
  - `\pageref{key}`

# Placement of `\label`

- In ordinary text, the `\label` must appear after `\chapter`, `\section`, `\subsection`, etc.
- In equations, the `\label` command must appear on the line of the equation.
- In figures or tables, the `\label` command must appear after each `\caption` command.
- Use `\protect` before any reference macro when used within another macro.

# Other Reminders

- Moving Arguments
  - sectioning commands
  - `\caption`
- Fragile Commands in Moving Arguments
  - `\label`, `\ref`, `\pageref`
  - `\sqrt`
  - `\cite`

# graphics Package

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Provides commands for performing geometric transformations and including graphics prepared with other computer programs.

# graphics Package

- `\scalebox{h_scale}[v_scale]{text}`
- `\resizebox{width}{ht}{text}`  
`\resizebox*{width}{ht}{text}`
- `\rotatebox{angle}{text}`
- `\reflectbox{text}`
- `\includegraphics[x_len1,y_len1][x_len2,y_len2]{filename}`  
`\includegraphics*[x_len1,y_len1][x_len2,y_len2]{filename}`