An Introduction to LaTeX

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LaTeX

- Computer program for typesetting documents
- Input plain text file using special commands and outputs typeset document for high-quality printing
- Simple documents easily produced
  - Automatic numbering of chapters, sections, theorems, equations
  - Automatic generation of cross-references, indexes, citations, bibliography
- Mathematical formulas supported by powerful macros and typesetting facilities

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Producing a Document

- Edit LaTeX file in plain text editor
- Save file
- Run **latex** (like a compiler) on file
  - May produce error messages
  - Outputs a DVI or PDF file
- Preview/print DVI or PDF file

Typical LaTeX File

- latex/examples/ex01.tex
- Essential parts of input file:
  \documentclass{article}
  \begin{document}
  …
  \end{document}
- Special characters:
  \ { } $ ^ _ % ~ # &

Control Sequences

- Used to produce mathematical symbols, formulae, matrices, equations, other complicated expressions
- Also used to accomplish tasks such as changing fonts
- Most commonly a sequence of characters beginning with backslash \
  \alpha   \textit \sum

Formatting Simple Text

- LaTeX ignores line breaks and extra spaces in input file
- Makes appropriate line and page breaks, hyphenating as necessary
- Justifies text in each paragraph
- Indents paragraphs, except for first one in a section or subsection
- Produces large, book-size margins
- Sets text in 10 point font, single spaced
- Example: latex/examples/ex02.tex

Spacing and Paragraphs

- Use single space (at least) to separate words
- Leave a blank line to start a new paragraph
- End of sentence indicated by . ? or ! followed by a space
- Use backslash followed by space to explicitly include a space in output " \ "
- Spaces following a control sequence are ignored
- Example: latex/examples/ex03.tex

Quotation Marks and Dashes

- Single quotation marks: ` '
- Double quotation marks: `` "
  - *Not* " (the double quotation mark on the keyboard)
- Dashes:

  hyphens: -   (intra-word dash)
  en-dashes: --   (medium dash for number ranges)
  em-dashes: ---   (punctuation dash)
- Example: latex/examples/ex04.tex

Section Headings

- Number section headings of various sizes produced using
  \section, \subsection, \subsubsection
- Title of section is passed as an argument between curly brackets
  \section{Section Headings}
  - Title will be typeset in large boldface font and numbered appropriately
- To suppress automatic numbering, use \section*{…}
- Other document styles have other sectioning commands- e.g. book: \chapter{…}

Changing Fonts and Typestyle

- \emph{…} puts text in *italic* font
- \textbf{…} typesets text in **bold** font
- Sizes changed by:
  \tiny \scriptsize \footnotesize \small \normalsize \large \Large \LARGE \huge \HUGE
- Example: latex/examples/ex05.tex

Special Symbols

- Use escape backslash to produce special characters in final document:
  \# \$ \% \& _ \{ \}
- For \ ^ ~ use \char92, \char94, \char126 in \texttt mode
- Lots of other special symbols
- Example: latex/examples/ex06.tex

Mathematics Mode

- To produce mathematical formula, must enter *math mode*
- Formulae can be embedded in text or displayed between lines of text
- Within text of a paragraph, use $ (dollar sign) before and after the formula
  - Can also use \(and \) to surround formula
- To display formula or equation on line by itself, use \[and \] around expression
  - Use \begin{equation} … \end{equation} for automatically numbered equations
- Example: latex/examples/ex07.tex

Mathematical Expressions

- Superscript: ^{...}
- Subscript: _{...}
- Fractions: a/b or $\frac{a}{b}$
- Roots: \sqrt{...}
- Example: latex/examples/ex08.tex

Greek Letters

α	\alpha	ι	\iota	ρ	\rho
β	\beta	κ	\kappa	σ	\sigma
γ	\gamma	λ	\lambda	τ	\tau
δ	\delta	μ	\mu	υ	\upsilon
ϵ	\epsilon	ν	\nu	ϕ	\phi
ζ	\zeta	ξ	\xi	χ	\chi
η	\eta	o	o	ψ	\psi
θ	\theta	π	\pi	ω	\omega

More Greek

Γ	\Gamma	Ξ	\Xi	Φ	\Phi
Δ	\Delta	Π	\Pi	Ψ	\Psi
Θ	\Theta	Σ	\Sigma	Ω	\Omega
Λ	\Lambda	Υ	\Upsilon		

ϵ	\epsilon	ε	\varepsilon
θ	\theta	ϑ	\vartheta
π	\pi	ϖ	\varpi
ρ	\rho	ϱ	\varrho
σ	\sigma	ς	\varsigma
ϕ	\phi	φ	\varphi

Mathematical Symbols

- See website linked on the course homepage, or any LaTeX reference

Math Fonts and Functions

- In math mode, use **\mathbf** and **\mathrm** instead of \textbf, \textrm
- \cal for calligraphy font (only uppercase)
- Standard function names:
  \arccos \cos \cosh \csc \exp \arcsin ...
  \ln \lg \lim \det ...

Other Math

- See course webpage link for details
  - Accents
  - Ellipsis
  - Brackets

Matrices and Arrays

- Use array environment (in math mode)
- Specify number of columns and alignment in each
- Use & to split column entries
- Use \\ to start new row
- Example: latex/examples/ex09.tex

Lists

- List environments:
  - **enumerate** for numbered list
  - **itemize** for un-numbered list
  - **description** for labeled list

```
\begin{enumerate}
   \item …
\end{enumerate}
```

Tables

- Produced using **tabular** environment
- Just like array but not in math mode
- Can draw horizontal and vertical lines
- Example: latex/examples/ex10.tex
- To span multiple columns:
  \multicolumn{3}{c}{Year of entry}

LaTeX Preamble

- Document begins with \documentclass
- Main text included between
  \begin{document} … \end{document}
- Can include options for document class
  - 11pt, 12pt, twocolumn, letter
  - \documentclass[12pt,twocolumn]{article}

Defining New Control Sequences

\newcommand{\name}[2]{ … }

Name of new command

Number of arguments (optional)

Body of control sequence (use #1, #2,… to indicate substitution of arguments)