A Brief Introduction to LaTeX

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What are \TeX{} and \LaTeX{}?

\begin{itemize}
\item \LaTeX{} is a typesetting system suitable for producing scientific and mathematical documents.
  \begin{itemize}
  \item \LaTeX{} enables authors to typeset and print their work at the highest typographical quality.
  \item \LaTeX{} is pronounced “Lay-tech”.
  \item \LaTeX{} uses \TeX{} formatter as its typesetting engine.
  \end{itemize}
\end{itemize}

\begin{itemize}
\item \TeX{} is a program written by Donald Knuth for typesetting text and mathematical formulas.
\end{itemize}
Why LaTeX?

- Easy to use, especially for typing mathematical formulae
- Portability (Windows, Unix, Mac)
- Stability and interchangeability
Why LaTeX? contd...

- High quality

- Most journals have their LaTeX styles.

- you will be forced to use it, since everyone else around you is using it.
Why LaTeX? contd...

- Documentation and forums
- A universal acceptance among researchers
- Error finding and troubleshooting are not difficult.
References for LaTeX

— The not so short introduction to LaTeX2e
  ◦ http://tobi.oetiker.ch/lshort/lshort.pdf
— Comprehensive TeX archive network
  ◦ http://www.ctan.org/
— Beginning LaTeX
  ◦ http://www.cs.cornell.edu/Info/Misc/LaTeX-Tutorial/LaTeX-Home.html
— Google! !

....Leslie Lamport

.....H. Kopka
# Basic File Extensions in LaTeX

<table>
<thead>
<tr>
<th>File Extensions</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>.tex</td>
<td>Contains symbols and text written in the editor</td>
</tr>
<tr>
<td>.aux</td>
<td>Data file for cross referencing and across compilers</td>
</tr>
<tr>
<td>.log</td>
<td>Compiler information, warnings, error messages</td>
</tr>
<tr>
<td>.dvi</td>
<td>Main output file of initial TeX, same across systems</td>
</tr>
<tr>
<td>.ps</td>
<td>Postscript files</td>
</tr>
<tr>
<td>.cls</td>
<td>Class file containing commands, environments</td>
</tr>
<tr>
<td>.sty</td>
<td>Style file containing macro definitions, other extensions</td>
</tr>
<tr>
<td>.pdf</td>
<td>Common output format: Portability</td>
</tr>
<tr>
<td>.bib</td>
<td>Bibliography entries</td>
</tr>
</tbody>
</table>
How to Setup LaTeX for Windows

1. Download and install MikTeX
   http://www.miktex.org/

2. Install Ghostscript and Gsview
   http://pages.cs.wisc.edu/~ghost/

3. Install Acrobat Reader

4. Install Editor
   — WinEdt
     http://www.winedt.com/
   — TexnicCenter
     http://www.texniccenter.org/
   — Emacs, vi, etc.

For MAC Users
TeXShop
iTexMac
Texmaker
...
Creating a Document Using LaTeX

TeX input file
file.tex

Source LaTeX document

Run LaTeX program

DVI file
file.dvi

Device independent output

Run Device Driver

Output file
file.ps or file.pdf

Unix Commands
> latex file.tex runs latex
> xdvi file.dvi previewer
> dvipdf file.dvi creates .pdf
> pdflatex file.tex creates .pdf directly
Creating a Document Using \LaTeX

- **Start with a skeletal document** (create it, get it from classmates, download it from journals’ website...).

- Fill (text, formula, figure, table, text ...) the document.

- Run \LaTeX{} to generate output and make modifications.

- Learn as you move. Code. Write.
LaTeX Document: Some Tips

- Use the tools for text formatting as need be: \paragraph, \setlength, \linespread.

- Commands start with ‘\’; spaces are allocated by the engine for ‘\\’, ‘,\’ commands. Any in-text mathematical expression is embedded in ‘$ $’ sign.

- ‘%’ is used for commenting and ignorable text.

- Commands take values called arguments: \command{argument} [value]. Varies the extent of the command with varying argument.
LaTeX Document: Some Useful Facts

The preamble of the document contains all the necessary information for a fixed document type and code execution.
- \documentclass, \userpackage, \newcommand, etc.
- global declarations applicable to a particular document
- External files: class files
- text and content type

LaTeX builds up its pages by pushing around boxes: \mbox, \parbox, \fbox, etc.

Commands and texts enter together in ASCII file.

Different text fonts (\it, \bf, \rm, \sl etc.)
Basic Structure of LaTeX Document

\documentclass [12pt]{article}
\usepackage {color}
\usepackage {graphicx}
\begin{document}
\end{document}

Define the types of the document (article, book, thesis ...)
Preamble. Incorporate packages or define macros here

Main body, stuff to be printed, title, authors, abstract, sections, references, .....

\begin{document}
\title{A Very Simple Introduction to LaTeX}
\author{names}
\thanks{AMS UCSC}
\maketitle
...
\section{Introduction}
\subsection{Subsection Heading Here}
\end{document}
Example.tex

% This is an example.tex
\documentclass {article}
\begin {document}
This is a test
\end {document}
Writing a Document in Latex

Section and subsection

Example.tex

% This is an example.tex

\documentclass [12pt]{article}
\begin {document}
\title {This is an example}
\author {James Bond}
\maketitle
\section {Introduction}
\subsection {Experiment}
\end {document}

(1) latex Example.tex    Example.dvi    (2) dvips Example.dvi    Example.ps
(3) ps2pdf Example.ps    Example.pdf
Online Library: LaTeX Symbols

- https://tex.stackexchange.com/ (Discussion forum)
- http://latex.wikia.com/wiki/List_of_LaTeX_symbols
- https://oeis.org/wiki/List_of_LaTeX_mathematical_symbols
- http://www.ctan.org/
How to Input Math Formulas

• Use $( ... \)$ for in-line and $[ ... \]$ for displaying math formulas.

• Spaces inside $( ... \)$ and $[ ... \]$ are ignored. If needed, use ‘\’ to add space.

• Use \mbox{...} for words inside math formulas.
Standard Environments: Theorem; Equation. Etc.

\begin{env_name}
detail
\end{env_name}

Environment name (env_name) can be document, itemize, enumerate, tabular, etc.

\begin{itemize}
  \item The first item
  \item The second item
\end{itemize}

\begin{enumerate}
  \item The first item
  \item The second item
\end{enumerate}
Cross Referencing

\textit{LaTeX} generates numbers for Theorem, Equation, Section, Figure and other environments automatically. Access them with \texttt{\label} and \texttt{\ref}

\begin{verbatim}
\section{Introduction} \label{sec:intro}

....

In Section \ref{sec:intro}
\end{verbatim}
Writing a Document in Latex

\texttt{\textbackslash userpackages}  \texttt{\textbackslash newcommands}

Install packages on the fly as need be.

Special packages are available for neat description of elegant mathematics and algorithms.

Use multicolumn for lengthy equations and install the requisite packages.

Journal class files use specific packages and provides less trouble while compilation.

LaTeX does not provide a command or environment that matches the criteria. Output produced by existing command may not meet requirements.

Macros

\texttt{\newcommand\{name\}[Num]\{Definition\}}

\textit{A new definition for mod sign in the preamble:}\n\texttt{\newcommand\norm[1]\{\left\vert #1 \right\vert\}}
Writing a Document in Latex

\usepackage{graphicx}
\usepackage{epstopdf}
\usepackage{subfigure}
\usepackage{comment}
\usepackage{amsmath}
\usepackage{amssymb}
\usepackage{algorithm2e}
\usepackage{algorithmicx}

Images and artwork
eps – pdf conversion
Grouping of figures
Comments and margins

Mathematical symbol and environments
\do

Environments for algorithms
Writing a Document in Latex

Equations

Example.tex
\documentclass [12pt]{article}
\begin{document}
\title{This is an example}
\author{James Bond}
\maketitle
\section{Introduction}
\begin{equation}
g_{\gamma_{n}}(t) = \frac{1}{\sqrt{s_n}} g\left(\frac{t-p_n}{s_n}\right) \exp\left\{j(2\pi f_n t + \phi_n)\right\}, \label{eq1}\end{equation}
\end{document}
Writing a Document in Latex

Equations

\documentclass [12pt]{article}
\begin {document}
\title {This is an example}
\author {James Bond}
\maketitle
\section {Introduction}
\begin {equation}
g_{\gamma_{n}}(t) = \frac {1}{\sqrt {s_{n}}} \; g(\frac {t-p_{n}}{s_{n}}) \exp \left\{ j(2\pi f_{n}t+\phi_{n}) \right\}, \label {eq1}\end {equation}
\end {document}
Writing a Document in Latex

Images

Insert figures in pdf, jpg, eps, and other formats into the document.

Separate packages to handle graphics need to be installed.

\begin{figure}
  \centering
  \includegraphics \{name of the figure file\}
  \caption{Put the caption here}
\end{figure}
Writing a Document in Latex

Figures

Example.tex

\documentclass [12pt]{article}
\usepackage \{graphicx\}
\begin{document}

\begin{figure}
\centering
\includegraphics[width=0.80\textwidth]\{Sistina-interno\}
\caption {Sample Figure}
\label {fig1}
\end{figure}

\end{document}
Writing a Document in Latex

Figures

Example.tex

% This is an example.tex
\documentclass [12pt]{article}
\usepackage {epsfig, graphicx}
\begin {document}
\begin {figure}
\epsfxsize =6.5in
\centerline {Sistina-interno.jpg}
\end {figure}
\end {document}
A float object: Latex is opportunist unless the author forces it \{!htb\}.

Use \texttt{subfigure} package for grouping of pictures.

Exercise caution for graphics inclusion about general formatting of the text.

.jpg and .eps serve better than most.

Adhere to the artwork guideline of the journal.
% This is an example.tex

\documentclass[12pt]{article}
\usepackage{epsfig, graphicx}
\begin{document}

\begin{table}
\centering
\begin{tabular}{|c|c|c|c|c|}
\hline
Method & Groups & Normal & Abnormal & Total \\
\hline
LR & Normal & 40 & 11 & 51 \\
& Abnormal & 17 & 22 & 39 \\
\% & Normal & 78.4 & 21.6 & 100 \\
& Abnormal & 43.6 & 56.4 & 100 \\
\hline
\end{tabular}
\caption{Sample Table}
\label{tab1}
\end{table}

\end{document}
Writing a Document in Latex

References within a document

Example.tex

\begin{document}
\section{Introduction}
\label{intro}

This is section on Introduction.

\subsection{experiment}
\label{exp}

This is an example subsection. Please refer Section \ref{intro} for introduction. Refer Section \ref{exp}

\end{document}

Very easy to manage all the references in long documents
Writing a Document in Latex

Citing other works

Example.tex

% This is an example.tex
\documentclass [12pt]{article}
\bibliographystyle {IEEEtran}
\begin {document}
\section {Introduction}
\label {intro}
This is section on Introduction.

\subsection {experiment}
\label {exp}
This is an example subsection. This work is based on the MP algorithm \cite {mallat2}

\bibliography {bibfile}
\end {document}

Order and numbering of the references are automatic
References and Citations

The `\thebibliography` environment produces a bibliography or reference list. In the article style, this reference list is as labeled "References"; in the report style, it is labeled as "Bibliography".

\begin{thebibliography}{widest-label}
\bibitem[label]{cite_key}
\end{thebibliography}

`widest-label`: Text that, when printed, is approximately as wide as the widest item label produces by the `\bibitem` commands.
Reference and Citation

For 10 and 99 publications, start with \begin{thebibliography} [99]. Use any two digit number in the argument, since all numerals are of the same width.

For customized labels, put the longest label in argument, i.e., type. \begin{thebibliography} [Longest-name]
Reference and Citation

\begin{thebibliography}{widest-label}

\bibitem[label]{cite_key} . . .
\end{thebibliography}

- cite_key is used to cite publications inside the document.

- To cite a publication from the reference list, use the \cite command.

- The argument to \cite may be one key, or two or more keys, separated by commas.

One can use the bibTeX package to generate reference list.
Example Document From an IEEE Journal

To write a paper for conferences/journals/transactions:

- Download LaTeX template from IEEE (or from the specific journal website).

  http://www.ieee.org/web/publications/authors/transjnl/index.html

- Open example LaTeX file (bare_jrnl.tex) and modify it.

- No need to worry about things like margin, font, ...

bare_jrnl.tex
Questions!