

A Brief Overview of \LaTeX

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What Is \LaTeX ?

\LaTeX is a document preparation system designed by Leslie Lamport on top of Donald Knuth's \TeX .

- Leslie Lamport. *L^AT_EX: A document preparation system* (Second edition). Addison-Wesley, 1994.
- Michel Goossens, Frank Mittelbach, and Alexander Samarin. *The L^AT_EX Companion*. Addison Wesley Longman, Inc., 1994.

Useful Documentation Websites

The Department of Engineering at the University of Cambridge maintains a useful website

<http://www-h.eng.cam.ac.uk/help/tpl/textprocessing/>
with pointers to lots of useful documentation.

- The T_EX Users Group (TUG) website (<http://www.tug.org>) is a good place to find information.
- Also try the L^AT_EX Project's website at <http://www.latex-project.org/>
- MiK_TE_X: For Windows, public domain, and available at <http://www.miktex.org/>
- Here's a Mac OSX L^AT_EX website: <http://www.esm.psu.edu/mac-tex/>

For Windows:

WinEdt: Available at <http://www.winedt.com> (shareware: \$30 student registration after a 30-day trial period). It can connect to pretty much any version of T_EX, but is preconfigured for MiK_TE_X.

LEd: A free environment for rapid T_EX and L^AT_EX document development. It is available at <http://www.latexeditor.org/>.

Texmaker: A free L^AT_EX editor that integrates many tools needed to develop documents with L^AT_EX in just one application. Texmaker runs on Unix, Mac OS X, and Windows systems and is available at <http://www.xmlmath.net/texmaker/>.

Check the Mac OS X L^AT_EX website (http://mactex-wiki.tug.org/wiki/index.php?title=Main_Page) for Mac editors.

LyX runs on many platforms (<http://www.lyx.org/>).

How Do I Use \LaTeX ?

- Create a \LaTeX source file (filename.tex) containing the content of the document plus \LaTeX commands that describe the logical structure of the document.
- Run \LaTeX on the source file (latex filename.tex).
- \LaTeX formats the document using the formatting rules of the document class specified in the source, putting the output in a device-independent file (filename.dvi).
- The formatted output can be displayed on the screen using `xdvi`, or translated into Postscript using `dvips` and then printed.

How Do I Use PDF \LaTeX ?

- Create a \LaTeX source file (filename.tex) containing the content of the document plus \LaTeX commands that describe the logical structure of the document.
- Run PDF \LaTeX on the source file (pdflatex filename.tex).
- PDF \LaTeX formats the document using the formatting rules of the document class specified in the source, putting the output in a PDF file (no .dvi file).

You must use the command

```
source /usr/local/tex/setup.csh
```

to use LaTeX 2e on our Unix systems. (This command could go in one of the standard files such as your .login file.)

Typical session on our Unix systems:

```
latex file.tex
bibtex file
latex file.tex
latex file.tex
xdvi file.dvi &
dvips -o file.ps file.dvi
lpr -Pamber file.ps
```

```
\documentclass[options]{chosenDocumentClass}
```

```
    preamble
```

```
\begin{document}
```

```
    The content of your document goes here!
```

```
\end{document}
```

article: used for ordinary documents.

Some options: 11pt, 12pt, twoside, twocolumn

report: like article, only for longer documents.

book: for books.

letter: for letters.

seminar, slides or beamer: for slides.

The Title Page

Specify the title, author(s), and date (optional) in the preamble, and generate the title page with the `\maketitle` command.

```
\documentclass{article}
  \title{$P \not= \mathit{NP}$}
  \author{Helen Cameron}
\begin{document}
  \maketitle
  The rest of my article goes here.
\end{document}
```

- Start a new section with `\section{section_title}`.
- Also available `\subsection{subsection_title}` and `\subsubsection{subsubsection_title}`.
- To get unnumbered sections and subsections, use `\section*{section_title}` and `\subsection*{subsection_title}`.

Example:

```
\section{Introduction}
```

Many theoretical computer scientists have hypothesized --- correctly --- that $P \neq \mathit{NP}$, but none were able to prove it. At last, that hypothesis is proved correct.

```
\subsection{The Class  $P$ }
```

The class P consists of all decision problems that can be solved in polynomial time.

```
\subsection{The Class  $\mathit{NP}$ }
```

The class NP consist of all decision problems that can be solved in nondeterministic polynomial time.

- Type in the text of your document mostly as you normally would.
- \LaTeX ignores whitespace (tabs, blanks, newlines) except . . .
- a blank line ends a paragraph.
- \LaTeX ignores the formatting you used when you type in your text and formats it according to the document class you specified.

\LaTeX provides three types of lists:

enumerated list: items are numbered

itemized list: unnumbered items

descriptive lists: items are named

Example: Enumerated List

```
\begin{enumerate}
\item Prove that  $P \neq \mathit{NP}$ .
  \begin{enumerate}
    \item Give an overview of your proof.
    \item Now provide the details.
  \end{enumerate}
\end{enumerate}
```

produces

- 1 Prove that $P \neq NP$.
 - 1 Give an overview of your proof.
 - 2 Now provide the details.

Example: Itemized List

```
\begin{itemize}
  \item I can describe my ideas in point form.
  \item Students like point form.
  \item English professors do not.
\end{itemize}
```

produces

- I can describe my ideas in point form.
- Students like point form.
- English professors do not.

Example: Descriptive List

```
\begin{description}
  \item[Chocolate:] Necessary to my existence.
    Don't get between me and my chocolate!
  \item[Baby carrots:] Nice crunch and healthy, too.
\end{description}
```

produces

Chocolate: Necessary to my existence. Don't get between me and my chocolate!

Baby carrots: Nice crunch and healthy, too.

To produce a list that is inline in a sentence, investigate the `paralist` package.

- In-line equation $\log_2 32 = \log_2 2^5 = 5$ is created with `\log_{2} 32 = \log_{2} 2^{5} = 5`.
- Unnumbered displayed equation

$$\frac{x^2 + x}{x} = x + 1$$

is created by

```
\[  
\frac{x^{2}+x}{x} = x + 1  
\]
```

- Numbered displayed equation

$$\sum_{i=1}^n i = \frac{n(n+1)}{2} \quad (1)$$

is created by

```
\begin{equation}
\sum_{i=1}^n i = \frac{n(n+1)}{2} \quad \label{mysum}
\end{equation}
```

and can be referred to in text as Equation 1 by
`Equation~\ref{mysum}`.

Do *not* use `\frac{numerator}{denominator}` in an in-line formula.

Instead, either use a displayed equation

```
\[
\frac{numerator}{denominator}
\]
```

or use `(numerator)/(denominator)` in an in-line formula.

Consider $\frac{1}{2}$, which produces $\frac{1}{2}$. The digits are too small, and the result is too tall and will make the inter-line spacing look funny.

The result is more readable if you use $1/2$, which produces $1/2$. The result is of `\frac{}{}` is readable only in a displayed formula:

```
\[  
\frac{1}{2}  
\]
```

produces

$$\frac{1}{2}$$

Many Useful Symbols and Math Commands

- Don't type words directly in mathematical expressions.
- For example, if you type $\$log n\$$, you get $logn$. \LaTeX thinks you are multiplying four variables named l , o , g and n , and does not typeset “log” as a word.
- \LaTeX provides many useful commands for commonly-used mathematical words: $\backslash log$, $\backslash ln$, $\backslash lim$, $\backslash sin$, and so on.
- In the above example, you should type $\$\backslash log n\$$ to get $\log n$.
- <http://www.ctan.org/tex-archive/info/symbols/comprehensive/symbols-a4.pdf> contains a comprehensive list of symbols you can use in mathematical expressions and elsewhere.

- \LaTeX can figure out the numbering for you, if you tell it to remember a number with `\label{yourlabelname}`, just as we saw in numbered displayed equations.
- Example: Because I typed

```
\frametitle{Numbering}  
\label{num}
```

I can refer to this section as Slide 26 *anywhere* in this document using `Slide~\ref{num}` and \LaTeX automagically fills in the number for me.

Any number that \LaTeX generates (page numbers, item numbers, section or subsection numbers, figure numbers, equation numbers and so on) can be “captured” using the `\label` command and used elsewhere in your text with the `\ref` command.

Never type the numbers that \LaTeX generated for you. For example, never type “As Figure 1 shows, ...”. Always use `\label` and `\ref`. Make \LaTeX do the work, instead!

\LaTeX can do figures:

```
\begin{figure}  
  Content of the figure goes here.  
  \caption{Caption of the figure.}  
  \label{figurelabel}  
\end{figure}
```

The contents could be text, encapsulated Postscript diagrams, diagrams created with \LaTeX 's own picture environment, a table or anything else that \LaTeX is capable of handling.

Note: Tables, encapsulated Postscript and picture diagrams can all go anywhere in a document, not just in figures.

Encapsulated Postscript

- To include an encapsulated Postscript picture, you must include some package (e.g. graphics, epsfig) that handles pictures.
- You include a package using the `\usepackage{packageName}` command in the preamble.
- Using the graphics package, you can include a picture using `\includegraphics{fileName.eps}`.
- Using the epsfig package, you can include a picture using `\epsfig{file=fileName.eps}`. (You can shrink or expand a picture by specifying a height and/or a width: `\epsfig{file=fileName.eps,width=3cm}`)

Example:

```
\usepackage{graphics} % In the preamble

\begin{center}          % In the body of the document
  \includegraphics{tinyPicture.eps}
\end{center}
```

- Using `pdf \LaTeX` and including the `graphicx` package, you can include PDF image and bitmap images in JPEG (best for photos) or PNG (best for other bitmap images) or GIF.
- Other formats should be converted to PDF.
- `graphicx` allows you to specify width, height, or scale:

```
\includegraphics[width=0.5\textwidth]{boy.png}  
\includegraphics[height=60mm]{cats.jpg}  
\includegraphics[scale=0.5]{myGraphic.png}
```

If you want an abstract in your document (for example, a thesis proposal usually has one), then use the `abstract` environment:

```
\begin{abstract}
```

```
  The negative side-effects of using lock-based  
  synchronization mechanisms are well known.
```

```
\end{abstract}
```


Double-Spaced Document

To double-space your document (for your seminar reports, for example), use

```
\usepackage{setspace}  
\doublespacing
```

in the preamble.

A Period That Does Not End a Sentence

- A period is used to mark the end of sentence in \LaTeX source. (Exception: a period following an uppercase letter does not end a sentence in \LaTeX source.)
- \LaTeX puts a larger amount of space between the end of sentence and the start of the next one than it puts between two words within a sentence.

- You may want to use a period that does not end a sentence.
- Example: in “Cameron et al.”, the period does not end a sentence.
- To tell \LaTeX that a period does not end a sentence, place a backslash followed by a blank immediately after the period.
- Example: “Cameron et al.\ ”
- If you want a period after an uppercase letter to end a sentence, type \@ immediately after the period.

For example:

```
DO NOT REMOVE YOUR LAPTOP CASE.\@  
It would void your warranty.
```

Periods That Don't End Sentences: Examples

Look for common abbreviations. Here are some examples:

et al.: Using “et al.” without a `\cite{}` command immediately after it.

Titles of people: Dr. or Mr. or Mrs. or other abbreviated titles. Type “Dr. \ Peter Graham”, for example.

etc.: Note that you should avoid “etc.” as much as possible and certainly not end a sentence with “etc.”

Special case: “i.e.” and “e.g.” should each be followed immediately by a comma — “i.e.,” and “e.g.,” — so you don't need to type “\ ” after them.

Correct Quotation Marks

Here is what correct quotation marks look like:

“Be careful how you type in your quotes,” she said.

In elementary school, we referred to them as 66 and 99.

To get correct quotes:

Opening double quotes: Type two single back quotes with no space between.

Closing double quotes: Type two single forward (ordinary) quotes with no space between them.

Quoting Someone Else's Words

Remember that you must:

- indent the copied text,
- put quotation marks around the copied text,
- provide a reference to the original document (the one that you copied the text from) immediately before the copied text, and
- provide a complete bibliographic entry for the original document in a “References” section at the end of your document.

```
Gunawi et al.~\cite{gun} conclude that
\begin{quote}
  ‘‘Adding reliability through the
  I/O shepherd was simple in some
  ways and challenging in others.’’
\end{quote}
```

Gunawi et al. [1] conclude that

“Adding reliability through the I/O shepherd was simple in some ways and challenging in others.”

Learn to let \LaTeX do the formatting.

- Microsoft Word makes you do the formatting.
- \LaTeX is expert at formatting.

There's Lots More!

- You can do a table of contents and an index.
- You can split your \LaTeX source into multiple files.
- And there's lots of other things \LaTeX can do!



Haryadi S. Gunawi, Vijayan Prabhakaran, Swetha Krishnan, Andrea C. Arpaci-Dusseau, and Remzi H. Arpaci-Dusseau. Improving file system reliability with I/O shepherding. *ACM SIGOPS Operating Systems Review*, 41(6):293–306, December 2007.