Beginning LaTeX

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A Complete Example

```
\documentclass{article}
\begin{document}
\title{Short Example}
\author{Mark Senn}
\maketitle

This is
the first paragraph.
Note
the indentation.

This is
the second paragraph.
\end{document}
```

Short Example

Mark Senn

September 14, 1999

This is the first paragraph. Note the indentation.

This is the second paragraph.

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Acknowledgements

The following books were used to help prepare this.

The TEXbook by Donald Knuth. ISBN 0-201-13447-0.

LATEX: A Document Preparation System, 2nd edition, by Leslie Lamport. ISBN 0-201-52983-1.

The LATEX Companion by Michel Goossens, Frank Mittelbach, and Alexander Samarin. ISBN 0-201-54199-8.

A Guide to LATEX 2_ε, 2nd edition, by Helmut Kopka and Patrick W. Daly. ISBN 0-201-42777-X.

The Chicago Manual of Style, a standard reference tool for authors, editors, copywriters, and proofreaders. ISBN 0-226-10390-0.

Web Pages

LATEX by Norm Walsh:
`http://www.ora.com/homepages/jasper/texhelp/LaTeX.html`.

LATEX help from Emory University: `http://www.emerson-.emory.edu/services/latex/latex2e/latex2e_toc.html`.

Document Preparation with LATEX, from University of Sterling, UK: `http://www.cs.stir.ac.uk/guides/latex/guide.html`.

Introduction to LATEX:
`http://www.cec.mtu.edu/all/node18.html`.

A Guide to LATEX from the University of Alberta:
`http://ugweb.cs.ualberta.ca/~pub/latex.html`.

Hypertext Help with LATEX:
`http://molscat.giss.nasa.gov/LaTeX`.

What is LaTeX?

LaTeX is a computer program that reads your file containing commands and text for something you want typeset. It normally reads your file whose name ends in '`.tex`' and writes a file whose name ends with '`.dvi`'.

The '`.dvi`' file is device-independent meaning that it can be typeset on a very wide range of output devices. Some of the more common ones are: cheap dot matrix printers, computer screens, laser printers, and expensive phototypesetters.

LaTeX is not a "What You See is What you Get' (WYSIWYG) program. Documents are created in an ordinary editor and then processed by LaTeX to generate a file that can later be printed.

History

Prof. Donald Knuth of the Computer Science Department at Stanford University wrote TeX to publish his seven-volume series of books, *The Art of Computer Programming.* He wasn't happy with other computer typesetting systems in the early '80s. TeX input files specify what the output should look like.

Dr. Leslie Lamport of the Systems Research Center at Digital Equipment Corporation wrote LaTeX while employed at SRI International. LaTeX is based on TeX. LaTeX input files specify the logical structure of a document and LaTeX takes care, to a large extent, of what the document should look like.

Future

LaTeX is being rewritten by Frank Mittelbach, Chris Rowley, and Rainer Schöpf. This endeavor is called the LaTeX3 Project.

The basic goal of the LaTeX3 Project is just to improve on LaTeX 2_ε with no major changes apparent to the normal user. Writing and modifying document classes is easier in LaTeX3.

LaTeX 2.09 vs. LaTeX

LaTeX 2.09 was the first version of LaTeX widely used. It used '`\documentstyle`' instead of '`\documentclass`'.

The current version of LaTeX is LaTeX 2_ε, also known as LaTeX 2e since that's easier to say and write. Besides using the new '`\documentclass`' command it also has a compatibility mode to process documents that use LaTeX 2.09's '`\documentstyle`'.

Now, when most people say LaTeX they mean LaTeX 2_ε, also known as LaTeX 2e.

Use the '`\documentclass`' command for all new documents.

LaTeX Input File Format

`\documentclass`*[options]*{*documentclass*}
preamble (definitions, etc.)
`\begin{document}`
body (what to typeset)
`\end{document}`

Unix Commands

`texspell` *filename*	spell check *filename*`.tex`
`latex` *filename*	process *filename*`.tex` with LaTeX
`xdvi` *filename*	preview *filename*`.dvi`
`dvipr` *filename*	print *filename*`.dvi`
`texclean`	delete LaTeX output files

Document Classes

LaTeX comes with the following document classes: letter, article, report, book, slides.

The "`puthesis`" document class is for Purdue theses.

This document was produced using the seminar document class.

Other document classes are available.

Input Reading Rules

Paragraphs are separated by blank lines.

Spaces at the beginning of a line are ignored.

A newline (carriage return) is equivalent to a space.

Multiple spaces are the same as one space.

A '`%`' starts a comment. The '`%`' and everything after it on that line are ignored.

Text Input Suggestions

Keep all lines 78 characters or less.

Start every sentence on a new line.

Put 'and' at the beginning of a line.

Put "outermost" (not in quotes, parentheses, etc.) comma, semicolon, and colon punctuation at the end of a line.

Indent two spaces when inside an environment.

Indent comments two spaces.

Text Input and Output Example

I typed

```
From The Holy Bible,
King James Version,
Gen.\ 1.3:
\begin{quote}
  And God said,
  let there be light:
  and there was light.
\end{quote}
```

to get

From The Holy Bible, King James Version, Gen. 1.3:

> And God said, let there be light: and there was light.

Display Math Input Suggestions

Keep all lines 78 characters or less.

Start every equation on a new line.

Indent continuation lines two spaces.

Indent two spaces when inside an environment.

Indent comments two spaces.

Display Math Input and Output Example

I typed

```
  % A trigonometric equation with some extra nonsense
  % to demonstrate continuation lines.
\begin{equation}
  \alpha + \beta + \gamma - \alpha - \beta - \gamma
    + (\sin x)^2 + (\cos x)^2 = 1
\end{equation}
```

to get

$$\alpha + \beta + \gamma - \alpha - \beta - \gamma + (\sin x)^2 + (\cos x)^2 = 1 \tag{1}$$

Special Characters

The following characters have special meaning: \$, %, and &. To get them printed normally put a '\' (backslash, also known as virgule) before them.

EXAMPLE: '`\$`' gives '\$'

Basic Command Types

There are three basic command kinds of LaTeX commands:

- Control Sequences (usually known simply as commands)
  cs[options]{*parameter1*}{*parameter2*}...
- Curly Braces Limit Scope
  {*cs* ...}
- Environments
  `\begin`{*env*}
  ⋮
  `\end`{*env*}

Control Sequences

cs[options]{*parameter1*}{*parameter2*}...

This is a control sequence (command) named '*cs*' followed by optional *options* followed by, in some cases, a list of parameters.

Input	**Output**	**Comment**
`\dag`	†	dagger
`\\[1in]`		end current line and skip one inch
`\vspace{2in}`		vertically skip two inches
`$\sqrt{x}$`	$\sqrt{x}$	the $'s are for math mode
`$\sqrt[3]{x}$`	$\sqrt[3]{x}$	the $'s are for math mode
`$\frac{a}{b}$`	$\frac{a}{b}$	the $'s are for math mode

Curly Braces Limit Scope

{*cs* ...}

The '{' and '}' limit the scope of *cs* to within the braces.

Input	**Output**	**Comment**
`I {\bf am} here`	I **am** here	`\bf` is bold face
`I {\Large am} here`	I am here	`\Large` is large

Environment

`\begin{`*env*`}`

⋮

`\end{`*env*`}`

> This begins and ends the environment *env*.

I typed

```
\begin{quotation}
  This is an example quotation.
\end{quotation}
```

to get

> This is an example quotation.

Title, Author, etc.

`\title{`*title*`}`

`\author{`*author's name*`}`

> Use '`\and`' to separate multiple authors.
> Example: '`Joe Jones\and Sam Smith`'.
> Example: '`Joe Jones\and Sam Smith\and Mark Senn`'.

`\date{`*date*`}`

> '`\date`' is optional. If not specified, today's date will be used.

`\maketitle`

Sectioning Commands

`\part{`*part name*`}`

`\chapter{`*chapter name*`}`

`\section{`*section name*`}`

`\subsection{`*subsection name*`}`

`\subsubsection{`*subsubsection name*`}`

`\paragraph{`*paragraph name*`}`

`\subparagraph{`*subparagraph name*`}`

Not all sectioning commands are available in all document classes.

EXAMPLE: '`\section{Intro}`' gives '**Intro**'

Page Control

Normally, LaTeX figures out where to stop one page and go the next. This is called breaking the page.

Use '`\newpage`' to fill rest of page with blank space and go to next page.

Use '`\pagebreak`' to break the column here. For one column output this is the same as using '`\newpage`'.

Use '`\nopagebreak`' to forbid a column page break here.

Use '`\clearpage`' to break the page here and print any pending tables or figures.

Left Justify, Center, Right Justify Text

```
\begin{flushleft}
  Left justify.
\end{flushleft}

\begin{center}
  Center.\\
  Second line.
\end{center}

\begin{flushright}
  Right justify.\\
  Second line.\\
  Third line.
\end{flushright}
```

Left justify.
Center.
Second line.
Right justify.
Second line.
Third line.

Line Control

Normally, LaTeX figures out when to stop one line and go the next.

Use '`\newline`' or '`\\`' to fill rest of line with blank space and go to next line. I use '`\\`' because it is easier to type.

Use '`\linebreak`' to break a line here.

Use '`\nolinebreak`' to forbid a line break here.

Dashes

LaTeX has four kinds of dashes.

The hyphen is used for hyphenated words.

The en-dash is used for separate two parts of a range and is also used in contexts like 'exercise 1.2.6–52'.

The em-dash is used for punctuation in sentences—they are what we often call simply dashes.

The minus sign is used in math formulas.

Hyphens

Hyphens are used for compound words like '32-bit', 'daughter-in-law', 'low-cost', 'state-of-the-art', 'time-critical', and 'X-rated'.

To get a hyphen type '`-`' (one hyphen).

EXAMPLE: '`a 32-bit computer`' gives 'a 32-bit computer'

En-dashes

En-dashes are used for number ranges like ‘pages 13–34’ and also in contexts like ‘exercise 1.2.6–52’.

To get an en-dash type ‘`--`’ (two hyphens).

Example: ‘`read pages 1--5 in`’ gives ‘read pages 1–5 in’

Em-dashes

Em-dashes are used for punctuation in sentences—they are what we often call dashes.

To get an em-dash type ‘`---`’ (three hyphens).

Example: ‘`in sentences---they`’ gives ‘in sentences—they’

Minus Sign

The minus sign is available only in math mode.

To get a minus sign type, '`-`' (one hyphen) while in math mode.

EXAMPLE: '`$a=b-c$`' gives '$a = b - c$'

Quotes

To get a single left quote (‘) type the left quote key (`` ` ``) once.
To get a single right quote (’) type the right quote key (`'`) once.

To get double left quotes (“) type the left quote key (`` ` ``) twice.
To get double right quotes (”) type the right quote key (`'`) twice.

Do not use the double quote key (`"`) on the keyboard.

EXAMPLE: '`` in `single' quotes ``' gives 'in ‘single’ quotes'

EXAMPLE: '``` in ``double'' quotes ```' gives 'in “double” quotes'

Lowercase Letter Doesn't End Sentence

Normally a lowercase letter, period, whitespace sequence ends a sentence.

We need a way to indicate when this sequence isn't the end of a sentence.

Input	**Output**	**Comment**
`Dr.␣Beering`	Dr. Beering	wrong, 'Dr.' ends sentence
`Dr.\␣Beering`	Dr. Beering	wrong, 'Dr.' and 'Beering' could be on different lines
`Dr.~Beering`	Dr. Beering	right, 'Dr.' tied to 'Beering'

Uppercase Letter Does End Sentence

Normally an uppercase letter, period, whitespace sequence does not end a sentence. (LaTeX guesses it is a person's initial even if there are multiple uppercase letters in a row. It only looks at the character immediately before the period.)

We need a way to indicate when this sequence is the end of a sentence.

Input	**Output**	**Comment**
`I␣know␣C.␣␣Yes.`	I know C. Yes.	wrong
`I␣know␣C\@.␣␣Yes.`	I know C. Yes.	right
`I'm␣at␣IBM.␣␣Yes.`	I'm at IBM. Yes.	wrong
`I'm␣at␣IBM\@.␣␣Yes.`	I'm at IBM. Yes.	right

Font Sizes also see "Font Styles" (slide 35)

`\tiny`	Sample
`\scriptsize`	Sample
`\footnotesize`	Sample
`\small`	Sample
`\normalsize`	Sample
`\large`	Sample
`\Large`	Sample
`\LARGE`	Sample
`\huge`	Sample
`\Huge`	Sample

EXAMPLE: '`a {\tiny faint} voice`' gives 'a faint voice'

Font Styles also see "Font Sizes" (slide 36)
"Italic Correction" (slide 36)

`\bf`	**Bold Face**
`\it`	*Italics*
`\rm`	Roman
`\sc`	SMALL CAPS
`\sf`	Sans-serif
`\sl`	*Slanted*
`\tt`	`Typewriter`

EXAMPLE: '`a {\bf major\/} problem`' gives 'a **major** problem'

Italic Correction also see "Font Styles" (slide 37)

When switching from *italic* or *slanted* font to an upright font one should add the *italic correction*, except when a small punctuation character follows.

This is to compensate for the slant of the italic or slanted character so the next character is not too close.

Type '`\/`' to get the italic correction.

Input	**Output**	**Comment**
`{\it strained} beet`	*strained* beet	wrong
`{\it strained\/} beet`	*strained* beet	right
`strained {\it beet}.`	strained *beet*.	right
`strained {\it beet\/}.`	strained *beet*.	wrong

Combination Font Changes

Font changes can be nested.

EXAMPLE: '`{normal, \large large {\it italics\/} large}`' gives 'normal, large *italics* large'

Making Lists

The '`enumerate`' and '`itemize`' environments are used to make lists of items. Enumerate numbers the items and itemize puts bullets in from of items.

See a LaTeX book for a description of the more advanced '`description`' environment that lets you specify how you'd like each item labelled.

Enumerate Environment

The `enumerate` environment numbers items.

I suggest indenting as shown here so it is easy to see where items begin and end.

I typed

```
\begin{enumerate}
  \item This is the first item.
  \item This is the second item.
\end{enumerate}
```

to get

1. This is the first item.
2. This is the second item.

Itemize Environment

The `itemize` environment puts a `\bullet` before each item.

I typed

```
\begin{itemize}
  \item The input for this first item is over one line.
    Input lines after the first are indented.
  \item This is the second item.
\end{itemize}
```

to get

- This input for this first item is over one line. Input lines after the first are indented.
- This is the second item.

Mathematics

Mathematics is typeset two different ways.

Text math is typeset in text like this: $a + b = c$.

Displayed math is typeset on a line by itself with extra vertical space before and after it like this:

$$a = b + c$$

Text Mathematics

To do text mathematics put '`\(`' or '`$`' before the math and '`\)`' or '`$`' after the math. I use '`$`' before and after because it is easier to type.

LaTeX ignores all spaces in text and display math mode.
So, '`$a = b + c$`', would be typeset exactly like '`$a=b+c$`'.

EXAMPLE: '`$a = b - c$`' gives '$a = b - c$'

Display Mathematics

To do display math put '`\[`' before the math and '`\]`' after the math. I suggest indenting display math input by two spaces so it is easy to see where the display math begins and ends.

EXAMPLE:

I typed

```
\[
  a = b + c
\]
```

to get

$$a + b = c$$

Numbered Equations

The '`equation`' environment is used for numbered equations. I suggest indenting display math input by two spaces so it is easy to see where the display math begins and ends.

EXAMPLE:

I typed

```
\begin{equation}
  \sum_1^n = \frac{n(n+1)}{2}
\end{equation}
```

to get

$$\sum_1^n = \frac{n(n+1)}{2} \tag{2}$$

Subscripts and Superscripts

Subscripts and superscripts are only available in math mode.

To make a subscript precede it with '`_`' (underline).
To make a superscript precede it with '`^`' (up arrow).

The examples are mostly shown using subscripts, superscripts work in a similar way.

Input	**Output**	**Comment**
`a_b`	a_b	
`a_bc`	a_bc	
`a_{bc}`	a_{bc}	use braces for grouping
`a_{b_c}`	a_{b_c}	`a_b_c` won't work
`a_b^{c^d}`	$a_b^{c^d}$	mixed subscripts and superscripts

Label and Ref

The '`\label`' control sequence let's you give a chapter, section, equation, etc., a name for use with '`\ref`'.

You can '`\ref`' the name you used in '`\label`' to insert the corresponding chapter, section, equation, etc. number.

EXAMPLE:

```
\begin{equation}
  \label{einstein}
  E = mc^2
\end{equation}
⋮
In equation \ref{einstein}
the relationship between
```

$$E = mc^2 \tag{3}$$

⋮

In equation 3 the relationship between