LaTeX

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LaTeX Documents

A LaTeX source file is an ordinary text file with interspersed typography markup. It may be created with any text editor (Notepad, Textedit, gedit, emacs, vim) or with a dedicated LaTeX editor with syntax highlighting (Texstudio, Texmaker).

This text file will then be processed by a *TeX engine*:
latex, pdflatex, lualatex, xelatex
The result is a .pdf file, which may be printed or read on screen.

The Environment

The most fundamental LaTeX component is the **Environment**. Inside an environment the text gets a special layout and/or special commands are defined.

```
This is a paragraph with some
surrounding text.
\begin{itemize}
  \item This is the first point.
  \item And here comes number two.
  \begin{enumerate}
      \item Multiple levels are possible
    \item They get automatically
      indented and enumerated.
  \end{enumerate}
  \item The last point
\end{itemize}
We also have some text after
the different items.
```

This is a paragraph with some surrounding text.

- This is the first point.
- And here comes number two.
  1. Multiple levels are possible
  2. They get automatically indented and enumerated.
- The last point

We also have some text after the different items.

A Short Document

```
\documentclass{article}
\usepackage{fourier}
\usepackage[swedish]{babel}
\begin{document}
  Här kommer texten till mitt banbrytande dokument.
\end{document}
```

The part between `\documentclass` and `\begin{document}` is called the *preamble,* and may contain definitions special to this document. In particular it may call on *packages* with the `\usepackage` command.

There are also *style options*
`\documentclass[a4paper,12pt]{article}`

Documentclasses

Standard LaTeX:

article report book letter memoir beamer
Journals and conferences often have their own classes.

Local classes

LTHtwocol LTHthesis LTHreport
More classes will be created as needed.

Options for standard classes

10pt 11pt 12pt final a4paper

Special Characters

To get	Write	Used for
$	`\$`	Start and end of math
%	`\%`	Comment to end of line
&	`\&`	Column separator
_	`\_`	Math subscript
#	`\#`	Parameter placeholder
{	`\{`	Start group or parameter
}	`\}`	End group or parameter
^	`\textasciicircum`	Math superscript
\	`\textbackslash`	Command character
~	`\texttildelow`	Non-breaking space

The last three characters require `\usepackage{textcomp}`.
For the last character `\usepackage{url}` is better.

Miscellaneous Commands

Sectioning

```
\chapter{...}   \section{...}  \subsection{...}
\subsubsection{...}
```

Type Size

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

Cross Reference

`\label{`*key*`}` Define the reference. One place.
`\ref{`*key*`}` Use the reference. Many places.

key is any user-defined string. To be safe, use only A..Za..z0..9

New Paragraph and Vertical Space

The command `\par` or an *empty line* ends a paragraph. Any text starts a new paragraph.

To make a stretchable vertical space, use the commands `\smallskip`, `\medskip`, or `\bigskip` respectively. To make a fixed, possibly larger vertical space, use `\vspace{55mm}`. These commands should be used *between* paragraphs.

The paragraph indent and the spacing between paragraphs are decided by the document class. Do not make local changes for each paragraph!

Note!
Some LaTeX tutorials claim that the command `\\` ends a paragraph. This is WRONG!

Multiple command forms

Many commands have multiple forms

- Optional argument:
  `\item[$\spadesuit$]`
- Star-form:
  `\section*{An Unnumbered Section}`

They may sometimes be combined.

The meaning of star-forms and optional arguments vary from command to command, but in practice this is not a problem.

Environments

`\begin{center}...\end{center}`
Centered lines, use `\\` to separate

`\begin{quotation}...\end{quotation}`
Narrower than surrounding text

`{itemize}` and `{enumerate}` as described above.

`\begin{description}...\end{description}`
Labeled items.

In the last three cases the item is started with an `\item` command. The `description` needs an argument: `\item[`*keylabel*`]`.

Grouping

A pair of curly braces `{...}` in the text delimit a *LaTeX group*. Any change made to a property (size, font, width, etc.) is only valid inside the group.

```
Some people like {\footnotesize small text} and others
{\Large tend to shout}. Back to normal size.
```

Some people like small text and others tend to shout. Back to normal size.

A *LaTeX environment* is an implicit group, so after `\begin{center}\LARGE ...\end{center}` the text size would be back to normal.

Type Styles 1

LaTeX type style is specified by three components: shape, series, family.

Italic shape	`\textit{Italic shape}`
SMALL CAPS SHAPE	`\textsc{Small Caps shape}`
Boldface series	`\textbf{Boldface series}`
Roman family	`\textrm{Roman family}`
Sans Serif family	`\textsf{Sans Serif family}`
Typewriter family	`\texttt{Typewriter family}`
Bold italic text	`\textbf{\textit{Bold italic text}}`

Use `\emph{...}` to get *emphasized text* inside other text. `\emph{...\emph{...}...}` will work properly.

These commands work only in text mode. In math mode, use `\mathrm, \mathbf, \mathit` etc.

Type Style 2

Each of the commands in the previous slide have a corresponding *declaration*.

```
{\itshape Italic shape}
{\scshape Small Caps shape}
{\bfseries Boldface series}
{\rmfamily Roman family}
{\sffamily Sans Serif family}
{\ttfamily Typewriter family}
```

The `{\em ...}` declaration corresponds to the `\emph{...}` command.

The old commands `\it \bf \ss \tt` should not be used. They may not work in new versions of important classes.

Verbatim

Short verbatim strings: `\verb? any $ % & # characters?`
Result: `any $ % & # characters`. The special marker may be any nonalphabetic character.

Longer verbatim text is created with the `{verbatim}` environment.

```
\begin{verbatim}
  Text with       & % #  any characters  $ \ } {
  except the special string
\end{verbatim}
```
The special string is `\end{verbatim}`

Result:

```
  Text with       & % #  any characters  $ \ } {
  except the special string
```

Floating Figures and Tables

```
\begin{figure}
  \centering
  %insert the graphics here
  \caption{.....}\label{faa}
 \end{figure}
```

```
\begin{table}
  \caption{.....}\label{taa}
  \centering
  %tabular material here
\end{table}
```

Makes a floating insert. Note different placement of `\caption`. This is a tradition, not a technical requirement. Note also that the `\label` must come after the `\caption`.

Both environments can take an optional argument specifying desired position. Do not use this until the really final version of the document. In particular, do not use the [h] variant at all.

Do not confuse the `{table}` environment with the `{tabular}` environment described later.

Inserting Graphics

The modern TeX engines, typically `pdflatex`, can directly process graphics of type *.pdf*, *.jpg*, *.png*, and through auto-conversion *.eps*.

All known graphics-generating programs can export to one of these formats.

```
\usepackage{graphicx}
...
\begin{center}
  \includegraphics[width=80mm]{drawing}
\end{center}
...
```

Many other options are available. See the documentation for *Packages in 'The Graphics Bundle'* (`texdoc graphicx`)

The Tabular Environment

```
\begin{tabular}{||l|c|r||}
  \hline
  \textit{Name} & \textit{Place} & \textit{Weight}\\
  \hline\hline
  O. Olsson  & Lund      &  73 \\
  F. Baby    & Varying   &   4 \\
  P. Persson & Tokholmen & 110 \\
  \hline
\end{tabular}
```

Name	*Place*	*Weight*
O. Olsson	Lund	73
F. Baby	Varying	4
P. Persson	Tokholmen	110

For professional-looking tables, use the package *booktabs*.

Tabular with *booktabs*

```
\usepackage{booktabs}

    \begin{tabular}{lcr}
    \toprule
    \textit{Name} & \textit{Place} & \textit{Weight}\\
    \midrule
    O. Olsson  & Lund      &  73 \\
    F. Baby    & Varying   &   4 \\
    P. Persson & Tokholmen & 110 \\
    \bottomrule
    \end{tabular}
```

Name	*Place*	*Weight*
O. Olsson	Lund	73
F. Baby	Varying	4
P. Persson	Tokholmen	110

Mathematics

Inline math:
`This formula \( f(x) = x^2 \) is an example.`
Will give:
This formula $f(x) = x^2$ is an example.

`Example:\( \cos2\theta = \cos^2 \theta - \sin^2 \theta \)`
Example: $\cos 2\theta = \cos^2 \theta - \sin^2 \theta$

The pair `\( \)` may also be written `$ $`. A matter of personal taste.

Displayed Math usually needs the `amsmath` package:
`\usepackage{amsmath}` in the preamble.

Math environments 1

```
\begin{equation}
  a = b + c + d
\end{equation}
```

$$a = b + c + d \tag{1}$$

```
\begin{multline}
  a+b+c+d+e+f+g+h\\
  =i+j+k+l+m+n\\
  +o+p+q+r+s
\end{multline}
```

$$\begin{aligned} a+b+c+d+e+f+g+h \\ =i+j+k+l+m+n \\ +o+p+q+r+s \end{aligned} \tag{2}$$

```
\begin{equation}
  \begin{split}
    A &= x + y \\
      &= a + b + c
  \end{split}
\end{equation}
```

$$\begin{aligned} A &= x + y \\ &= a + b + c \end{aligned} \tag{3}$$

The forms `{equation*}` and `{multline*}` get no number.

Math Environments 2

```
\begin{gather}
  a_{1}=b_{1}+c_{1}\\
  a_{2}=b_{2}+c_{2}
        -d_{2}+e_{2}
\end{gather}
```

$$\begin{aligned} a_1 &= b_1 + c_1 && (4)\\ a_2 &= b_2 + c_2 - d_2 + e_2 && (5) \end{aligned}$$

```
\begin{align}
  a_1 &= b_1 + c_1 \notag\\
  a_2 + b_2 &= c_2 + d_2
                + e_2
\end{align}
```

$$\begin{aligned} a_1 &= b_1 + c_1 \\ a_2 + b_2 &= c_2 + d_2 + e_2 \end{aligned} \tag{6}$$

Do not use `{eqnarray}`! It works, but the result is ugly.
Note that `{align}` uses only one `&` to the left of the alignment point.

Math Environments 3

```
\begin{equation}
 \begin{aligned}
  a_{11}+b_{11}&=c_{11} &
    a_{12}&=c_{12}\\
  a_{21}&=b_{21}+c_{21} &
    a_{22}&=b_{22}
 \end{aligned}
\end{equation}
```

$$\begin{aligned} a_{11}+b_{11}&=c_{11} & a_{12}&=c_{12}\\ a_{21}&=b_{21}+c_{21} & a_{22}&=b_{22} \end{aligned} \tag{7}$$

```
\begin{equation}
  \lvert x\rvert =
   \begin{cases}
      -x & \text{if }  x < 0 \\
       x & \text{if }  x\ge 0
  \end{cases}
\end{equation}
```

$$|x| = \begin{cases} -x & \text{if } x < 0 \\ x & \text{if } x \geq 0 \end{cases} \tag{8}$$

Matrices and Fractions

```
    \begin{equation*}
    A = \begin{matrix}
    a_{11} & a_{12} \\
    a_{21} & a_{22}
    \end{matrix}
    \end{equation*}
```

$$A = \begin{matrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{matrix}$$

`{pmatrix}` $A = \begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{pmatrix}$ `{bmatrix}` $A = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}$

`a=\frac{1}{x} + \frac{1}{y}` $a = \frac{1}{x} + \frac{1}{y}$

`b=\frac{\frac{1}{x}+\frac{1}{y}}{y-z}` $b = \frac{\frac{1}{x} + \frac{1}{y}}{y - z}$

Note that a fraction inside a fraction is noticeably smaller. If that is not desired, use `\dfrac`, for *displaystyle fraction*.

Defining and Redefining Commands

`\newcommand{\DRC}{Defining and Redefining Commands}` defines a new command `\DRC` that can be used as an abbreviation for 'Defining and Redefining Commands'.

The new command *must not* exist previously. LaTeX will refuse if it does.

Use `\renewcommand...` to redefine a command, if you really know what you are doing. The command *must* exist previously. LaTeXwill refuse if it does not.

`\newcommand\itbold[1]{\textit{\textbf{#1}}}` defines a command with one parameter, to create `\itbold{bold italic}` ***bold italic*** text.

Defining and Redefining Environments

```
\newenvironment{largebold}{\large\bfseries}{\par}
\begin{largebold}
  The quick brown fox jumps
  over the  lazy dog's back.
\end{largebold}
```

The quick brown fox jumps over the lazy dog's back.

There is also `\renewenvironment{...}`. Same rules as for `\newcommand` and `\renewcommand`

Installing or Accessing LaTeX

On a Mac: MacTeX `http://www.tug.org/mactex/`

On Windows: Two possibilities

TexLive `http://tug.org/texlive/`

MiKTeX `https://miktex.org/`

On Linux: Install through your package manager, or use TeXLive.

In a browser: ShareLatex `https://www.sharelatex.com/`
`https://sharelatex.control.lth.se/`

More Information

LaTeX Wikibook `https://en.wikibooks.org/wiki/LaTeX`

'The Not so Short Introduction to LaTeX 2_ε'. `texdoc lshort`

LaTeX Stackexchange `https://tex.stackexchange.com/`