How to use LaTeX?

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Abstract

Welcome to LaTeX2, the new standard version of the LaTeX Document Preparation System.

This document describes how to use LaTeX. However, this document is only a brief introduction of the features of the LaTeX. It is not a reference manual for LaTeX2 nor is it a complete introduction to LaTeX.

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Chapter 1

Introduction

1.1 What is LaTeX?

LaTeXis a typesetting program, designed to produce publication-quality typeset documents. It is an extension of the original program TEX written by *Donald Knuth*.

In most word processors (like MS Word) all operations are integrated into a single package. However in LaTeX, we type the text and the formatting commands in a text editor and then compile it.

1.2 Why LaTeX?

Creates beautifully typeset technical documents. Very easy to create documents containing lot of mathematics. Even for ordinary text, if you want your document to look really beautiful then LaTeXis the natural choice.

1.3 What is TeXworks?

A text editor for LaTeXto create documents with LaTeXand to typeset them to PDF. Offers at first sight only some limited tools for text editing. Runs on Linux, Mac OS as well as Windows.

1.4 Installation

One needs to install a TEX distribution; a bunch of programmes and other necessary files which will be automatically called by TeXworks during its work. For Windows: an often used distribution is MiKTeX (http://www.miktex.org/).

Chapter 2

Document Structure

2.1 Required Components of a LaTeX Document

Every LaTeX document must contain the following three components. Everything else is optional even text.

\documentclass[options]{class}
Further optional global commands and options, such as
\usepackage{packagename}
\begin{document}
text mixed with typesetting commands
\end{document}
NOTE: LaTeX is case sensitive. Enter all commands in lower case unless explicitly directed to do otherwise.

2.2 Document Classes

The following classes are distributed with LaTeX:

\documentclass{article}
\documentclass{letter}
\documentclass{report}
\documentclass{beamer}
\documentclass{book}
\documentclass{slides}

2.2.1 Document Class Options

Following options are available with document class:

1. Font Size

   10pt 11pt 12pt

2. Paper Size

   letterpaper a4paper legalpaper etc.

3. Page Formats

   onecolumn twocolumn

   For example: \documentclass[11pt,a4paper,twocolumn]{article}

2.2.2 Example

\documentclass{article}
\begin{document}
This is my first document prepared in LaTeX.
I typed it on today.
\end{document}

Note: We have seen that to typeset something in LaTeX, we type in the text to be typeset together with some LaTeXcommands. Words must be separated by spaces (does not matter how many) and lines maybe broken arbitrarily. The end of a paragraph is specified by a blank line in the input. In other words, whenever you want to start a new paragraph, just leave a blank line and proceed.

2.3 Packages

Additional structures are defined by packages, which are loaded by the **\usepackage[options]{package name}** command.

Standard Packages
The standard packages include:
\usepackage{graphicx}
\usepackage{amsmath}
\usepackage{cite}
\usepackage{latexsym}
\usepackage{makeidx}

2.4 Page Style

The command **\pagestyle** controls page numbering and headings.

\pagestyle{plain} is the default, which puts the page number at the center of the bottom of the page and provides no headings.
\pagestyle{empty} provides neither page numbers nor headings.

\pagestyle{headings} will provide page numbers and headings from any sections that you are using.

\pagestyle{myheadings} will provide page numbers and custom headings.

Moreover, we can customize the style for the current page by using the command **\thispagestyle{style}**.

2.5 Font Style

2.5.1 Font Shape

you can choose a text shape with various text commands:

\textit{italics text}
\textsl{slanted text}
\textsc{small caps text}
\textup{upright}

2.5.2 Font Weight

you can also choose text \weight with \text commands:

\textmd{medium weight}
\textbf{boldface weight}

2.5.3 Font Types

you can also choose font types with \text commands:

\textrm{Roman family}
\textsf{Sans serif family}
\texttt{Typewriter\teletype family}

Also, you can use \usepackage{font type} to specify a font type:

\usepackage{avant}
\usepackage{bookman}
\usepackage{chancery}
\usepackage{charter}
\usepackage{courier}
\usepackage{newcent}
\usepackage{palatino}

2.5.4 Font Sizes

You can use the following commands to modify the current font size:

\tiny
\scriptsize
\footnotesize
\normalsize
\large
\Large
\LARGE
\huge
\Huge

2.6 Parts of a Document

Documents (especially longer ones) are divided into chapters, sections and so on. There may be a title part (sometimes even a separate title page) and an abstract.

2.6.1 Title

The 'title' part of a document usually consists of the name of the document, the name of author(s) and sometimes a date. To produce a title, we make use of the commands:

\title{document name}
\author{author names}
\date{date text or \today}

\maketitle

Note: After specifying the arguments of \title, \author and \date, we must issue the command \maketitle for this part to be typeset.

2.6.2 Example 3

\title{Title}
\author{Author 1\ \
Address line 1\ \
Address line 2\ \
Address line 3

\and
Author 2\ \
Address line 1\ \
Address line 2\ \
Address line 3}
\date{Month Date, Year}
\maketitle

2.6.3 Table of Contents, List of Figures, and List of Tables

A table of contents is a special list which contains the section numbers and corresponding headings, together with the page numbers on which they begin. **\tableofcontents** produces a table of contents. **\listoffigures** and **\listoftables** produce a list of figures and list of tables respectively. Standard LATEXcan automatically create these three contents lists.

2.6.4 Abstract

In the document classes article and report, an abstract can be produced by the commands

\begin{abstract}
Abstract Text
\end{abstract}

2.7 Dividing the Document

A book is usually divided into chapters and chapters are divided into sections, sections into subsections and so on.
Sectioning commands in the book, report, and article class:

\chapter (not in article class)
\section
\subsection
\subsubsection
\paragraph
\subparagraph

Chapter 3

Text Formatting

3.1   Text Positioning

The command typesets the text between them exactly at the center of the page.

\begin{center}

....

\end{center}

The command typesets text flush with the right margin.

\begin{flushright}

....

\end{flushright}

The command places the enclosed text flush with the left margin.

\begin{flushleft}

....

\end{flushleft}

3.2   Extended Quotation

If you are going to include an extended quotation from another source, it is important to indicate the difference between the quotation and your words. In LaTeX, surround the quotation with

\begin{quote}

....

\end{quote}

3.3   Bulleted Lists

To create a bulleted list, surround the information with a

\begin{itemize}
\item ....
\item ....
\end{itemize}

3.4   Numbered Lists

To create a numbered list, surround the information with a

\begin{enumerate}
\item ....
\item ....
\end{enumerate}

Chapter 4

Including Graphics

4.1 Graphics Package

While LaTeXcan import virtually any graphics format, Encapsulated Post Script (EPS) is the easiest graphics format to import into LaTeX.

Graphics Package:

Place \usepackage{graphicx} in the preamble.

4.2 Including Graphics Within Your Document

Use fallowing command to include your graphic file in your document.

\includegraphics{graphics file}

You can also specify the height and width:

\includegraphics[height= 2in, width = 3in]{graphics file}

4.3 Figure Placement

As we want to add the figure in document use fallowing syntex:

\begin{figure}[figure location]
\centering
\includegraphics{file name}
\caption{title of figure}
\end{figure}

Optional argument which allows users to specify possible figure locations:

- h (Place the figure in the text where the gure command is located)

- t (Place the figure at the top of the page)

- b (Place the figure at the bottom of a page)

- p (Place the figure on a page containing only oats)

NOTE: If no optional arguments are given, the placement options default to [tbp].

Chapter 5

Tables and Arrays

5.1 Constructing Tables

To construct a table use syntex:
\begin{tabular}{justification}
....
\end{tabular}

The justication should consist of

- 'l' for left justication

- 'c' for centered justication

- 'r' for right justication

NOTE: Separate column entries by a '&', and end each line with a \ \.
Use \hline to construct a horizontal line, and separate the l, c, and rs by a
'|' wherever you want a vertical line.

5.1.1 Example

CODE:

\begin{tabular}{|l|c|r|}
\hline
X & Y & Z \\
\hline
1 & 2 & 3 \\
\hline
\end{tabular}

OUTPUT:

X	Y	Z
1	2	3

5.2 Example

CODE:

\begin{table}[h]
\begin{center}
\caption{title of table}
\lable{reference name}
\begin{tabular}{|l|c|r|}
\hline
X & Y & Z \\
\hline
1 & 2 & 3 \\
\hline
\end{tabular}
\end{center}
\end{table}

OUTPUT:

Table 5.1: title of table

X	Y	Z
1	2	3

5.3 Constructing Arrays

To construct a array use syntex:
\begin{array}{justification}
....
\end{array}

The justication should consist of

- 'l' for left justication

- 'c' for centered justication

- 'r' for right justication

NOTE: Separate column entries by a '&', and end each line with a \ \.
If your array is a matrix, you can surround it with large parentheses \left(
and \right)

5.3.1 Example

CODE:
```
$$
\left(
\begin{array}{rcl}
\alpha & \beta & \gamma\\
\delta & \epsilon & \zeta\\
\eta & \theta & \iota \\
\end{array}
\right)
$$
```

OUTPUT:

$$
\left(
\begin{array}{rcl}
\alpha & \beta & \gamma\\
\delta & \epsilon & \zeta\\
\eta & \theta & \iota
\end{array}
\right)
$$

Chapter 6

Mathematical Typesetting

6.1   Mathematical Formulas

There are two ways to insert mathematical formulas into your document with LaTeX.

One is to have it appear in a paragraph with text. For example α is the first letter of the Greek alphabet. is produced by
$\backslash\alpha$$ is the first letter of the Greek alphabet.

The other way is to have them appear in a separate paragraph. For example

$$\frac{x^n-1}{x-1} = \sum_{k=0}^{n-1} x^k$$

is produced by
$$
\frac{x^n-1}{x-1} = \sum_{k=0}^{n-1}x^k
$$

6.2   Exponents and Subscripts

Use the '^'character (shift + 6), known as a caret, to create exponents:
x^2 produces x^2

If you have an exponent containing more than one character, group the exponent characters inside braces
$x^21 \ne x^{21}$ produces $x^21 \ne x^{21}$

Similarly, subscripts are created using the (underscore character)
$x_21 \ne x_{21}$ produces $x_21 \ne x_{21}$

6.3 Above and Below

It is useful to be able to draw horizontal lines and braces above and below parts of a formula. We can use \overline, \overbrace, \underline, and \underbrace commands to do this.

6.3.1 Example

```
$$
\left(
\begin{array}{c}
m+n\\
m
\end{array}
\right)
= \frac{(m+n)!}{m!n!}
= \frac {\overbrace{(m+n)(m+n-1)\cdots(n+1)}}{\underbrace{m(m-1)\cdots
1}}
$$
```

produce

$$
\left(
\begin{array}{c}
m+n\\
m
\end{array}
\right)
= \frac{(m+n)!}{m!n!} = \frac{\overbrace{(m+n)(m+n-1)\cdots(n+1)}}{\underbrace{m(m-1)\cdots1}}
$$

6.3.2 Example

```
$\overline{x+\overline{y}} = \overline{x}+y$
```

produce

$$\overline{x+\overline{y}} = \overline{x} + y$$

6.4 Sums and Integrals

```
$$
\sum_{k=0}^\infty \frac{(-1)^k}{k+1} = \int_0^1 \frac{dx}{1+x}
$$
```

produce

$$\sum_{k=0}^{\infty} \frac{(-1)^k}{k+1} = \int_0^1 \frac{dx}{1+x}$$

6.5 Limits

```
$$
\lim_{x\rightarrow 0} \frac{\sin x}{x} = 1
$$
```

produce

$$\lim_{x\to 0} \frac{\sin x}{x} = 1$$

6.6 Multi-line Equations

```
\begin{align*}
(a+b)^2 & = (a+b)(a+b)\\
& = a^2+ab+ba+b^\\
& = a^2+2ab+b^2
\end{align*}
```

produce

$$\begin{aligned}
(a + b)^2 = (a + b)(a + b) \\
= a^2 + ab + ba + b^2 \\
= a^2 + 2ab + b^2
\end{aligned}$$

Equations with proper numbering

```
\begin{align}
(a+b)^2 & = (a+b)(a+b)\\
& = a^2+ab+ba+b^\\
& = a^2+2ab+b^2
\end{align}
```

produce

$$(a+b)^2 = (a+b)(a+b) \tag{6.1}$$
$$= a^2 + ab + ba + b^2 \tag{6.2}$$
$$= a^2 + 2ab + b^2 \tag{6.3}$$

6.7   Text in Math

Use the command \mbox{your text here} to include short phrases in any math environment, but \intertext{your text here} is use in align math environment only.

For example

```
$$
\int_0^{2\pi}\cos(mx)\,dx = 0 \hspace{1cm}
\mbox{if and only if} \hspace{1cm} m \ne 0
$$
```
produces

$$\int_0^{2\pi} \cos(mx)\, dx = 0 \qquad \text{if and only if} \qquad m \neq 0$$

Chapter 7

Bibliography

Bibliography is the environment which helps the author to cross-reference one publication from the list of sources at the end of the document. LATEXhelps authors to write a well structured bibliography.

7.1   thebibliography Environment

To produce bibliography, one has to use

\begin{thebibliography}{widest-label}
\bibitem{key1}
\bibitem{key2}
\end{thebibliography}

Use the command \bibitem to separate the entries in the bibliography and use \cite to refer to a specic entry from this list in the document. Width of the widest label is mandatory in \begin{thebibliography}{widestlabel} command.
If you know you would have between 10 and 99 citations, you should start with
\begin{thebibliography}{99}
Each entry in the environment should start with \bibitem{key1}
If the author name is Alex and year 1991, the key can be coded as ale91. This key is used to cite the publication within the document text. However, the argument to \cite can also be two or more keys, separated by commas. For example
\cite{key1,key2}
You may also add a note to your citation, such as page number, chapter number etc.
For example

\cite[page 25]{key1}

7.2   Example

\begin{thebibliography}{9}
\bibitem{les85}Leslie Lamport, 1985. \emph{\LaTeX—A Document
Preparation System—Users Guide and Reference Manual},
Addision-Wesley, Reading.
\bibitem{don89}Donald E. Knuth, 1989. \emph{Typesetting Concrete
Mathematics}, TUGBoat, 10(1):31-36.
\bibitem{rondon89}Ronald L. Graham, Donald E. Knuth, and Ore Patash-
nik,
1989. \emph{Concrete Mathematics: A Foundation for Computer Science},
Addison-Wesley, Reading.
\end{thebibliography}

produces the following output

Bibliography

[1] Leslie Lamport, 1985. *LaTeX—A Document Preparation System—Users Guide and Reference Manual*, Addision-Wesley, Reading.

[2] Donald E. Knuth, 1989. *Typesetting Concrete Mathematics*, TUGBoat, 10(1):31-36.

[3] Ronald L. Graham, Donald E. Knuth, and Ore Patashnik, 1989. *Concrete Mathematics: A Foundation for Computer Science*, Addison-Wesley, Reading.