

Latex Guide

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Oct. 20, 1996

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1 Introduction

This is a collection of materials about Latex, it's a guide on how to write a Latex file, and make to output more beautiful. And this is for MATH 602.

2 A General Structure of a Latex Document

Following is a general structure shared by the majority of Latex document files.

```
\documentclass{article}
\begin{document}
\title{Latex Bones}
\author{Dreamer}
\maketitle
You can put text here.
\end{document}
```

To start a new paragraph, skip a line.

3 Forms

Here are some commands you can use to maintain your documents' output form.

- `\documentclass{article}`: the document class declaration, some options such as: `\documentclass[12pt,oneside]{article}`
- `\begin{document}` and `\end{document}`: delimiting the body of the document;
- `\title` and `\author`: declarations, also known as *top matter* declarations;
- `\maketitle`: to display the top matter;
- `\tableofcontents`: as title, after `\begin{document}`.
- `\newpage`: as title
- `\section`: as title, but it'll be numbered automatically
- `\verb+**+`: use for citation
- `\emph{ab}`: to emphasize *ab*
- `\texttt{ab}` or `{\bf ab}`: to produce **ab**
- `\large{a}`: a
- `\underline{aa}`: aa
- `\hskip`, `\vskip`

- `\": ö`
- `\#`: #

The part of a Latex document file that lies between `\documentclass{article}` and `\begin{document}` is called the **preamble**. In our sketch example above, the preamble is empty. Normally the preamble contains:

- `\usepackage`: such as `\usepackage{amsmath,amssymb,asmthm}`, to activate additional math constructions(amsmath), symbols (amssymb) and `\theoremstyle`, `\proof` environment (asmthm)
- `\textwidth`: for example `\textwidth=160truemm`
- `\textheight`: for example `\textheight=215truemm`
- `\oddsidemargin`: for example `\oddsidemargin=-2truemm`
- `\null\vspace`: for example `\null\vspace{21truemm}`
- `\topmargin`: for example `\topmargin=-10truemm`
- `\thispagestyle`: for example `\thispagestyle{empty}`
- `\nopagenumbers`
- `\newtheorem`: control theorem-like environments, mainly in the way it'll be numbered
- `\newcommand`: macro or abbreviation

4 Environments

An *environment* is a part of the body of a document file that is delimited by `\begin{<name>}` and `\end{<name>}`, where `<name>` specifies the type of environment. Latex makes extensive use of environments.

- `\begin{verbatim}`, `\end{verbatim}`: use for citation.
- `\begin{itemize}`, `\item ***`, `\end{itemize}`: to list parallel items
- `\(` and `\)`: delimiting the math mode within a paragraph of text, and `***$` works too
- `\[` and `\]` or `\begin{displaymath}` `end{displaymath}`: delimiting the math mode, not numbered
- `\begin{equation}` `\label{**}` `\end{equation}`: equation, (it'll be numbered, so we can put label here)
- `\begin{flushright}` `***` `end{flushright}`:

There are also a great many other useful environments such as `quotation`, `table`, `figure`, `enumerate`, `array`, `eqnarray`, `theorem`, `lemma`, `corollary` and `proof`. See the Example section.

5 Mathematical Formula

They should be put in math mode.

- `\frac{a}{b}`: $\frac{a}{b}$
- `c^*`: c^* , if * represent more than 1 character, use `{*}` to delimit it
- `c_*`: c_*
- `\sum`: \sum
- `\infty`: ∞
- `\int`: \int
- `\sqrt a`: \sqrt{a}
- `\binom{n}{i}`: $\binom{n}{i}$
- `\mathbb{a}`: blackboard bold of a, such as `\mathbb{R}`: \mathbb{R}
- `\pi`: π
- `\varnothing`: \varnothing
- `\aleph`: \aleph
- `\ldots`: \dots
- `\bigcup`: \bigcup
- `\oplus`: \oplus
- `\cal A`: \mathcal{A}
- `\Bbb A`: \mathbb{A}
- `\mbox{Tr}`: Tr
- `\partial`: ∂
- `\rightarrow`: \rightarrow
- `\longrightarrow`: \longrightarrow
- `\rightharpoonup`: \rightharpoonup

- `\leftharpoonup`: \leftarrow
- `\longmapsto`: \longmapsto
- `\langle`: \langle
- `\rangle`: \rangle
- `\otimes`: \otimes
- `\cdot`: \cdot
- `\beta`: β
- `\gamma`: γ
- `\scriptscriptstyle A`: A
- `\Delta`: Δ
- `\times`: \times
- `\frac k`: $\frac{k}{}$
- `\wedge`: \wedge
- `\eta`: η
- `\perp`: \perp
- `\bowtie`: \bowtie
- `\varepsilon`: ε
- `\tilde{\pi}`: $\tilde{\pi}$
- `\bar{x}`: \bar{x}
- `\tiny g`: g

6 Examples

Example 1.

New commands and macros are introduced by means of `\newcommand`. Thus

```
\newcommand{\RR}{\mathbb{R}}
```

defines `\RR` to be a macro or abbreviation for `\mathbb{R}`.

Example 2.

For displayed math material such as

$$\int_0^{\infty} e^{-x^2} dx = \frac{\sqrt{\pi}}{2}$$

use `\[` and `\]`, as in `\[\int_0^\infty e^{-x^2} dx = \frac{\sqrt{\pi}}{2}\]`.

Example 3.

Following text:

```
\begin{theorem}[Cantor's Theorem]
  The real number system,  $\mathbb{R}$ , is uncountable.
\end{theorem}
```

will give you

Theorem 1 (Cantor's Theorem) *The real number system, \mathbb{R} , is uncountable.*

Example 4.

By

```
\begin{equation}
  \label{bt}
  (A+B)^n = \sum_{i=0}^n \binom{n}{i} A^i B^{n-i} \ , .
\end{equation}
```

we can get

$$(A + B)^n = \sum_{i=0}^n \binom{n}{i} A^i B^{n-i} . \tag{1}$$

Example 5.

This is an example of enumerate environment:

```
\begin{enumerate}
  \item a well-written reference manual;
  \item automatic numbering and cross referencing of
    \begin{enumerate}
      \item sections
      \item equations
      \item tables
      \item figures
      \item \emph{etc}.
    \end{enumerate}
  \item convenient bibliographic citations;
  \item special environments for tables and figures.
\end{enumerate}
```

produces:

1. a well-written reference manual;
2. automatic numbering and cross referencing of
 - (a) sections

Table 1: Grades earned by political leaders

Last Name	Score	Letter Grade
Clinton	95	A
Dole	95	A
Gingrich	95	A

- (b) equations
- (c) tables
- (d) figures
- (e) *etc.*

3. convenient bibliographic citations;
4. special environments for tables and figures.

Example 6.

Following is a table:

```

\begin{table}
  \begin{center}
    \caption{Grades earned by political leaders}
    \label{grades}
    \begin{tabular}{|l|c|c|}
      \hline
      Last Name & Score & Letter Grade \\ \hline
      Clinton & 95 & A \\ \hline
      Dole & 95 & A \\ \hline
      Gingrich & 95 & A \\ \hline
    \end{tabular}
  \end{center}
\end{table}

```

which looks like that table in the top of this page.

7 Other Aspects

7.1 Top Matter All of the top matter items are optional and can be omitted.

- `\author{**}`
- `\address{**}`
- `\curraddr`: current address
- `\email`: for multi-aanother, repeat above terms

- `\title: \title[LX]{Latex Guide}`, LX for head, In the long title, line breaks are indicated by `\\`
- `\abstract: \begin{abstract} *** \end{abstract}`
- `\subclass`: AMS subject classifications
- `\keywords`: AMS keywords
- `\thanks{**}`: acknowledge support, etc, can be repeated
- `\dedicatory{***}`: dedication
- `\date`

7.2 Document Classes

The general Latex document classes:

- `article` (for a journal article);
- `slides` (for slides or transparencies);
- `letter` (for letters to be put in envelopes and mailed);
- `proc` (for a conference proceedings article);
- `report` (for a report);
- `book` (for a book).

Other available classes:

- `amsart` (an AMS variant of the `article` class);
- `amsproc`;
- `amsbook`;

7.3 Labeling

With the `article` or `amsart` document class, the body of the article is usually automatically numbered, such as sections by means of `\section` commands, so how to refer to them? Using labeling.

For instance

```
\section{Other Aspects}
\label{o-a}
```

Then when we use `\ref{o-a}`, it produces 7, the number of the this section.

The `\ref` and `\label` commands are used to other numbered environments such as theorems, figures, tables, and displayed equations. Anyway you can do it by yourself.

7.4 Theorem-Like Environments

You must specify all of your theorem-like environments in the preamble, using `\newtheorem`. Typically your preamble will contain something like


```

\theoremstyle{plain}
\newtheorem{theorem}{Theorem}[section]
\newtheorem{lemma}[theorem]{Lemma}
\newtheorem{corollary}[theorem]{Corollary}

\theoremstyle{definition}
\newtheorem{definition}[theorem]{Definition}

\theoremstyle{remark}
\newtheorem{remark}[theorem]{Remark}

```

this defines the way to display Theorems, Lemmas, *etc.*

To control the numbering of Theorems, Lemmas, *etc.*, we can do like this:

```
\newtheorem{theorem}{Theorem}[section]
```

causes Theorems to be numbered within each section, while

```
\newtheorem{lemma}[theorem]{Lemma}
```

causes Lemmas to be numbered in the same sequence with Theorems.

7.5 Bibliographical Citations

A bibliography at the end of an article is created by a `thebibliography` environment: `\begin{thebibliography}{99}, **\end{thebibliography}`.

Within the `thebibliography` environment, `\bibitem` commands are used to separate and label individual bibliographical items. The items can then be cited by means of `\cite` commands.

For example,

```

\begin{thebibliography}{99}
\bibitem{companion}
  \emph{The Latex Companion}, by Goossens, Mittelbach,
  and Samarin; Addison-Wesley, 1994.
\bibitem{manual}
  Leslie Lamport, \emph{\LaTeX:} A Document Preparation
  System}; Second Edition, Addison-Wesley, 1994.
\end{thebibliography}

```

Here `companion` and `manual` are labels.