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The Small Book of

Latex

Introduction to LaTeXand
how to use to write articles and books

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Dedication

This book is dedicated to summerize the knowledge I learned about LaTeX.

Meanwhile, I record the experience of using LaTeXto write article and books.

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Chapter 1

Environment

The operating system is Ubuntu 20.04.1 LTS.

The text editor is Emacs.

The installation of Emacs is as follows:

```
1 sudo apt install emacs
```

The installation of LaTex and some packages is as follows:

```
1 sudo apt install texlive-latex-base
2 sudo apt install texlive-xetex
3 sudo apt install texlive-full
```

Chapter 2

What is LaTeX

2.1 What is LaTeX

LaTeXis a document markup language.

2.2 LaTeX's Properties

1. LaTeXis portable in three ways:
   (a) The source code is open.
   (b) The implementation is in plain text.
   (c) The output is in multiple format: PDF, DVI, PostScript, HTML.
2. Protect your work:
   (a) compatibility (plain text)

(b) no viruses (plain text)

2.3 Reason to Use It

Becuase LaTeXis a markup language, you should learn it before you can use it. So why should you spend so much time to learn it while there is so much document creator like Word, Pages?

There is several reasons that push me to select it:

powerful: LaTeXprovides powerful edit ability. You can almost get whatever you want to show, especially the mathematical equations. Other document editor is less powerful in equations editing.

easy to alter: Because LaTeXseperate the format and the content, it is easy to do format alteration in the full document domain, for example change the style of the capter.

one for all: Once you create your own template, it is easy to wreate document with the template applied, saving so much time in format. The disadvantage is that you spend more time in the first time.

Chapter 3

LaTeX Base

3.1 Hello World in LaTeX

```
1  \documentclass[a4paper,11pt]{article} % specify the document
       class, different class for different purpose.
2  \begin{document}
3  \title{Example}
4  \author{Mike Chyson}
5  \date{Thu Jan 3 16:22:11 CST 2019}
6  \maketitle % make a title according to the title and author etc.
7  \section{What's this?}
8  This is simple document. It contains a title and a section with
       text.
9  \end{document}
```

The output is as follows:

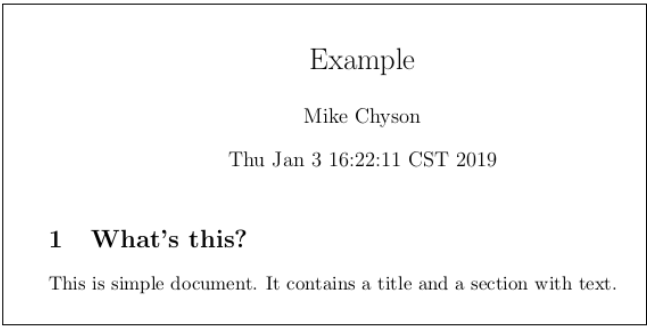

Figure 3.1: Example

Because the seperation of the format and the content, you do not specify the font size, font color, font family and so on. Instead, you tell LaTeXit is a `title`, or `author` or `date` and so on. LaTeXformat them for you. As if there is a logical layer between the appearance and the content.

3.2 Document Structure

A LaTeXdocument doesn't stand alone commonly the document is based on a versatile template. Such a fundamental template is called a class. It provides customizable features, usually built for a certain purpose.

This first part of the document is called the preamble of the document. This is where we choose the class, specify properties, and in general, make document-wide definitions.

The first line starts with `\documentclass`. This word begins with a backslash; such a word is called a **command**. We used

commands to specify the class and to state document properties: `title` , `author` , and `date`.

```
preamble
body
```

3.3 LaTeXCommand

```
1 \command
2 \command{argument}
3 \command[optional argument]{argument}
```

3.4 Comment

The percent sing(%) introduces a **comment**.

3.5 Create Your Own Commands

3.5.1 With No Arguments

```
1 \newcommand{\TUG}{TeX Users Group}
2 \TUG
```

3.5.2 With Arguments

```
\newcommand{\keyword}[1]{\textbf{#1}}
\keyword{declrations}
```

3.5.3 With Optional Arguments

```
\newcommand{\keyword2}[2][\bfseries]{{#1#2}}
\keyword2[\itshape]{declarations}
```

3.6 Breaking Lines

```
\\ % end a line
\newline % has the same effect with \\
\linebreak % tells LeTeX to end the line but to keep the full justification
\\[3mm] % insert additional vertical space after the break depending on the value
\linebreak[4] % can be used to influence the line break slightly or strongly:
%% If number is 0, a line break is allowed, 1 means it's desired, 2 and 3 mark more
%% insistent requests, and 4 will force it. The latter is the default behavior if no number
%% was given.
\nolinebreak
```

3.7 Breaking Pages

```
1 \pagebreak
2 \newpage
3 \nopagebreak
```

3.8 Get Help

Three ways to get help about the package:

- Use the `texdoc` command:

```
1 texdoc <package>
```

- Use the `kpsewhich` command:

```
1 kpsewhich <package>.sty
```

- Visit the website: http://ctan.org/pkg

Chapter 4

Font

4.1 Shape

Table 4.1: Font Command

Command	Explaination	Output
`\textbf`	bold font	**Example**
`\textit`	italic	*Example*
`\textsl`	slated	*Example*
`\textsc`	small caps	Example
`\textup`		Example
`\textmd`	medium	Example
`\textnormal`		Example

Table 4.2: Font Declaration

Declaration	Explaination	Output
`\itshape`	italic	*Example*
`\bfseries`	bold font	**Example**
`\slshape`	slated	*Example*
`\scshape`	small caps	Example
`\upshape`		Example
`\mdseries`	medium	Example
`\normalfont`		Example

Table 4.3: Font Emphasized

Command	Explaination	Output
`\emph`	emphasized	*Example*

4.2 Family

Table 4.4: Font Family

Command or Declariation	Explaination	Output
`\textsf`	sans-serif	Example
`\texttt`	typewritter	`Example`
`\textrm`	Roman	Example

4.3 Size

Table 4.5: Font Size

Command	Output
`\tiny`	Example
`\scriptsize`	Example
`\footnotesize`	Example
`\small`	Example
`\normalsize`	Example
`\large`	Example
`\Large`	Example
`\LARGE`	Example
`\huge`	Example
`\Huge`	Example

Chapter 5

Box

```
\quad\parbox[b]{1.8cm}{this parbox is aligned at its bottom
    line}
```

this parbox
is aligned at
its bottom
line

```
\quad\parbox{1.5cm}{center−aligned parbox}
```

center-
aligned
parbox

```
1 \quad\parbox[t]{2cm}{another parbox aligned at its top line}
```

another par-
box aligned
at its top line

```
1 \mbox{Hello World}
```

Hello World

Chapter 6

Justification

```
\parbox{3cm}{\raggedright hello} % \raggedright
{\centering hello} % \centering
\begin{center} % environment
  hello
\end{center}
```

Chapter 7

Designing Pages

7.1 Defining the Overall Layout

```
1  \usepackage[a4paper, inner=1.5cm, outer=3cm, top=2cm,
       bottom=3cm, bindingoffset=1cm, landscape]{geometry}
2  %% paper=name
3  %% paperwidth=7in
4  %% paperheight=10in
5  %% papersize={7in,10in}
6  %% landscape
7  %% portrait
8  %% textwidth=140mm
9  %% textheight=180mm
10 %% lines=25
```

```
11  %% includedhead % cause the header of the page to be included
        into the body area
12  %% includefoot
13  %% left=2cm
14  %% right=2cm
15  %% bindingoffset % reserves space on the left margin (one-size),
        respectively the inner margin (two-sided) for the binding
16
17  %% default margin ratio:
18  %% top:bottom = 2:3
19  %% left:right = 1:1 for one-side documents
20  %% inner:outer = 2:3 for two-side documents
```

```
1  \usepackage[onehalfspacing]{setspace}
2  %% singlespacing, onehalfspacing, doublespacing
3  %% \begin{spacing}{2.4}
4  %% This text is stretched by a factor of 2.4.
5  %% \end{spacing}
```

```
1  \documentclass[a4paper,12pt,twocolumn]{book} % the
       document class book, suitable for book-like documents
2  %% book, report, article, slides, letter
3  %% oneside or twoside
4  %% openright or openany % only support book and report
5  %% titlepage or notitlepage
6  %% final or draft: If draft is set, then LaTeX will mark overfull
       lines with a black box, which is helpful in reviewing and
       improving the output.
```

```
%% openbib : When this option is set, a bibliography would be formatted in open style instead of compressed style.
%% fleqn : Causes displayed formulas to be left−aligned.
%% leqno : For numbered displayed formulas, the number would be put to the left side. The right side is the default.
```

7.2 Creating a Table of Contents

```
\tableofcontents
```

7.3 Designing Headers and Footers

```
\usepackage{fancyhdr}
\fancyhf{}
\fancyhead[LE]{\leftmark}
\fancyhead[RO]{\nouppercase{\rightmark}}
\fancyfoot[LE,RO]{\thepage}
\pagestyle{fancy}
```

Chapter 8

Footnotes

```
1  \footnote{hello world}
2  \section[title without footnote]{This is a section\protect\
       footnote{section footnote}}
3
4  \footnote[number]{text}
5
6  \footnotemark[number] % produces a superscripted number in
       the text as a
7  % footnote mark. If the optional argument wasn't given, it's also
        stepping and using
8  % the internal footnote counter. No footnote will be generated.
9
10 \footnotetext[number]{text} % generates a footnote without
       putting a
```

```
11 % footnote mark into the text without stepping the internal
       footnote counter.
12
13 \footnoterule % used to alter the footnote line
14
15 \renewcommand{\footnoterule}{\noindent\smash{\rule[3pt]{\
       textwidth}{0.4pt}}}
16 % \rule[raising]{width}{height} draws a line, here 0.4 pt thick,
       and as wide as the text, raised a bit by 3 pt.
17 % \smash , let the line pretend to have a height and a depth of
       zero, so it's occupying no vertical space at all.
```

Example:

```
1 Hello World\footnote{hello world}
```

Hello World[a].

[a] hello world

Chapter 9

Lists

9.1 Bulleted Lists

```
\begin{itemize}
\item geometry
\item amsmath
\end{itemize}
```

- geometry
- amsmath

9.2 Numbered Lists

```
\begin{enumerate}
\item geometry
\item amsmath
\end{enumerate}
```

1. geometry
2. amsmath

9.3 Definition Lists

```
\begin{description}
\item[paralist] provides compact lists and list versions that
  can be used within paragraphs, helps to customize labels and
  layout
\item[enumitem] gives control over labels and lengths
  in all kind of lists
\item[mdwlist] is useful to customize description lists, it
  even allows multi−line labels. It features compact lists and
  the capability to suspend and resume.
\item[desclist] offers more flexibility in definition list
\item[multenum] produces vertical enumeration in multiple
  columns
\end{description}
```

paralist provides compact lists and list versions that can be used within paragraphs, helps to customize labels and layout

enumitem gives control over labels and lengths in all kind of lists

mdwlist is useful to customize description lists, it even allows multi-line labels. It features compact lists and the capability to suspend and resume.

desclist offers more flexibility in definition list

multenum produces vertical enumeration in multiple columns

Chapter 10

Tables

```
1  \newcommand{\head}[1]{\textnormal{\textbf{#1}}}
2  \begin{tabular}{ccc}
3    \hline
4    \head{Command} & \head{Declaration} & \head{Output} \\
5    \hline
6    \verb|\textrm| & \verb|\rmfamily| & \rmfamily Example text
           \\
7    \verb|\textsf| & \verb|\sffamily| & \sffamily Example text \\
8    \verb|\texttt| & \verb|\ttfamily| & \ttfamily Example text \\
9    \hline
10 \end{tabular}
```

Command	Declaration	Output
\textrm	\rmfamily	Example text
\textsf	\sffamily	Example text
\texttt	\ttfamily	Example text

```
1
2   \usepackage{booktabs} % toprule, midrule, bottomrule
3
4   \begin{tabular}{ccc}
5     \toprule[1.5pt] % British typesetters call a line a rule
6     \head{Command} & \head{Declaration}& \head{Output}\\
7     \midrule %
8     \verb|\textrm| & \verb|\rmfamily| & \rmfamily Example text
            \\
9     \verb|\textsf| & \verb|\sffamily| & \sffamily Example text \\
10    \verb|\texttt| & \verb|\ttfamily| & \ttfamily Example text \\
11    \bottomrule[1.5pt] %
12  \end{tabular}
```

Command	Declaration	Output
`\textrm`	`\rmfamily`	Example text
`\textsf`	`\sffamily`	Example text
`\texttt`	`\ttfamily`	`Example text`

To avoid the table exceed out the page:

```
\resizebox{\textwidth}{!}{
  ...
}
```

To wrap automatically in cell, use the `p{width}` parameter. For example:

```
1
2  \begin{table}[htb!]
3    \centering
4    \begin{tabular}{p{0.3\columnwidth}p{0.3\columnwidth}p{0.3\
         columnwidth}}
5      \toprule{}
6      & \head{advantage} & \head{disadvantage} \\
7      \midrule
8      multiple processes & each process runs independently &
           communication and data sharing can be inconvenient \\
9      multiple threads & can communicate simply by data sharing &
           more complex than single--threaded program\\
10     \bottomrule
11   \end{tabular}
12   \caption{multiple processes and multiple threads}
13 \end{table}
```

	advantage	**disadvantage**
multiple processes	each process runs independently	communication and data sharing can be inconvenient
multiple threads	can communicate simply by data sharing	more complex than single-threaded program

Table 10.1: multiple processes and multiple threads

Chapter 11

Figure

```
1  \usepackage{graphicx}
2  \begin{figure}
3    \centering
4    \includegraphics[width=0.8\textwidth]{zm.jpg} % include
         picture
5  \end{figure}
```

Chapter 12

Cross Referencing

```
1  \label % mark the label
2  \ref % refer after marking
3  \pageref
4  % notice, typeset twice to produce the corrent reference
5
6  % If the \label command appeared in ordinary text, then the
       current sectional unit,
7  % like the chapter or the section, would be assigned.
8  % If the \label would be placed within a numbered environment,
        that environment
9  % would be assigned to the key.
10
11 \newcommand{\fullref}[1]{\ref{#1} on page~\pageref{#1}}
```

For example:

```
1 Hello World\label{hello-label}
2
3 Refer to \ref{hello-label}
```

Hello World
Refer to 12

Chapter 13

Content

Table 13.1: Content

Command	Level
\part	-1 (book and report class)
\chapter	0 (not available in article)
\section	1
\subsection	2
\subsubsection	3
\paragraph	4
\subparagraph	5

Chapter 14

Math

14.1 Basic Formula

```
\section*{Quadratic equations}
\begin{equation}
  \label{quad}
  ax^2 + bx + c = 0,
\end{equation}
where \( a, b\) and \( c \) are constants and \( a \neq 0 \),
has two solutions for the variable \( x \):
\begin{equation}
  \label{root}
  x_{1,2} = \frac{-b \pm \sqrt{b^2 -4ac}}{2a}.
\end{equation}
If the \emph{discriminant} \( \Detla \) with
```

```
13  \[ \Delta = b^2 - 4ac \]
14  is zero, then the equation (\ref{quad}) has a double solution:
15  (\ref{root}) becomes
16  \[ x = - \frac{b}{2a}. \]
```

14.2 Expressions within Text

LaTeX provides the math environment in-text formulas:

```
1  \begin{math}
2    expression
3  \end{math}
```

LaTeX offers an alias that's doing the same:

```
1  \( expression \)
```

A third way is by using a shortcut, coming from TeX:

```
1  $expression$
```

For example:

```
1  This is an equation: $x^2 + x = 10$
```

This is an equation: $x^2 + x = 10$

14.3 Displaying Formula

```
\begin{displaymath}
  expression % displayed formula, centered
\end{displaymath}
```

There are shortcuts:

```
\[
  expression
\]
```

```
$$
expression
$$
```

For example:

```
\begin{displaymath}
  x^2 + x = 10
\end{displaymath}
```

$$x^2 + x = 10$$

14.4 Numbering Equations

```
\begin{equation}
  \label{newton}
  F = ma^2
\end{equation}
Newton's law: \eqref{newton}.
```

$$F = ma^2 \tag{14.1}$$

Newton's law: (14.1).

Chapter 15

Larger Document

If you are writing a book, it is better to split the book into several parts.

For example:

```
\documentclass{book}
\input{preamble}

\hypersetup{pdfauthor={Li Mingming},
  pdftitle={The Big Book of \LaTeX},
  pdfsubject={Introduction to \LaTeX and how to use it},
  pdfkeywords={latex}}

\begin{document}

\frontmatter
```

```
\include{title}
\include{dedication}
\tableofcontents
\listoftables
\listoffigures
\mainmatter
\include{environment}
\include{what-is-latex}
\include{latex-base}
\include{font}
\include{box}
\include{justification}
\include{designing-pages}
\include{footnote}
\include{list}
\include{table}
\include{figure}
\include{cross-referencing}
\include{content}
\include{math}
\include{large-document}
\backmatter
\bibliographystyle{plainnat}
\bibliography{tex}


\end{document}
```

Chapter 16

French

16.1 Phonetic Symbols

Use **TIPA** package to input phonetic symbols.

```
\usepackage{tipa}
\usepackage{tipx}
```

```
Consonants: \\
\textipa{b d f k l m n p s t v z g K S Z dZ tS N \textltailn}

Semivowels: \\
\textipa{j w 4}

Oral vowels: \\
\textipa{a e i o u y \o \ \oe \ O @ E}

```

```
10 Nasal vowels: \\
11 \textipa{\~a \~o \~e}
```

Consonants:
b d f k l m n p s t v z g ʁ ʃ ʒ dʒ tʃ ŋ ɲ
Semivowels:
j w ɥ
Oral vowels:
a e i o u y ø œ ɔ ə ɛ
Nasal vowels:
ã õ ẽ

Chapter 17

Common signs

Chapter 18

Algorithm

To write pseudocode algorithms, you should use several packages:

```
1  \usepackage[ruled,vlined]{algorithm2e}
```

18.1 Example

```
1
2  \begin{algorithm}[H]
3    \SetAlgoLined
4    \KwData{this text}
5    \KwResult{how to write algorithm with \LaTeX2e }
6    initialization\;
7    \While{not at end of this document}{
```

```
8         read current\;
9         \eIf{understand}{
10          go to next section\;
11          current section becomes this one\;
12        }{
13          go back to the beginning of current section\;
14        }
15      }
16      \caption{How to write algorithms}
17    \end{algorithm}
```

The result is shown in Figure 18.1

Algorithm 1: How to write algorithms

Data: this text
Result: how to write algorithm with LaTeX2e
initialization;
while *not at end of this document* **do**
  read current;
  if *understand* **then**
    go to next section;
    current section becomes this one;
  else
    go back to the beginning of current section;
  end
end

Figure 18.1: Algorithm2e example

Chapter 19

Special characters

```
\# % #
\$ % $
\% % %
\& % &
\{ % {
\} % }
\_ % _
\^{} % ^
\--{} % -
\textbar % |
\textbackslash % \
```

$ % & { } _ ^ - |\