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The Small Book of

L^AT_EX

Introduction to L^AT_EX and
how to use to write articles and books

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Dedication

This book is dedicated to summerize the knowledge I learned about L^AT_EX.

Meanwhile, I record the experience of using L^AT_EX to 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 L^AT_EX

2.1 What is L^AT_EX

L^AT_EX is a document markup language.

2.2 L^AT_EX's Properties

1. L^AT_EX is 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

Because L^AT_EX is 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: L^AT_EX provides 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 L^AT_EX separate the format and the content, it is easy to do format alteration in the full document domain, for example change the style of the chapter.

one for all: Once you create your own template, it is easy to create 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

L^AT_EX Base

3.1 Hello World in L^AT_EX

```
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:

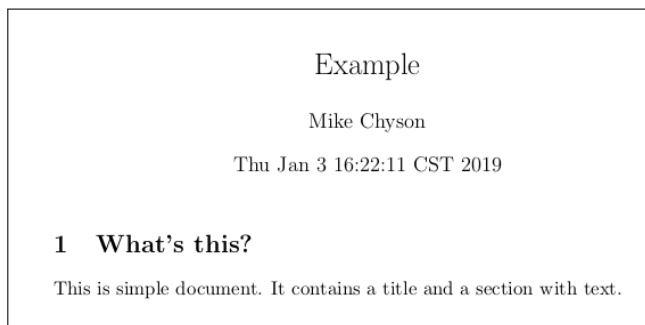


Figure 3.1: Example

Because the separation of the format and the content, you do not specify the font size, font color, font family and so on. Instead, you tell *L*^AT_EX it is a **title**, or **author** or **date** and so on. *L*^AT_EX formats them for you. As if there is a logical layer between the appearance and the content.

3.2 Document Structure

A *L*^AT_EX document 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 **L_AT_EX**Command

```
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**

```

1 \newcommand{\keyword}[1]{\textbf{#1}}
2 \keyword{declarations}

```

3.5.3 With Optional Arguments

```

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

```

3.6 Breaking Lines

```

1 \\ % end a line
2 \newline % has the same effect with \\
3 \linebreak % tells LATEX to end the line but to keep the full
   justification
4 \\[3mm] % insert additional vertical space after the break
   depending on the value
5 \linebreak[4] % can be used to influence the line break slightly
   or strongly:
6 %% If number is 0, a line break is allowed, 1 means it's desired, 2
   and 3 mark more
7 %% insistent requests, and 4 will force it. The latter is the default
   behavior if no number
8 %% was given.
9 \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	Explanation	Output
<code>\textbf</code>	bold font	Example
<code>\textit</code>	italic	<i>Example</i>
<code>\textsl</code>	slated	<i>Example</i>
<code>\textsc</code>	small caps	EXAMPLE
<code>\textup</code>		Example
<code>\textmd</code>	medium	Example
<code>\textnormal</code>		Example

Table 4.2: Font Declaration

Declaration	Explanation	Output
<code>\itshape</code>	italic	<i>Example</i>
<code>\bfseries</code>	bold font	Example
<code>\slshape</code>	slated	<i>Example</i>
<code>\scshape</code>	small caps	EXAMPLE
<code>\upshape</code>		Example
<code>\mdseries</code>	medium	Example
<code>\normalfont</code>		Example

Table 4.3: Font Emphasized

Command	Explanation	Output
<code>\emph</code>	emphasized	<i>Example</i>

4.2 Family

Table 4.4: Font Family

Command or Declaration	Explanation	Output
<code>\textsf</code>	sans-serif	Example
<code>\texttt</code>	typewriter	Example
<code>\textrm</code>	Roman	Example

4.3 Size

Table 4.5: Font Size

Command	Output
<code>\tiny</code>	Example
<code>\scriptsize</code>	Example
<code>\footnotesize</code>	Example
<code>\small</code>	Example
<code>\normalsize</code>	Example
<code>\large</code>	Example
<code>\Large</code>	Example
<code>\LARGE</code>	Example
<code>\huge</code>	Example
<code>\Huge</code>	Example

Chapter 5

Box

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

this parbox
is aligned at
its bottom
line

1 `\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

```
1 \parbox{3cm}{\raggedright hello} % \raggedright
2 {\centering hello} % \centering
3 \begin{center} % environment
4     hello
5 \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  %% singlesspacing, 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.

```



```
7  %% openbib : When this option is set, a bibliography would be
    formatted in open style instead of compressed style.
8  %% fleqn : Causes displayed formulas to be left-aligned.
9  %% 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

```
1  \tableofcontents
```

7.3 Designing Headers and Footers

```
1  \usepackage{fancyhdr}
2  \fancyhf{}
3  \fancyhead[LE]{\leftmark}
4  \fancyhead[RO]{\nouppercase{\rightmark}}
5  \fancyfoot[LE,RO]{\thepage}
6  \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.

^ahello world

Chapter 9

Lists

9.1 Bulleted Lists

```
1 \begin{itemize}  
2 \item geometry  
3 \item amsmath  
4 \end{itemize}
```

- geometry
- amsmath

9.2 Numbered Lists

```
1 \begin{enumerate}  
2 \item geometry  
3 \item amsmath  
4 \end{enumerate}
```

1. geometry
2. amsmath

9.3 Definition Lists

```
1 \begin{description}  
2 \item[paralist] provides compact lists and list versions that  
3 can be used within paragraphs, helps to customize labels and  
4 layout  
5 \item[enumitem] gives control over labels and lengths  
6 in all kind of lists  
7 \item[mdwlist] is useful to customize description lists, it  
8 even allows multi—line labels. It features compact lists and  
9 the capability to suspend and resume.  
10 \item[desclist] offers more flexibility in definition list  
11 \item[multenum] produces vertical enumeration in multiple  
12 columns  
13 \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 \\\br/>7 \verb|\textsf| & \verb|\sffamily| & \sffamily Example text \\  
8 \verb|\texttt| & \verb|\ttfamily| & \ttfamily Example text \\  
9 \hline  
10 \end{tabular}
```

Command	Declaration	Output
<code>\textrm</code>	<code>\rmfamily</code>	Example text
<code>\textsf</code>	<code>\sffamily</code>	Example text
<code>\texttt</code>	<code>\ttfamily</code>	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   \\
10  \verb|\textsf| & \verb|\sffamily| & \sffamily Example text \\
11  \verb|\texttt| & \verb|\ttfamily| & \ttfamily Example text \\
12  \bottomrule[1.5pt] %
13 \end{tabular}

```

Command	Declaration	Output
<code>\textrm</code>	<code>\rmfamily</code>	Example text
<code>\textsf</code>	<code>\sffamily</code>	Example text
<code>\texttt</code>	<code>\ttfamily</code>	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  \begin{table}[htb!]
2  \centering
3  \begin{tabular}{p{0.3\columnwidth}p{0.3\columnwidth}p{0.3\columnwidth}}
4    \toprule{}
5    & \head{advantage} & \head{disadvantage} \\
6    \midrule
7    multiple processes & each process runs independently &
8      communication and data sharing can be inconvenient \\
9    multiple threads & can communicate simply by data sharing &
10     more complex than single-threaded program \\
11  \bottomrule
12  \end{tabular}
13  \caption{multiple processes and multiple threads}
14  \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
5   picture
6 \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 current 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
<code>\part</code>	-1 (book and report class)
<code>\chapter</code>	0 (not available in article)
<code>\section</code>	1
<code>\subsection</code>	2
<code>\subsubsection</code>	3
<code>\paragraph</code>	4
<code>\subparagraph</code>	5

Chapter 14

Math

14.1 Basic Formula

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

```

1 \begin{displaymath}
2   expression % displayed formula, centered
3 \end{displaymath}

```

There are shortcuts:

```

1 \[
2   expression
3 \]

```

```

1 $$
2   expression
3 $$

```

For example:

```

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

```

$$x^2 + x = 10$$

14.4 Numbering Equations

```
1 \begin{equation}
2   \label{newton}
3   F = ma^2
4 \end{equation}
5 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.

```
1 \usepackage{tipa}
2 \usepackage{tipx}

1 Consonants: \\
2 \textipa{b d f k l m n p s t v z g K S Z dZ tS N \textltailn}
3
4 Semivowels: \\
5 \textipa{j w 4}
6
7 Oral vowels: \\
8 \textipa{a e i o u y \o \oe \ O @ E}
9
```

10 Nasal vowels: \\

11 \textipa{\~a \~o \~e}

Consonants:

b d f k l m n p s t v z ɡ ʁ ʒ dʒ tʃ ɲ ɲ

Semivowels:

j w ɥ

Oral vowels:

a e i o u y ø œ ɔ ə ɛ

Nasal vowels:

ã õ ĕ

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 L^AT_EX2e
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

```
1 \# % #
2 \$ % $
3 \% % %
4 \& % &
5 \{ % {
6 \} % }
7 \_ % _
8 \^{} % ^
9 \--{} % -
10 \textbar % |
11 \textbackslash % \
```

\$ % & { } _ ^ - | \

