LaTeX Tutorial

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April 22, 2020

This is just a beginners guide to writing documents in LaTeX without prior knowledge of LaTeX. This slide is designed for the LaTeX workshop at School of Economics, Peking University.

This file and some other materials can be download from my GitHub repository: https://github.com/MengLingchao/LaTex_tutorial. Please feel free to download and use it.

If you want, you can also star it!

Figure 1: GitHub Repository
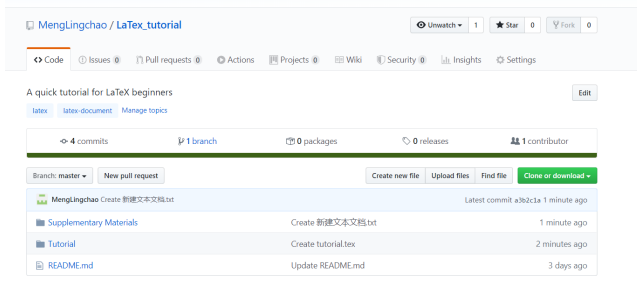
Outline

Introduction

What's LaTeX?

LaTeX (pronounced either "Lay-tech" or "Lah-tech")

- is based on Tex, a typesetting system designed by Donald Knuth in 1978 for high quality digital typesetting.

- is a *typesetting system* and *programming language*, not a *word processor*.

This is **my** *first* document prepared in LaTeX. I typed it on April 22, 2020.

```
This is \textbf{my} \emph{first}
        document prepared in \LaTeX. I
        \underline{typed} it on \today.
```

Listing 1: the typesetting nature of LaTeX

Why LaTeX?

- Donald Knuth says that his aim in creating TEX is to beautifully typeset *technical documents* especially those *containing a lot of Mathematics*.
- Most English journals have their own LaTeX template.
- Even for ordinary text, LaTeX is also a good choice.

Installation

On Windows, users have two main choices of TeX system to install: TeX Live or MiKTeX. I highly recommend Tex Live for the following reasons

- The standard installer for MiKTeX installs 'just the basics' and uses on-the-fly installation for anything else you need; the standard install for TeX Live is 'everything' (about 4.5 Gb!).
- Real-time updates.
- Faster compilation (especially in case of graphics files)

Installation

There are many different editors of LATEX.

- professional LATEX editors, such as TeXstudio, TeXwork.
- edit LATEXfiles using Vim, Sublime Text, Visual Code, etc.
- For more comparison of LATEX, you can refer to
  https://en.wikipedia.org/wiki/Comparison_of_TeX_editors

Recommend Tex Live with TexStudio, you can refer to
https://blog.csdn.net/zywhehe/article/details/83113214.

Installation
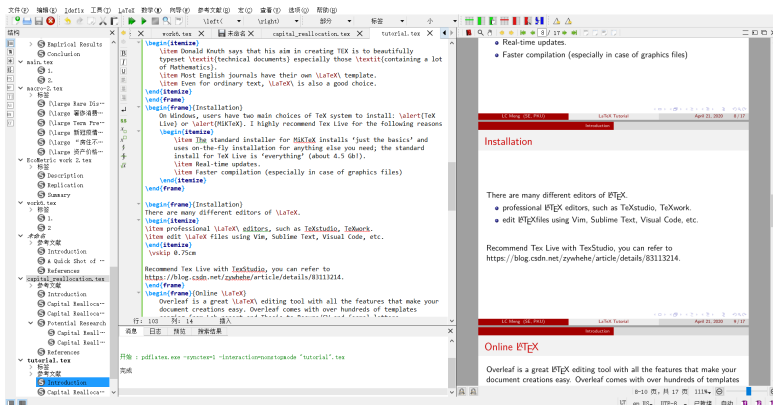
Figure 2: TeXstudio

Online LaTeX

Overleaf(https://www.overleaf.com/) is a great LaTeX editing tool with all the features that make your document creations easy. Overleaf comes with over hundreds of templates ranging from Lab report and Thesis to Resume/CV and formal letters.
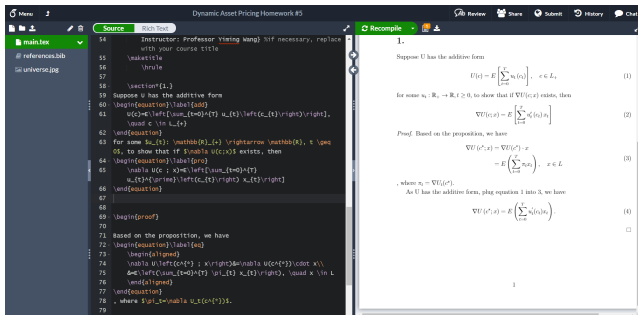
Figure 3: Overleaf website

LATEX Basic

The basic structure of a LATEX file

1. The *documentclass* command: define the property of the file
   - article, beamer, report, thesis, letter, book
2. Preamble
   - include the packages: \usepackage{package}
   - format the article.
3. Begin and end of the document: the main body of the file.

```
\documentclass[options]{article}
Preamble (for LATEX commands only)
\begin{document}
Document text (text with embedded LATEX commands)
\end{document}
```

Document Structure

LATEX can organize, number, and index chapters and sections of document. There are up to 7 levels of depth for defining sections depending on the document class

- \part{title}
- \chapter{title}
- \section{title}
- \subsection{title}
- \subsubsection{title}
- \paragraph{title}
- \subparagraph{title}

LATEX vocabulary

- **Commands**: produce text or space, like \textit{it}.
- **Declarations**: affect the following text, like \Large or {\Large }.
- **Environments**:receive special processing and are defined by \begin{name} ... \end{name}.
- **Mandatory arguments**: are included in braces, like \hspace{2in}.
- **Optional arguments**: are enclosed in brackets [ ], like \documentclass[11pt]{article}.
- *****: indicates a variation on a command or environment.

A little sample

See the simple sample!

Basic Typesetting

Basic Typesetting

- Simply enter your content in most times, just like using word or txt.
- When you need to start a new paragraph, add \par in the end or empty one line between two paragraphs.

The first paragraph.
The second paragraph.
The third paragraph.

```
1 The first paragraph.\par
2 The second paragraph.
3
4 The third paragraph.
```

Listing 2: new paragraph

Font effects

There are LaTeX commands for a variety of font effects:

hello world
hello wolld
<u>hello world</u>
HELLO WORLD
hello world

```
1 \textbf{ hello  world}
2
3 \textit { hello  wolld }
4
5 \underline { hello  world}
6
7 \textsc{ hello  world}
8
9 \textrm{ hello  world}
```

Listing 3: Font effects

Colored text

- Include the xcolor package in the preamble by
  \usepackage{xcolor}.
- Also can define customized color, such as
  \definecolor{myred}{RGB}{231, 76, 60}.

Red Gray Myred

```
1 \ textcolor {red}{Red}
2 \ textcolor {gray}{Gray}
3 \ textcolor {myred}{Myred}
```

Listing 4: Colored text

Font size

- The global font size can be set by the documentclass option.
- The local font size can be changed by the following commands.

tiny

scriptsize

footnotesize

small

normalsize

large

Large

LARGE

huge

Huge

```
1 {\tiny  tiny }\\
2 {\ scriptsize   scriptsize }\\
3 {\footnotesize  footnotesize }\\
4 {\small small}\\
5 {\normalsize normalsize}\\
6 {\large  large }\\
7 {\Large Large}\\
8 {\LARGE LARGE}\\
9 {\huge huge}\\
10 {\Huge Huge}
```

Listing 5: Font size

Lists

- LaTeX supports two types of lists: *enumerate* produces numbered lists, while *itemize* is for bulleted lists. Each list item is defined by \item. Lists can be nested to produce sub-lists.

❶ First thing

❷ Second thing
  - A sub-thing
  - Another sub-thing

(3) Third thing

```
1 \begin{enumerate}
2   \item  First  thing
3   \item Second thing
4   \begin{itemize}
5     \item A sub−thing
6     \item[−] Another sub−thing
7   \end{itemize}
8   \item[(3)]  Third thing
9 \end{enumerate}
```

Listing 6: Lists

Comments and Spacing

- LaTeX Comments are created using %. When LaTeX encounters a % character while processing a .tex file, it ignores the rest of the line.
- Multiple consecutive spaces inLaTeX are treated as a single space. Several empty lines are treated as one empty line.
- Use \␣ to produce more space and \vspace{length} to produce vertical space.

The following is comments 2.
more space in line like   ahh.
more vertical space like following.

third paragraph.

```
1 %comments 1
2 The following  is  comments 2. %
      comments 2
3
4 more space in  line    like  \ \ \ ahh.
5
6
7 more  vertical  space  like  following .
8
9 \vspace{0.5in}
10
11 third  paragraph.
```

Special characters

```
# $ % ^ & _ { } ~ \
```

```
1 \# \$ \% \^{} \& \_ \{ \} \~{} \
    textbackslash
```

Listing 8: Special characters

Equations

Mathematical modes

LATEX allows two writing modes for mathematical expressions: the *inline mode* and the *display mode*. The first one is used to write formulas that are part of a text. The second one is used to write expressions that are not part of a text or paragraph, and are therefore put on separate lines.

- Inline mode: use $equation$ or \(equation\)
- Display mode: use $$equation$$ or \[equation\]

Inline mode: $a = b + c$ or $a = b + c$
Display mode:

$$a = b + c$$

$$a = b + c$$

```
1 Inline  mode: $a=b+c$ or \(a=b+c\)
2
3 Display  mode:
4 \[a=b+c\]
5 $$a=b+c$$
```

Listing 9: equations

Equation Environment

- Another useful mode is the equation environment, which support the numbered equation and the reference.
- The reference can achieved through \label{} and \ref{}. The reference of the equation, table and figure are all the same.

An example
$$E = MC^2 \qquad (1)$$
Equation 1 is mass-energy equivalence.

```
1 An example
2 \begin{equation}\label{eq:myeq}
3 E=MC^2
4 \end{equation}
5 Equation \ref{eq:myeq} is mass−
     energy equivalence.
```

Listing 10: equation environment

Subscripts and Superscripts

Subscripts and superscripts are written using the symbols ^ and _.

$$a_1^2 = b_1^2 + c_1^2$$

$$a_m n^2 = b_m n^2$$

$$a_{mn}^2 = b_{mn}^2$$

```
1 \[a_1^2=b_1^2+c_1^2\]
2 \[a_mn^2=b_mn^2\]
3 \[a_{mn}^2=b_{mn}^2\]
```

Listing 11: subscripts and superscripts

Fractions

- To enable the fraction, you need to include the *amsmath* package, a powerful math package.
- \frac{numerator}{denominator}.

$$a_1 = \frac{b_1}{c_1}$$

$$a_1 = \frac{b_1}{c_1} mn$$

```
1 \[a_1 = \frac{b_1}{c_1}\]
2 \[a_1 = \frac{b_1}{c_1} mn\]
```

Listing 12: fractions

Brackets and Parentheses

- Use to \left and \right command to set dynamically resized brackets and parentheses.
- Even if you are using only one bracket, both commands are mandatory.

$$U_t = \left((1-\delta)\frac{A}{C} + \delta B\right)^{\frac{1}{1-\sigma}}$$

$$U_t = ((1-\delta)\frac{A}{C} + \delta B)^{\frac{1}{1-\sigma}}$$

$$(A$$

```
1 \[U_t=\left((1-\delta)\frac{A}{C
    }+\delta B\right)^{\frac
    {1}{1-\sigma}}\]
2 \[U_t=((1-\delta)\frac{A}{C}+\
    delta B)^{\frac{1}{1-\sigma
    }}\]
3 \[\ left (A\right .\]
```

Listing 13: brackets and parentheses

Aligning equations

- Amsmath package and `\begin{aligned}...\end{aligned}` environment.

$$\frac{\partial U_t}{\partial A} = (1 - \delta)U_t^{\frac{1}{1-\sigma^{-1}}-1}A^{-\sigma^{-1}}$$
$$\frac{\partial U_t}{\partial B} = \delta U_t^{\frac{1}{1-\sigma^{-1}}-1}B^{-\sigma^{-1}}$$

(2)

```
1 \begin{equation}
2 \begin{aligned}
3 \frac{\partial U_t}{\partial A
    }&=(1-\delta)U_t^{\frac
    {1}{1-\sigma^{-1}}-1}A^{-\
    sigma^{-1}}\\
4 \frac{\partial U_t}{\partial B}&=\
    delta U_t^{\frac{1}{1-\sigma
    ^{-1}}-1}B^{-\sigma^{-1}}
5 \end{aligned}
6 \end{equation}
```

Listing 14: aligning equations

Special symbols

- Integrals, sums and limits.
- Greek letters.
- math symbols.

$$\alpha$$

$$\beta$$

$$\int_a^b x^2 dx$$

$$\lim_{x \to \infty} f(x)$$

$$\uparrow \to \downarrow \leftarrow$$

```
1  \[\alpha\]
2  \[\beta\]
3  \[\int_{a}^{b} x^2 dx\]
4  \[\lim_{x\to\infty} f(x)\]
5  \[\uparrow\rightarrow\downarrow
      \leftarrow\]
```

Listing 15: special symbols

Special symbols

Some trickier equations(not just math)

$$\oint \mathbf{B} \cdot d\mathbf{S} = \mu_0 \epsilon_0 \frac{d\Phi_E}{dt} + \mu_0 i_{enc}$$

$$k = Ae^{-E_A/RT}$$

$$K_a = \frac{[\mathrm{H_3 0^+}][\mathrm{A^-}]}{[\mathrm{HA}]}$$

$$V = \left(\bigoplus_{\lambda \in \mathsf{Sec}(T)} V^{(\lambda)}\right) \oplus V \tag{3}$$

```
1  \begin{equation}\begin{aligned}
2  \oint \mathbf{B} \cdot d \
   mathbf{S} &=\mu_{0} \
   epsilon_{0} \frac{d \Phi_{E
   }}{d t}+\mu_{0} i_{e n c}
   \\
3  k &=A e^{-E_{A} / R T} \\
4  K_{a} &=\frac{\left[\mathrm{H
   }_{3} 0^{+}\right]\left[\
   mathrm{A}^{-}\right]}{[\
   mathrm{HA}]} \\
5  V &=\left(\bigoplus_{\lambda \
   in \operatorname{Sec}(T)}
   V^{(\lambda)}\right) \oplus
   V
6  \end{aligned}\end{equation}
```

Listing 16: special symbols

Special symbols

Some supplementary material

- Latex mathematical symbols.pdf
- The great, big list of latex symbols.pdf

An online website

- https://www.codecogs.com/latex/eqneditor.php?lang=zh-cn
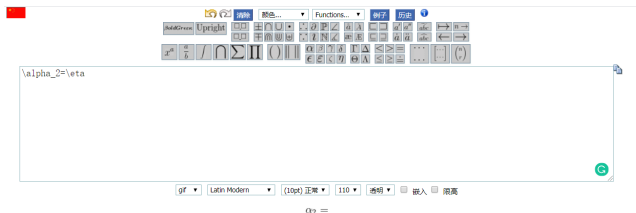
Figure 4: Online Equation Editor

Tables and Figures

Figures

- First include the *graphicx* package.
- Images should be EPS, PDF, PNG, JPEG or GIF files.

Figure 5: new york

```
1  \begin{figure}[h]
2    \centering
3    \includegraphics[width=0.7\
        linewidth]{"figs/new york"}
4    \caption{new york}
5    \label{fig:new-york}
6  \end{figure}
```

Listing 17: special symbols

Figures

1. **[h]** is the placement specifier. put the figure approximately here.
   - Other options are **t**(at the top of the page), **b**(at the bottom of the page) and **p**(on a separate page for figures).
2. \centering centres the image on the page, if not used images are left-aligned by default.
3. includegraphics{...} is the command that actually puts the image in your document. The image file should be saved in the same folder as the .tex file.
4. [width=0.7\textwidth]. is an optional command that specifies the width of the picture in this case the same width as the text. The width could also be given in centimeters (cm).
5. \label{...} creates a label to allow you to refer to the table or figure in your text.

Figures

1. **[h]** is the placement specifier. put the figure approximately here.
   - Other options are **t**(at the top of the page), **b**(at the bottom of the page) and **p**(on a separate page for figures).
2. \centering centres the image on the page, if not used images are left-aligned by default.
3. \label{...} creates a label to allow you to refer to the table or figure in your text.

Tables

Tablular environment is used to typeset basic tables.

1. The braces after \begin{tabular} defines the columns.
   - l for a column of left-aligned text.
   - r for a column of right-aligned text.
   - c for a column of center-aligned text.
   - | for a vertical line.

Apples	Green
Strawberries	Red
Oranges	Orange

```
1  \begin{tabular}{|rc}
2    Apples & Green \\
3    \hline
4    Strawberries & Red \\
5    \cline{1-1}
6    Oranges & Orange \\
7  \end{tabular}
```

Listing 18: Simple tables

Tables

Tablular environment is used to typeset basic tables.

1. The table data follows the \begin command:
   - & is placed between columns.
   - \\ is placed at the end of a row to start a new one.
   - \hline inserts a horizontal line.
   - \cline{1-2} a partial horizontal line between column 1 and column 2.

Apples	Green
Strawberries	Red
Oranges	Orange

```
1  \begin{tabular}{|rc}
2    Apples & Green \\
3    \hline
4    Strawberries & Red \\
5    \cline{1-1}
6    Oranges & Orange \\
7  \end{tabular}
```

Listing 19: Simple tables

Sample Tables

```latex
\begin{table}[]
    \centering
    \caption{PSM and Estimated Impact from NSW(re74) and CPS1 Sample}
    \vspace{-.2in}
    \label{tab:ps-nswre74-cps1}
    \resizebox{\textwidth}{!}{%
        \begin{tabular}{lcccccccccccccc}
            \hline
            & No. of & \multicolumn{2}{c}{Treatment Effect} & \multicolumn{10}{c}{whteher difference
            after matching significant} \\
            & observations & parameter & S.E. & age & education & black & hispanic & nodgree & married &
            re75 & u75 & re74 & u74 \\ \hline
            NSW & 445 & 1794 & (633) & & & & & & & & \\
            Full CPS & 15992 & -8498 & (583) & & & & & & & & \\
            Without replacement & 831 & 1449 & (783) & No & No & No & No & No & No & No & No \\
            With replacement & & & & & & & & & & & \\
            Nearest Neighbour (1) & 4416 & 2315 & (1047) & No & No & No & No & No & No & No & No
            \\
            Capliper, 0.00001 & 174 & 2879 & (1950) & No & No & No & Yes & No & No & No & No \\
            Capliper, 0.001 & 3564 & 1289 & (1065) & No & No & No & No & No & No & No & No \\
            Radius, 0.00001 & 174 & 2034 & (1797) & No & No & No & No & No & No & No & No \\
            Radius, 0.001 & 3564 & 1127 & (944) & No & No & No & No & No & No & No & No \\
            Kernel Normal & 4255 & 1084 & (742) & No & No & No & No & No & No & No & No \\
            Kernal Biweight & 4255 & 1148 & (770) & No & No & No & No & No & No & No & No \\
            \hline
        \end{tabular}%
    }
\end{table}
```

Figure 6: Sample Table Code

Sample Tables

Table 1: PSM and Estimated Impact from NSW(re74) and CPS1 Sample

	No. of observations	Treatment Effect parameter	S.E.	age	education	black	hispanic	nodgree	married	re75	u75	re74	u74
NSW	445	1794	(633)										
Full CPS	15992	-8498	(583)										
Without replacement	831	1449	(783)	No	No	No	No	No	No	No	No	No	No
With replacement													
Nearest Neghbour (1)	4416	2315	(1047)	No	No	No	No	No	No	No	No	No	No
Capliper, 0.00001	174	2879	(1950)	No	No	No	Yes	No	No	No	No	No	No
Capliper, 0.001	3564	1289	(1065)	No	No	No	No	No	No	No	No	No	No
Radius, 0.00001	174	2034	(1797)	No	No	No	No	No	No	No	No	No	No
Radius, 0.001	3564	1127	(944)	No	No	No	No	No	No	No	No	No	No
Kernel Normal	4255	1084	(742)	No	No	No	No	No	No	No	No	No	No
Kernal Biweight	4255	1148	(770)	No	No	No	No	No	No	No	No	No	No

Useful websites

Oneline LATEX table editor.

1. Tables Generator: https://www.tablesgenerator.com/#
2. LATEX Complex Table Editor: https://www.latex-tables.com/
3. latex table editor: https://truben.no/table/old/

Figure 7: LATEX Online Table Editor

Bibliography

How to cite literature in LaTeX

The BibTeX file is the key file.

- .bib file contains contains all the references you want to cite in your document.
- It should be kept in the same folder as your .tex file.
- It can be edited using Notepad or LaTeX editor.
- the bibtex reference can be downloaded from Google Scholar, Baidu Xueshu, or exported by EndNote, Mendeley, et.al.

```
@article{cochrane2011presidential,
  title={Presidential address: Discount rates},
  author={Cochrane, John H},
  journal={The Journal of finance},
  volume={66},
  number={4},
  pages={1047--1108},
  year={2011},
  publisher={Wiley Online Library}
}
```

Figure 8: BibTeX sample

How to cite literature in LaTeX

The .bsy file is another file.

- .bst file is the reference style file.
- one can use .bst file to edit his customized reference style or use some journal-specific style.
- Include the name of the .bst file in the \bibliographystyle{...} commmand.

BibTeX Sample

- \cite{jiang2019manager} constructs a manager sentiment index based on the aggregated textual tone of corporate financial disclosures.
- \bibliographystyle{jf}
- \bibliography{ref}

Jiang, Lee, Martin, and Zhou (2019) constructs a manager sentiment index based on the aggregated textual tone of corporate financial disclosures.

Jiang, Fuwei, Joshua Lee, Xiumin Martin, and Guofu Zhou, 2019, Manager sentiment and stock returns, *Journal of Financial Economics* 132, 126–149.

Conclusion

Why LaTeX?

- LaTeX allows you to concentrate on the content and the structure.
- LaTeX has one of the most advanced math typesetting systems around.
- LaTeX is incredibly extendible.
- LaTeX keeps track of references so you don't have to.
- LaTeX allows you to make more consistent, and more easily changeable, documents

Learning more

- The LaTeX wikipedia: https://en.wikibooks.org/wiki/LaTeX
- The Not So Short Introduction to LaTeX 2_ε:
  - in English version and Chinese version.
  - with LaTeXcode.
- LaTeX cheat sheets
  - LaTeX_24H_Note, Chang_LaTeX_sheet
- Some other books.

All the above materials can be downloaded from my GitHub repository.

Learning more

- Learn by examples or templates.
  - See overleaf.com
  - Most journals have their own LaTeX template.
  - I upload template of AER, ECTA, RFS LaTeXto my GitHub.
- Google(Baidu) is your good friend.
  - Know what you want to do and Google it!
- Some useful websites:
  - TeX Live: http://www.tug.org/texlive/
  - TeXstudio: https://www.texstudio.org/

Thanks!

LaTeX Tutorial