LaTeX Tutorial

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About LaTeX

- LaTeX (pronounced “Lay-tech" or “Lah-tech", derived from Greek) is a software system for preparing documents based on TeX typesetting program.
- LaTeX was originally written in 1984 by Leslie Lamport and has become the most popular tool in writing documents in academia.

$$\text{Einstein says} \quad E = \frac{mc^2}{\sqrt{1 - \frac{v^2}{c^2}}}$$

- LaTeX uses plain texts for the content and markups to define the general structure of a document as opposed to Word (“What You See Is What You Get").
- LaTeX can do almost Everything that you can think of. Use different documentclass and Package, you can write Reports, thesis, research paper and slides (ppt), etc. You can even use it to prepare scientific figures.
- Find some LaTeX manual online and use it as a dictionary ▸ Link

Installing LaTeX

- For Windows system: Link Mirror site at Tsinghua.

File Name ↓	File Size ↓	Date ↓
Parent directory/	–	–
README.md	1.1 KiB	2020-04-10 06:03
texlive.iso	3.7 GiB	2020-04-06 21:39
texlive2020-20200406.iso	3.7 GiB	2020-04-06 21:39
texlive2020-20200406.iso.md5	59 B	2020-04-06 21:40
texlive2020-20200406.iso.sha512	155 B	2020-04-06 21:40
texlive2020-20200406.iso.sha512.asc	455 B	2020-04-06 21:40
texlive2020.iso	3.7 GiB	2020-04-06 21:39
texlive2020.iso.md5	50 B	2020-04-06 21:40
texlive2020.iso.sha512	146 B	2020-04-06 21:40
texlive2020.iso.sha512.asc	455 B	2020-04-06 21:40

- For Mac OS X system: Link Mirror site at Tsinghua.

File Name ↓	File Size ↓	Date ↓
Parent directory/	–	–
BasicTeX.pkg	79.4 MiB	2020-04-08 00:54
BasicTeX.pkg.md5	47 B	2020-04-10 06:04
ExtrasFolder.pdf	37.1 KiB	2020-09-18 20:44
Ghostscript.pkg	23.8 MiB	2020-03-30 04:24
Ghostscript.pkg.md5	50 B	2020-04-10 06:04
Licenses.txt	1.7 KiB	2020-09-18 20:44
MacTeX.pkg	3.9 GiB	2020-04-08 07:38
MacTeX.pkg.md5	45 B	2020-04-10 06:05
MacTeXtras-20200918.zip	356.6 MiB	2020-09-18 20:44
MacTeXtras-20200918.zip.md5	58 B	2020-09-18 20:46
MacTeXtras.zip	356.6 MiB	2020-09-18 20:44
MacTeXtras.zip.md5	58 B	2020-09-18 20:46
README	169 B	2020-04-10 06:04
mactex-20200407.pkg	3.9 GiB	2020-04-08 07:38
mactex-20200407.pkg.md5	54 B	2020-04-08 07:40
mactex-basictex-20200407.pkg	79.4 MiB	2020-04-08 00:54
mactex-basictex-20200407.pkg.md5	63 B	2020-04-08 00:55
mactex-ghostscript-9.50-20200329.pkg	23.8 MiB	2020-03-30 04:24
mactex-ghostscript-9.50-20200329.pkg.md5	71 B	2020-03-30 04:27

How does LaTeXwork

- using your preferred text editor, write a .tex file.
- code-compile-execute
- You can use Texshop in Mac OS X system, or LyX in Windows systems. Many choices ▸ Link
- Structure of LaTeX file

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

Basics

- The backslash \ is used to begin all commands.
- You can change font size in the preamble \documentclass[11pt]{article} (10pt by default)
- Packages contain extra formatting features \usepackage{packagename}. For example, “graphicx" provides commands to include graphics files and “color" provides a way to use colors.
- Commands are case-senstive: \Sigma $\Rightarrow \Sigma$ while \sigma $\Rightarrow \sigma$
- Some commands take arguments, which are enclosed in braces: *textrm*{text in roman font} $\Rightarrow$ text in roman font
- Certain characters have special meaning, use them with caution. # $ % &
  - # (hashtag, pound (number)) is used to define parameters in a macro (newcommand).
  - $ begin and end math mode
  - % for comments in the input file (text behind this sign does not show)
  - & (ampersand) used in alignments.
  - ^(caret) raises things up, while _ (underscore) lowers things down.

List of formula inputs

```
\alpha \ln x
```
$\longrightarrow \quad \alpha \ln x$

```
\frac {\partial f (x,y)}{\partial x}
```
$\longrightarrow \quad \frac{\partial f(x,y)}{\partial x}$

```
\sin x
```
$\longrightarrow \quad \sin x$

```
4\cdot a^n
```
$\longrightarrow \quad 4 \cdot a^n$

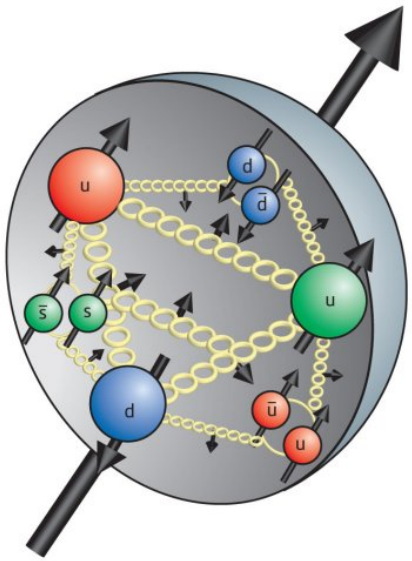
```
\sqrt {x^2+y^2}
```
$\longrightarrow \quad \sqrt{x^2+y^2}$

```
\displaystyle \int \cot ^2 x\,dx
```
$\longrightarrow \quad \displaystyle\int \cot^2 x\,dx$

```
\displaystyle \overline x=\frac {\sum _{i=1}^n x_i}{n}
```
$\longrightarrow \quad \displaystyle\overline{x} = \frac{\sum_{i=1}^{n} x_i}{n}$

- \$ $\cdots$ \$ math in main contexts.
- \begin{equation} \end{equation} for separate numbered equations
- \begin{eqnarray} \end{eqnarray} for numbered equation arrays
- There is also display math for un-numbered equations. Check latex manual.

Including figures




```
\begin{figure}[H]
\centering\includegraphics[width=3cm]{proton}
\caption{Proton}
\label{name}
\end{figure}
```

Figure: Proton

- $[H]$ tells the compiler to place the figure at that exact location in the page, instead of moving it to somewhere else. Whenever we want to use this option, we must include usepackage$\{float\}$ in our preamble (Already included in the template that we provided).
- Use the file name “proton" or “proton.pdf" or “proton.eps" or “proton.jpg"
- Write your own caption and use a different label for different figure.

Table

Table: Nonlinear Model Results

Case	Method#1	Method#2	Method#3
1	50	837	970
2	47	877	230
3	31	25	415
4	35	144	2356
5	45	300	556

```
\frametitle{Table}
\begin{table}[ht]
\caption{Nonlinear Model Results} % title of Table
\centering % used for centering table
\begin{tabular}{cl cl cl c} % centered columns (4 columns)
\hline\hline %inserts double horizontal lines
Case & Method\#1 & Method\#2 & Method\#3 \\ [0.5ex] % inserts table
%heading
\hline % inserts single horizontal line
1 & 50 & 837 & 970 \\ % inserting body of the table
\hline
2 & 47 & 877 & 230 \\
\hline
3 & 31 & 25 & 415 \\
\hline
4 & 35 & 144 & 2356 \\
5 & 45 & 300 & 556 \\ [1ex] % [1ex] adds vertical space
\hline %inserts single line
\end{tabular}
\label{table:nonlin} % is used to refer this table in the text
\end{table}
```

Error messages

When you compile a tex file, sometimes you see error messages in the command window if LaTeX finds errors. There are three comment errors:

1. Undefined control sequence: usually means a command on certain line (see message) is misspelled.
2. Other common errors include misuse of special signs and brackets (need to match or come in pairs).
   - you can type H for help; X for exit;
   - enter “return" to ignore the error message and hope for the best.
3. If it shows a $*$ prompt, it often means you forget to end an environment (math or document, etc).

Summary

- Install Latex
- Use the template
- Fill in your contents and debug.