

How to use \LaTeX

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Why \LaTeX ?

An extremely good philosophical question.

- ▶ Microsoft Office Word and PowerPoint are boring.
- ▶ \LaTeX is elegant, charming, or whatever...
- ▶ Excellent for mathematical typesetting.
- ▶ Powerful, lots and lots of power for you to extend it, be it theses, papers, slides (using Beamer), spreadsheets...

Useful Resources

Books list

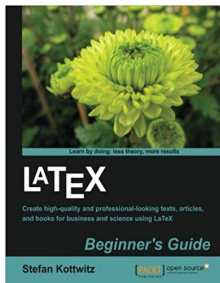


Figure 1: L^AT_EX Beginner's Guide

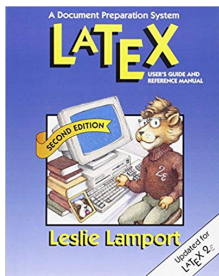


Figure 2: L^AT_EX: A Document Preparation System: User's Guide and Reference Manual

Useful Resources

Learn \LaTeX in one video :

<https://www.youtube.com/watch?v=VhmkLrOjLsw>

Mr Daoming Dong is also a good resource. He is nice and helpful.

A Brief History

In the mid 1970s, Donald Knuth, a Stanford CS geek developed $\text{T}_{\text{E}}\text{X}$ in SAIL to typeset his "The Art of Computer Programming" (TAOCP). First public release in 1978. He reimplemented it in Pascal in the mid 80s (WEB, literate programming). Leslie Lamport, the genius, wrote \LaTeX in early 80s by porting the original $\text{T}_{\text{E}}\text{X}$.

What is the relationship between $\text{T}_{\text{E}}\text{X}$ and \LaTeX ? \LaTeX uses the $\text{T}_{\text{E}}\text{X}$ typesetting programme to compile and generate its output. \LaTeX focuses on the content while $\text{T}_{\text{E}}\text{X}$ is the main programme for setting up the layout.

The first \LaTeX version available is 2.09 (strange number and strange version control). Later in 1994, $\text{\LaTeX}2_{\epsilon}$ replaced the old version, and remained ever since. \LaTeX 3 is a long-term research project, which started from the 1990s.

How to pronounce L^AT_EX ?

First and foremost, the pronunciation of L^AT_EX. According to the father of T_EX:

'English words like 'technology' stem from a Greek root beginning with the letters τεχ...; and this same Greek word means art as well as technology. Hence the name TeX, which is an uppercase form of τεχ.

Insiders pronounce the χ of TeX as a Greek chi, not as an 'x', so that TeX rhymes with the word blecchhh. It's the 'ch' sound in Scottish words like loch or German words like ach; it's a Spanish 'j' and a Russian 'kh'. When you say it correctly to your computer, the terminal may become slightly moist.'

Donald Knuth

How to pronounce L^AT_EX ?

Another quote from the father of L^AT_EX:

'One of the hardest things about LaTeX is deciding how to pronounce it. This is also one of the few things I'm not going to tell you about LaTeX, since pronunciation is best determined by usage, not fiat. TeX is usually pronounced teck, making lah-teck, and lay-teck the logical choices; but language is not always logical, so lay-tecks is also possible.' Leslie Lamport

What L^AT_EX can do and what it cannot

- ▶ Write scientific papers
- ▶ Write theses
- ▶ Typesetting books and publications
- ▶ Write typeset letters
- ▶ Play around with mathematical formula
- ▶ Make presentation slides
- ▶ and many more

Installation

We would highly recommend the following \LaTeX distributions.

- ▶ For Windows users
 - ▶ TeX Live
 - ▶ MiKTeX
- ▶ For MacOS users
 - ▶ TeX Live
 - ▶ MacTeX

Editors

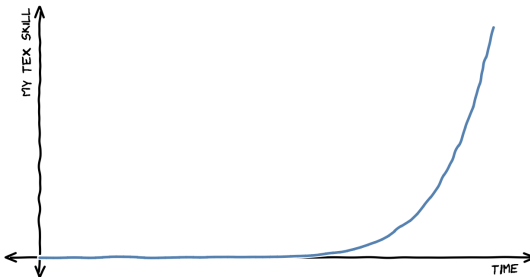
There are in fact numerous ways for you to write up a \LaTeX document.

- ▶ TeXStudio (**behold, the beamer template we used for this tutorial cannot be built using this editor**)
- ▶ TeXShop
- ▶ Notepad
- ▶ Sublime
- ▶ Visual Studio Code
- ▶ Vim
- ▶ and many others...
- ▶ Overleaf (the online editor)

How to use

We have to remind you that learning \LaTeX (might be) very hard

THE ULTIMATE TEX LEARNING CURVE
CREDIT: YOUCHAO



How to use

We have to remind you that learning \LaTeX (might be) very hard ¹

Newbie

Give up

Master

USUALLY

WANT THIS



¹These arrows are plotted using a package called tikz

Some common knowledge

Since \LaTeX is a package implemented in the \TeX typesetting **language**, we should consider the \TeX input syntax when use it.

Some common knowledge

- ▶ The effect of typing multiple space is the same as one space.
- ▶ The effect of typing multiple line feeds is the same as one line break.
- ▶ If you don't know how and when to use \ (backslash), then you are doomed.
- ▶ Be aware of the use of \xspace and whatever that follows the backslash after the ~mark, e.g., ~\ref.

Some common knowledge

- ▶ Special meta characters as part of the T_EX language syntax:

- ▶ # \$ % ^ & _ { } ~ \

- ▶ To use them you have to do the following

```
\# \$ \% \^ \& \_ \{ \} \textasciitilde \textbackslash
```


Changing fonts and styles

You may either use (1) commands or (2) lexical declarations. *Contents are referenced from the slides for a course held at the Computer Lab, Cambridge.*

`\mdseries`

`\textmd{text}`

Medium series

`\bfseries`

`\textbf{text}`

Boldface series

`\rmfamily`

`\textrm{text}`

Roman family

`\sffamily`

`\textsf{text}`

Sans-serif family

`\ttfamily`

`\texttt{text}`

Typewriter family

`\upshape`

`\textup{text}`

Upright shape

`\itshape`

`\textit{text}`

Italic shape

`\slshape`

`\textsl{text}`

Slanted shape

`\scshape`

`\textsc{text}`

SMALL CAPS SHAPE

`\normalfont`

`\textnormal{text}`

Normal style

Starting a report and title page

```
1 \documentclass{article}
2 \begin{document}
3 \begin{titlepage}
4   \begin{center}
5     \line(1,0){300}\\
6     [0.25in]
7     \huge{\textbf{ CSSA \LaTeX\ Notes
8       }}\\
9     [2mm]
10    \line(1,0){200}\\
11    [1.5cm]
12    \textsc{\LARGE University of
13      Cambridge}\\
14    \textsc{\LARGE Using \LaTeX\ to
15      Write a Simple Report}\\
16    [8cm]
17    \end{center}
18    \begin{flushright}
19      \textsc{\large CSSA. \A Latex
20        User\\
21        20th Apr 2019}
22    \end{flushright}
23  \end{titlepage}
24 \end{document}
```

CSSA \LaTeX Notes

UNIVERSITY OF CAMBRIDGE
USING \LaTeX TO WRITE A SIMPLE REPORT

CSSA.
A LATEX USER
20TH APR 2019

Sections

```
1 \section{Introduction}
2 This is the first line of the report.
   This report will show you how to
   use \LaTeX\\
3 % Text holder: show one paragraph of
   \lipsum
4 \lipsum[1]
5 % Text holder: show one paragraph of
   \lipsum
6 \section{Second section}
7 This is the second section of this
   report.
8 \subsection{Sub section 1}
9 This is the first sub section in this
   report.
10 \subsection{Sub section 2}
11 This is the second sub section in this
   report.
12 \subsubsection{Sub sub section}
13 This is a sub sub section. Replace
   text here when you write your
   report.
```

1 Introduction

This is the first line of the report. This report will show you how to use \LaTeX . Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut parum elit, vestibulum ut, placerat sit, adipiscing vitae, fides. Curabitur dui etiam auctor. Nam arcu libero, nuncius eget, consectetur id, volutate a, magna. Donec volutata augue eu augue. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Maecenas et leo. Cras viverra nunc rhoncus arcu. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices lobortis. Aenean faucibus. Maecenas dui nulla, malesuada eu, pulvinar at, nulla ac, nulla. Curabitur auctor augue nulla. Donec varius nec eget eros. Duis nulla sit, augue eu, accumsan dictum, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

2 Second section

This is the second section of this report.

2.1 Sub section 1

This is the first sub section in this report.

2.2 Sub section 2

This is the second sub section in this report.

2.2.1 Sub sub section

This is a sub sub section. Replace text here when you write your report.

Margins, page number

```
1 \documentclass{article}
2 \usepackage{lipsum}
3 % geometry package, control the margin
  of the article
4 \usepackage[margin = 1 in, left = 1.5
  in, includefoot]{geometry}
5 % Header and Footer Stuff
6 \usepackage{fancyhdr} % fancyhdr
  package
7 \pagestyle{fancy}
8 % Clear previous head and foot style
9 \fancyhead{}
10 \fancyfoot{}
11 % Position the page number RHS of the
  footer
12 \fancyfoot[R]{ \thepage \ }
13 % Clear the header line
14 \renewcommand{\headrulewidth}{0pt}
15 % Keep the footer line
16 \renewcommand{\footrulewidth}{1pt}
```

1 Introduction

This is the first line of the report. This report will show you how to use `\lipsum`. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut porta elit, vestibulum ut, placerat ac, adipiscing elit, id. Cras bibendum magna. Nam arcu libero, nuncius eget, consetetur et, vulputate a, magna. Donec vel porta magna eu tempus. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Maecis et leo. Cras viverra, nuncius dui. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus et amet tortor gravida placerat. Integer sapien est, laoreet la, pretium quis, viverra ac, sem. Praesent eget sem vel leo ultrices lobortis. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, nulla ac, nulla. Cras bibendum magna eu tempus. Donec viverra arcu eget risus. Duis nulla mi, congue eu, accumsan dui, sagittis quis, diam. Duis eget arcu sit amet vari dispartit rutrum.

2 Second section

This is the second section of this report.

2.1 Sub section 1

This is the first sub-section in this report.

2.2 Sub section 2

This is the second subsection in this report.

2.2.1 Sub-sub section

This is a sub-sub-section. Replace text here when you write your report.

```
% Normal bullet point: itemized
\begin{itemize}
  \item This is our first line
  \item This is our second line and I
        am making it longer so that you
        can see how text wraps around
        automatically in \LaTeX
\begin{itemize}
  \item A bullet within a bullet!
  \begin{itemize}
    \item More deeper
  \end{itemize}
\end{itemize}
\item [Title] blah blah blah
\item [This is a longer title] blah
      blah blah
\begin{enumerate}
  % Numberd lists
  \item \lipsum[1]
  % Just try to make the PDF looks
    okay for this presentation
  \item \lipsum[2]
\end{enumerate}
\end{itemize}
```

- This is our first line
- This is our second line and I am making it longer so that you can see how text wraps around automatically in \LaTeX
 - A bullet within a bullet!
 - More deeper

[illegible]

Figures and tables

```
1 \usepackage{graphicx}% Import images
2 \usepackage{float} % Control float
```

```
1 \section{Figures and Tables}
2 \subsection{Figures}
3 \begin{figure}[H]
4 \centering
5 \includegraphics[width = \textwidth]{Figures/space.png}
6 \caption{My desktop background}
7 \label{fig}
8 \end{figure}
9 \subsection{Tables}
10 \begin{table}[H]
11 \centering \label{tab}
12 \caption{This is a very simple table}
13 \begin{tabular}{l | c r}
14 Name & University & Department \\
15 \hline
16 CSSA & Cambridge & Engineering \\
17 \end{tabular}
18 \end{table}
19 Figure \ref{fig}. Table \ref{tab}.
```

4 Figures and Tables

4.1 Figures



Figure 1: My desktop background

4.2 Tables

Table 1: This is a very simple table

Name	University	Department
CSSA	Cambridge	Engineering

Figure 1: Table 1.

Math equations

```

1 \section{Math equation}
2 Fractions, inline equation: $d = v_{it}
   + \frac{1}{2} \cdot \text{at}^2$\\
3 Brackets:
4 $$\left(\frac{1}{2}\right) \cdot 2 =
   1$$
5 $$\left|-7\right| = 7$$
6 $$x^{2^3}$$
7 \begin{eqnarray*}
8 \quad \sqrt{4} \neq 5 \\
9 \quad \pi \approx 3 \\
10 \quad \pi \times \sqrt{4} < 15
11 \end{eqnarray*}
12 \begin{equation}
13 \quad U(\alpha, \beta) = \frac{e^{j\mathbf{k}z}}{\lambda z} e^{j\frac{k(\alpha^2 + \beta^2)}{2z}} \iint \left\{ U(x,y) e^{j\frac{k(x^2 + y^2)}{2z}} \right. \\
   \left. \right\} e^{-j\frac{k}{2}(\alpha x + \beta y)} \\
   dx dy
14 \quad \label{eq:Fresnel}
15 \end{equation}

```

5 Math equation

Fractions, inline equation: $d = v_{it} + \frac{1}{2} \cdot \text{at}^2$

Brackets:

$$\left(\frac{1}{2}\right) \cdot 2 = 1$$

$$|-7| = 7$$

$$x^{2^3}$$

$$\sqrt{4} \neq 5$$

$$\pi \approx 3$$

$$\pi \times \sqrt{4} < 15$$

$$U(\alpha, \beta) = \frac{e^{j\mathbf{k}z}}{\lambda z} e^{j\frac{k(\alpha^2 + \beta^2)}{2z}} \iint \left\{ U(x, y) e^{j\frac{k(x^2 + y^2)}{2z}} \right\} e^{-j\frac{k}{2}(\alpha x + \beta y)} dx dy \quad (1)$$

References: set up

- ▶ LHS: Journal paper
- ▶ RHS: Conference paper

```
1 @article{GaborHolography,  
2   author = {D. Gabor},  
3   journal = {Nature},  
4   number = {161},  
5   pages = {777--778},  
6   publisher = {Nature},  
7   title = {A new microscopic principle  
8     },  
9   volume = {161},  
10  month = {May},  
11  year = {1948},  
12  url = {https://www.nature.com/  
13    articles/161777a0},  
14  doi = {https://doi.org  
15    /10.1038/161777a0},  
16 }
```

```
1 @inproceedings{HardReview_84,  
2   author = {M. Lucente and Galyean, T.  
3     A.},  
4   title = {Rendering Interactive  
5     Holographic Images},  
6   booktitle = {Proceedings of the 22Nd  
7     Annual Conference on Computer  
8     Graphics and Interactive  
9     Techniques},  
10  series = {SIGGRAPH '95},  
11  year = {1995},  
12  isbn = {0-89791-701-4},  
13  pages = {387--394},  
14  numpages = {8},  
15  url = {http://doi.acm.org  
16    /10.1145/218380.218490},  
17  doi = {10.1145/218380.218490},  
18  acmid = {218490},  
19  publisher = {ACM},  
20  address = {New York, NY, USA},  
21 }
```


References: use

```
1 % Reference setup
2 \cleardoublepage
3
4 \section{How to use references}
5 \lipsum[1]
6 \textbf{I'm citing a journal article}
   \cite{GaborHolography}.\
7 \lipsum[2]
8 \textbf{I'm now citing a conference
   article} \cite{HardReview_84}.
9
10
11 \bibliographystyle{IEEEtran}
12 \cleardoublepage
13 \bibliography{References/references.
   bib}
14 \addcontentsline{toc}{section}{
   \numberline{}References}
```

```
1 % .bibtex file
2 use google
```

6 How to use references

Leten ipsum dolor sit amet, consectetur adipiscing elit. Ut porro elit, vestibulum ut, phasellus ac, adipiscing vitae, felis. Cras ultricies dictum gravida mauris. Nam arcu libero, semper eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Maeculis ut leo. Cras viverra netus diamque nisi. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida phasellus. Integer sapien est, iaculis in, pretium quis, viverra ac, nisi. Praesent eget nisi vel leo ultrices bibendum. Aenean laoreet. Morbi dolor nulla, malesuada eu, pulvinar et, nulla ac, nulla. Cras ultricies augue nisi. Donec varius orci eget tunc. Duis nulla nisi, congue eu, accumsan dui, dapibus quis, diam. Duis eget orci sit amet orci dignissim rutrum.

For citing a journal article [1].

Nam dui ligula, fringilla a, vulputate sodales, efficitur vel, wisi. Morbi arcu lorem non justo. Nam lacus libero, pretium at, lobortis vitae, ultricies et, tellus. Donec aliquet, tortor sed accumsan bibendum, erat ligula aliquet magna, vitae ornare odio metus a wisi. Morbi ac orci et wisi hendrerit nulla. Suspendisse ut massa. Cras nec ante. Pellentesque a nulla. Cum exite autogate proculibus et tempore de partemur nostris, inverteit ridiculus non. Aliquam tincidunt urna. Nulla ullamcorper vestibulum tristique. Pellentesque cursus lacinia mauris.

For now citing a conference article [2].

Appendix

```
1 \cleardoublepage
2 \appendix
3 \section{Appendix-1}
4 This is the first appendix.
5 \lipsum[1]
6 \section{Appendix-2}
7 This is the second appendix.
8 \begin{figure}[H]
9   \begin{subfigure}{0.5 \linewidth}
10     \includegraphics[width =
11       \textwidth]{Figures/Cubic_
12       aperture.png}
13     \caption{cubic aperture}
14     \label{cubicAperture}
15   \end{subfigure}
16   \begin{subfigure}{0.5 \linewidth}
17     \includegraphics[width =
18       \textwidth]{Figures/Circular_
19       aperture.png}
20     \caption{circular aperture}
21   \end{subfigure}
22   \caption{Two figures}
23 \end{figure}
```

A Appendix-1

This is the first appendix. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut porce elit, metusibus ut, phasmat se, adipiscing vitae, fides. Curabitur dictum gravida mauris. Nam acen libero, suscipit eget, consectetur id, vulputate a, magna. Donec volutatis augue eu magna. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Curabitur mauris donec sem. Nulla et lectus congue lacinia sem fringilla ultrices. Phasellus eu tellus ut auctor tunc gravida phasellus. Integer magna nisi, interdum in, porttitor quis, congue ac, ante. Praesent eget sem vel leo ultrices interdum. Aenean faucibus. Morbi dolor nulla, interdum eu, pulvinar ut, nulla ac, nulla. Curabitur auctor orci eget risus. Donec tunc orci eget risus. Duis nulla nisi, congue eu, acenamus duis, sagittis quis, diam. Duis eget nisi ut auctor congue dignissim rutrum.

B Appendix-2

This is the second appendix.

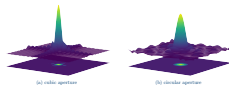


Figure 2: Two figures

Table of contents, list of figures, list of tables

```
1 \end{titlepage}
2 \cleardoublepage
3 % Table of contents stuff
4 \pagenumbering{roman}
5 \tableofcontents
6 % \cleardoublepage
7 % List of figures, list of tables
8 \listoffigures
9 \listoftables
10
11 \thispagestyle{empty}
12 \addcontentsline{toc}{section}{
13     \numberline{}List of Figures}
14 \addcontentsline{toc}{section}{
15     \numberline{}List of Tables}
16 \cleardoublepage
17 % Main body stuff
18 \pagenumbering{arabic}
19 \setcounter{page}{1}
20
21 \cleardoublepage
22 \section{Introduction}
```

Contents

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How to use dashes

There are, in fact, **en dashes**, **em dashes**, **hyphens** and **minus signs**.

- corresponds to - hyphen
- corresponds to – en dash
- corresponds to — em dash
- \$-\$ corresponds to – minus sign

In terms of how to properly use them, try searching the internet for answers. **Metaphysics** it is.

Templates

We will demonstrate some useful \LaTeX templates.

However, keep in mind that before you use templates, you should make yourself comfortable with the basic \LaTeX commands.

Useful resources revisit

- ▶ University of Cambridge CUED thesis template, **Gitlab: Siegfriedchao**, modified from **Github: kks32**
- ▶ University of Cambridge Powerpoint template, **Gitlab: Siegfriedchao**, modified from **Github: rjw57**