剑桥中国学生学者联谊会
Chinese Students and Scholars Association in Cambridge

How to use LaTeX: A gentle walk into the world of typesetting

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Why LaTeX ?

An extremely good philosophical question.

- Microsoft Office Word and PowerPoint are boring, because they literally are.
- LaTeX is elegant, charming, or whatever...
- Excellent for mathematical typesetting (you can even use LaTeX in Word!).
- Powerful, lots and lots of functionality for you to discover and extend. Be it theses, papers, slides (using Beamer), spreadsheets... Your imagination is the only limitation (apart from time...).
- Free and portable, supported by most OS platforms.

What LaTeX can do

- Write scientific papers
- Write theses
- Typeset books and publications
- Write typeset letters
- Play around with mathematical formulae
- Make presentation slides
- Beautify your CV
- and much more

Useful resources

Books list

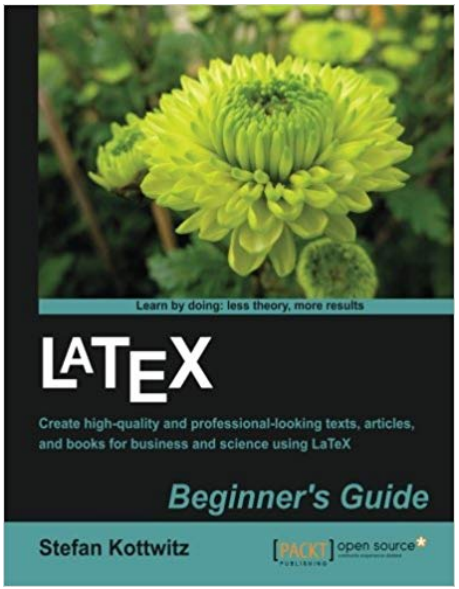


Figure 1: LaTeX Beginner's Guide

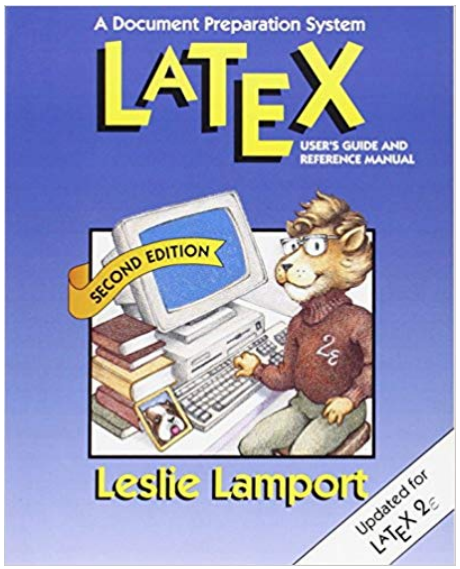


Figure 2: LaTeX: A Document Preparation System: User's Guide and Reference Manual

Useful resources

Learn LaTeX in one video:
`https://www.youtube.com/watch?v=VhmkLrOjLsw`

Overleaf: `https://www.overleaf.com`
The easy to use, online, collaborative editor. Templates and tutorials are available.

A brief history

In the mid 1970s, Donald Knuth, a Stanford CS geek and the academic world equivalent of Martin (the author of GOT), developed TEX 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 adding a set of macros to the orginal TEX.

Q: What is the relationship between TEX and LATEX?
LATEX uses the TEX typesetting programme to compile and generate its output. LATEX focuses on the content while TEX is the main programme for setting up the layout.

LaTeX version and more

The first LaTeX version available is 2.09 (strange number and strange version control). Later in 1994, LaTeX 2_ε replaced the old version, and remained ever since.

LaTeX 3 is a long-term research project, which started from the 1990s.

LaTeX, unlike Microsoft Word, does not use **direct manipulation**. (It *is* **WYSIWYG**—what you see is what you get—but only if you create a preview in a PDF file or similar. The text that you *edit* will *not* look like what you get, unless you have a clever editor like GNU TeXmacs.) LaTeX allows the user to focus on the content and structure of the text. Some strange syntax and commands are present in the LaTeX source file.

How to pronounce LaTeX

First and foremost, the pronunciation of LaTeX. According to the father of TeX[1]:

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

[1] This frame here uses the *aquote* package

How to pronounce LaTeX

Another quote from the father of LaTeX[2]:

> *'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

[2] This frame here uses the *aquote* package

Installation

I would highly recommend the following LaTeX distributions (or platforms).

- For Windows users
  - TeX Live
  - MiKTeX
- For MacOS users
  - TeX Live
  - MacTeX
- For web-based users
  - Overleaf

Note that the TeX Live distribution contains yearly updates, and the update installation must be done manually.

Editors

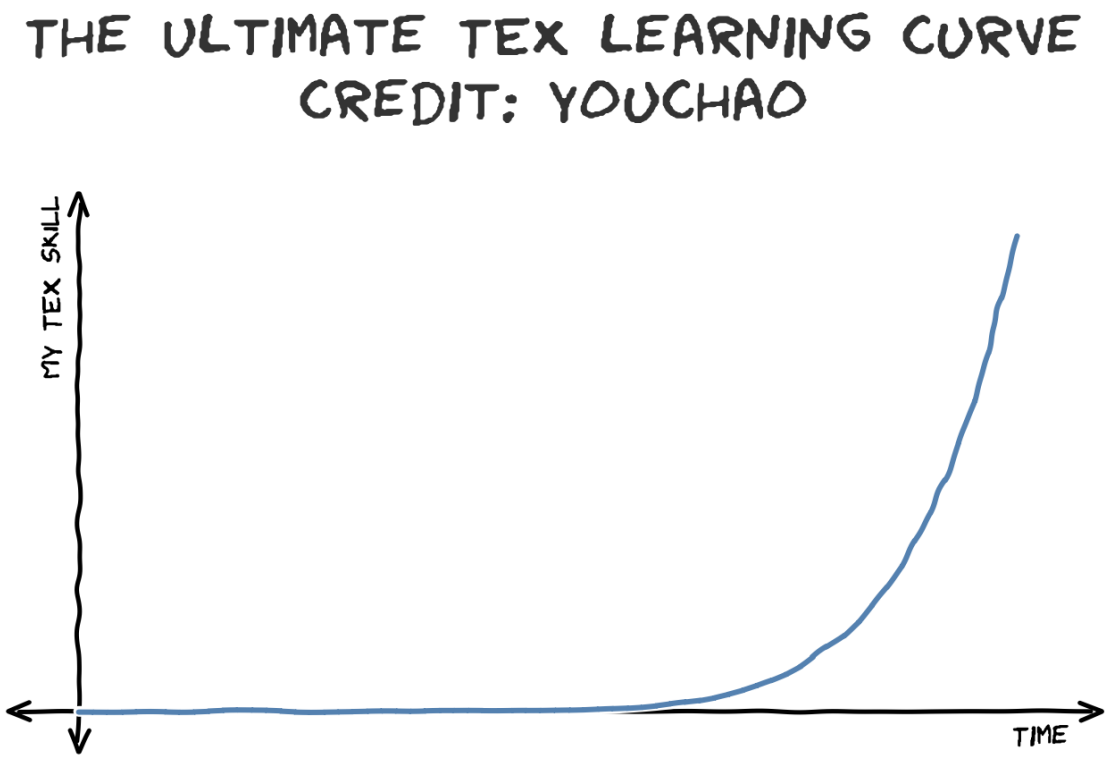
There are in fact numerous ways for you to write up a LaTeX document.

- TeXStudio (one that I am using to build the beamer slides)
- TeXShop
- Notepad / Notepad++
- Sublime
- Visual Studio Code
- Vi / Vim
- *Word* !!!
- Overleaf (the online editor)

In fact, any plain-text editor shall suffice. There are also front ends like TeXmacs and LyX.

How to use

We have to remind you that learning LaTeX is *(or might be) very hard* [3]



How to use

We have to remind you that learning LaTeX is *(or might be) very hard* [4]

[4] These arrows are plotted using a package called *tikz*

Some common knowledge

- Since LaTeX is implemented in the TeX **typesetting language**, we should consider the TeX input syntax when use it.
- Being able to use style files and packages/environments properly is the key to success. Use Google when uncertain—but check it's a good source (highly-upvoted StackOverflow, etc).
- TeX reads *.tex files, and with lots of interesting background procedures outputs *.pdf files.

Some common knowledge

- The effect of typing multiple spaces is the same as one space.
- The effect of typing multiple line feeds is the same as a one-paragraph break.
- If you don't know how and when to use \ (backslash), **then you need to know how and when to use it**.
- Be aware of the use of \xspace and whatever that follows the backslash after the ~mark, e.g., ~\ref[5].
- \(white space), this forces normal space, \@, this indicates that the next punctuation ends the sentence. Try out the differences by yourselves.

[5] I personally prefer to use ~\ref, ~\cite, etc., since doing so will force the symbols that follow not start a new line when required

Some common knowledge

- Special meta characters as part of the TEX language syntax:
  - `# $ % ^ & _ { } ~ \`
- To use them you have to do the following

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

Changing fonts and styles

You may either use (1) lexical declarations or (2) commands. *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

Changing fonts and styles

In order to properly apply the font and style settings to your text, you will need to use curly braces { and } for grouping.

- Using the commands and macros grouped by the curly braces.
  E.g.
  This is to demonstrate the \textbf {bold} statement.
  This is to demonstrate the **bold** statement.
- Setting up the lexical scope using the curly braces.
  E.g.
  This is to demonstrate the {\bfseries bold} statement.
  This is to demonstrate the **bold** statement.

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

For example, line-breaks (*hyphen*), Figures 1–4 (*en dash*), people—like me—love to use LaTeX (*em dash*).
In terms of how to properly use them, try searching the internet for answers. **Metaphysics** it is.

How to use quotation marks

One of the (out of the many) mistakes that you will definitely make throughout your LaTeX journey is the use of quotation marks.
Unlike Word, TeX uses single quotation mark (') and the grave accent (`) to encode the differences.

´ corresponds to ' left quote
` corresponds to ` right quote
´ ´ corresponds to " left double
` ` corresponds to `` right double

Surviving from using tables

Tables! Many have tried to survive, many then failed.

In general, there are:

- the normal table, \table (then \tabular),
- the table that can span over several pages, \longtable

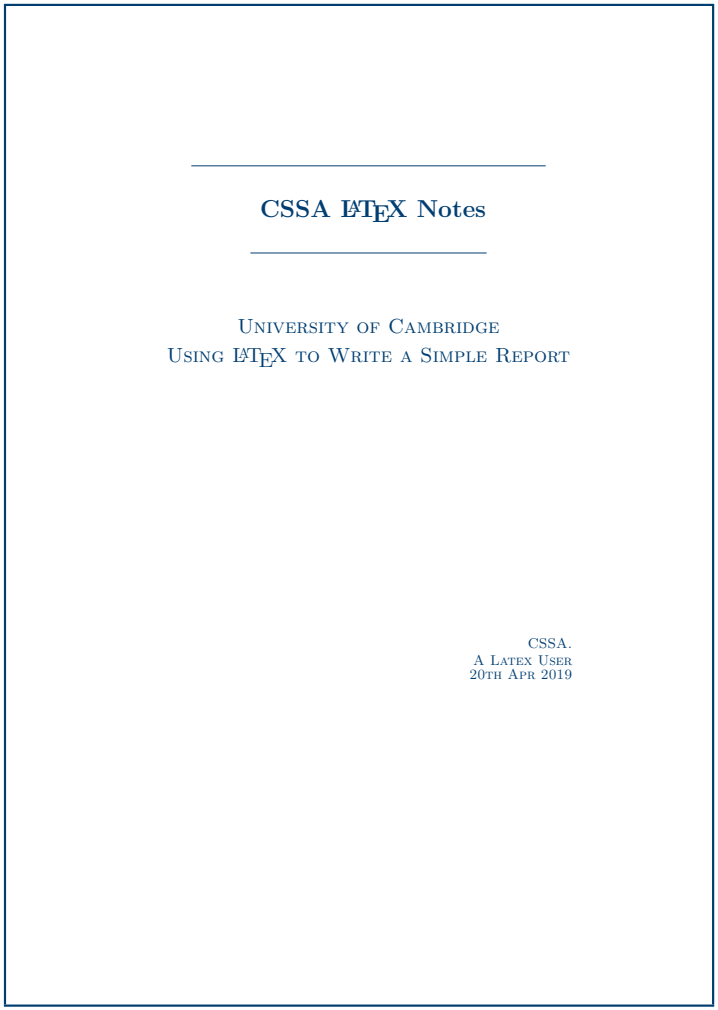
A word of caution

If you do not put theory into practice, you shall never be able to master LaTeX.[6]

[6] An infamous quote from Youchao Wang

Starting a report and title page

```latex
\documentclass{article}
\begin{document}
\begin{titlepage}
  \begin{center}
    \line(1,0){300}\\
    [0.25in]
    \huge{\textbf{ CSSA \LaTeX\ Notes }}\\
    [2mm]
    \line(1,0){200}\\
    [1.5cm]
    \textsc{\LARGE University of Cambridge}\\
    \textsc{\LARGE Using \LaTeX\ to Write a Simple Report}\\
    [8cm]
  \end{center}
  \begin{flushright}
    \textsc{\large CSSA. \\ A \LaTeX{} User\\
    20th Apr 2019}
  \end{flushright}
\end{titlepage}
\end{document}
```



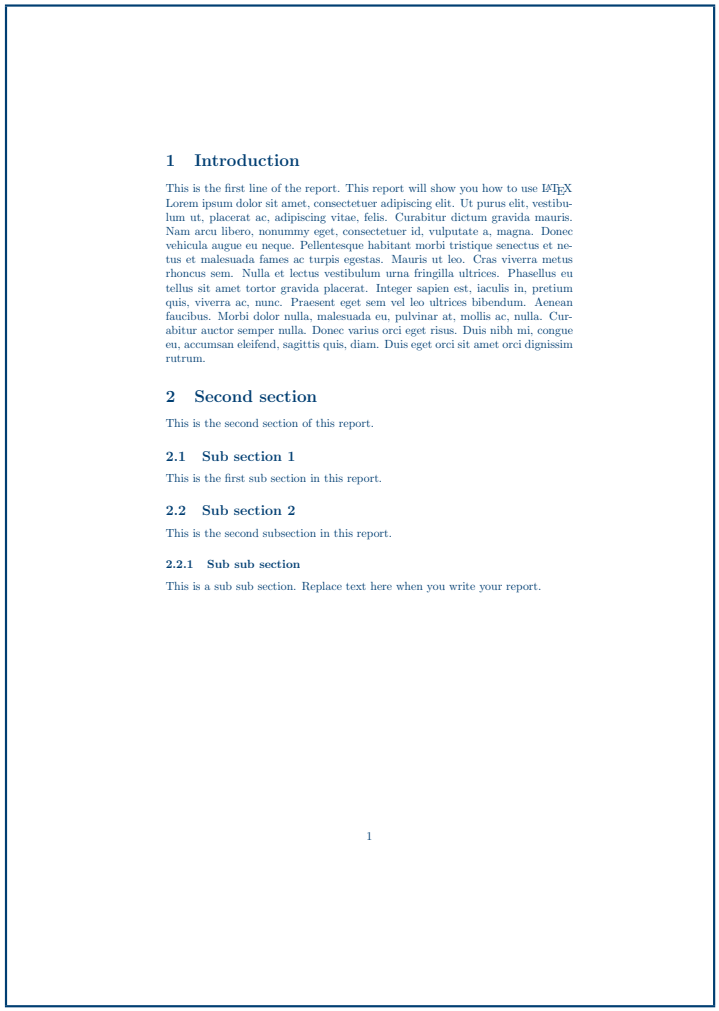
CSSA LaTeX Notes

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, consectetuer adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetuer id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. 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 bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, 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 subsection in this report.

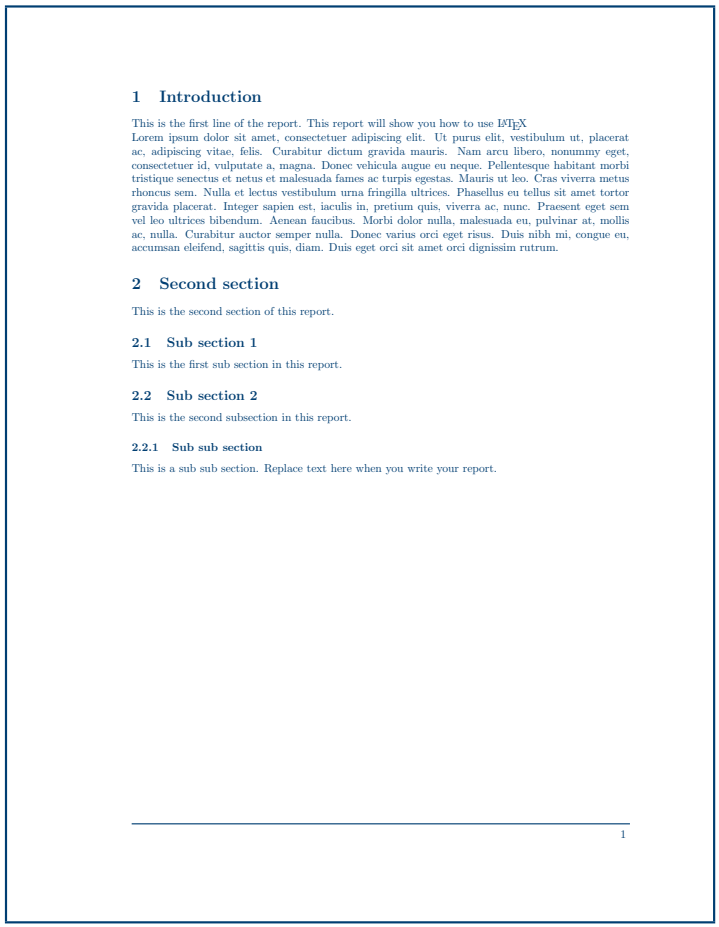
2.2.1 Sub sub section

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

1

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 LaTeX
Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetuer id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. 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 bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, 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 subsection in this report.

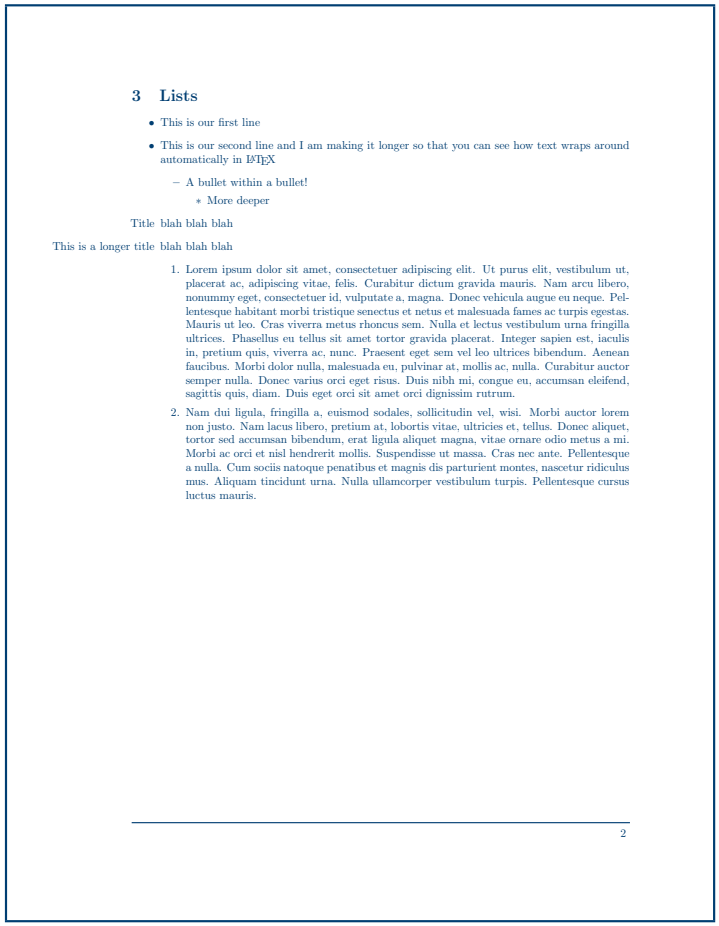
2.2.1 Sub sub section

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

1

Lists

```latex
% Normal bullet point: itemized
\begin{itemize}
  \item This is our first item
  \item This is our second item 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 trying to make the PDF look
          okay for this presentation
    \item \lipsum[2]
  \end{enumerate}
\end{itemize}
```



3 Lists

- 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

Title blah blah blah

This is a longer title blah blah blah

1. Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetuer id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. 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 bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.
2. Nam dui ligula, fringilla a, euismod sodales, sollicitudin vel, wisi. Morbi auctor 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 mi. Morbi ac orci et nisl hendrerit mollis. Suspendisse ut massa. Cras nec ante. Pellentesque a nulla. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Aliquam tincidunt urna. Nulla ullamcorper vestibulum turpis. Pellentesque cursus luctus mauris.

2

Figures and tables

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

```
\section{Figures and Tables}
\subsection{Figures}
\begin{figure}[H]
  \centering
  \includegraphics[width = \textwidth
      ]{Figures/space.png}
  \caption{My desktop background}
      \label{fig}
\end{figure}
\subsection{Tables}
\begin{table}[H]
  \centering \label{tab}
  \caption{This is a very simple table
      }
  \begin{tabular}{l | c r}
    Name & University & Department
        \\\hline
    CSSA & Cambridge & Engineering \\
  \end{tabular}
\end{table}
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

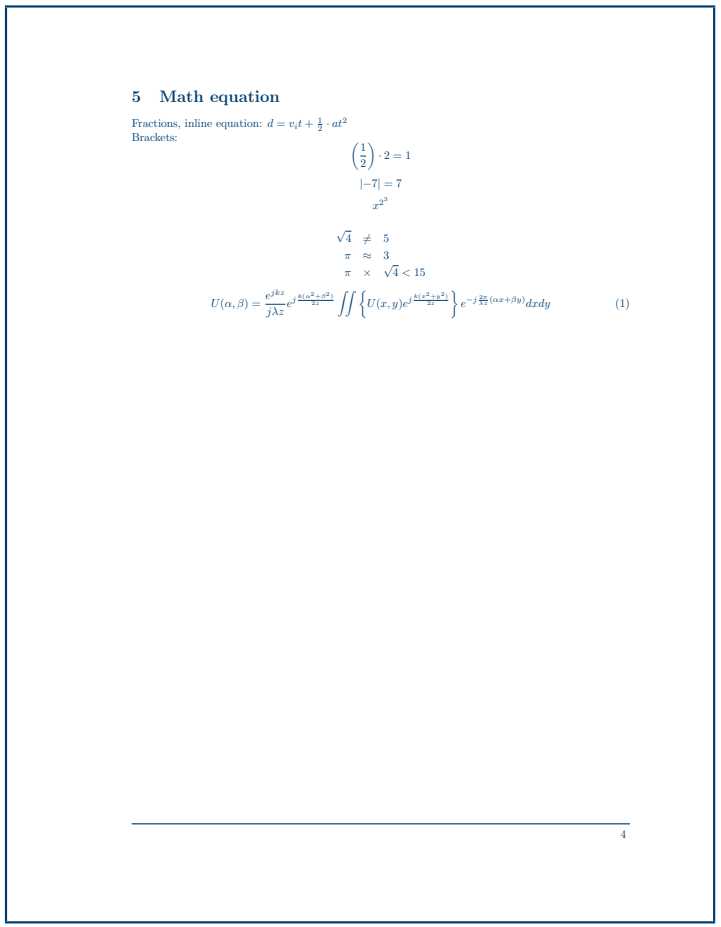
Name	University	Department
CSSA	Cambridge	Engineering

Figure 1. Table 1.

3

Math equations

```
\section{Math equation}
Fractions, inline equation: $d = v_it + \frac{1}{2} \cdot at^2$\\
Brackets:
$$\left(\frac{1}{2}\right) \cdot 2 = 1$$
$$\left|-7 \right| = 7$$
$$x^{2^3}$$
\begin{eqnarray*}
    \sqrt{4} &\neq& 5 \\
    \pi &\approx& 3 \\
    \pi &\times& \sqrt{4} < 15
\end{eqnarray*}
\begin{equation}
  U(\alpha, \beta) = \frac{e^{jkz}}{j\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{2\pi}{\lambda z}(\alpha x+\beta y)}dxdy
  \label{eq:Fresnel}
\end{equation}
```



5 Math equation

Fractions, inline equation: $d = v_it + \frac{1}{2} \cdot at^2$
Brackets:

$$\left(\frac{1}{2}\right) \cdot 2 = 1$$
$$\left|-7 \right| = 7$$
$$x^{2^3}$$

$$\begin{aligned} \sqrt{4} &\neq 5 \\ \pi &\approx 3 \\ \pi &\times \sqrt{4} < 15 \end{aligned}$$

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

4

References: set up

- LHS: Journal paper
- RHS: Conference paper

```
@article{GaborHolography,
  author = {D. Gabor},
  journal = {Nature},
  number = {161},
  pages = {777--778},
  publisher = {Nature},
  title = {A new microscopic principle},
  volume = {161},
  month = {May},
  year = {1948},
  url = {https://www.nature.com/articles/161777a0},
  doi = {https://doi.org/10.1038/161777a0},
}
```

```
@inproceedings{HardReview_84,
 author = {M. Lucente and Galyean, T. A.},
 title = {Rendering Interactive Holographic Images},
 booktitle = {Proceedings of the 22Nd Annual Conference on Computer Graphics and Interactive Techniques},
 series = {SIGGRAPH '95},
 year = {1995},
 isbn = {0-89791-701-4},
 pages = {387--394},
 numpages = {8},
 url = {http://doi.acm.org/10.1145/218380.218490},
 doi = {10.1145/218380.218490},
 acmid = {218490},
 publisher = {ACM},
 address = {New York, NY, USA},
}
```

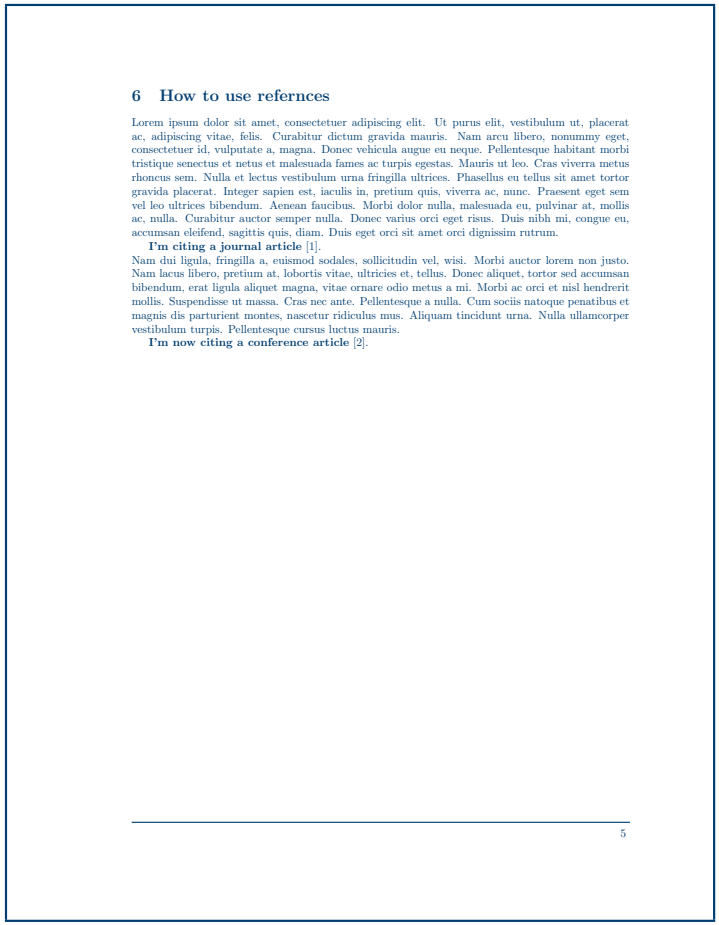
References: use

```
% Reference setup
\cleardoublepage

\section{How to use refernces}
\lipsum[1]
\textbf{I'm citing a journal article}
    \cite{GaborHolography}.\\
\lipsum[2]
\textbf{I'm now citing a conference
    article} \cite{HardReview_84}.


\bibliographystyle{IEEEtran}
\cleardoublepage
\bibliography{References/references.
    bib}
\addcontentsline{toc}{section}{
    \numberline{}References}
```

```
% .bibtex file
use Google
```



6 How to use refernces

Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetuer id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. 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 bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

I'm citing a journal article [1].

Nam dui ligula, fringilla a, euismod sodales, sollicitudin vel, wisi. Morbi auctor 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 mi. Morbi ac orci et nisl hendrerit mollis. Suspendisse ut massa. Cras nec ante. Pellentesque a nulla. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Aliquam tincidunt urna. Nulla ullamcorper vestibulum turpis. Pellentesque cursus luctus mauris.

I'm now citing a conference article [2].

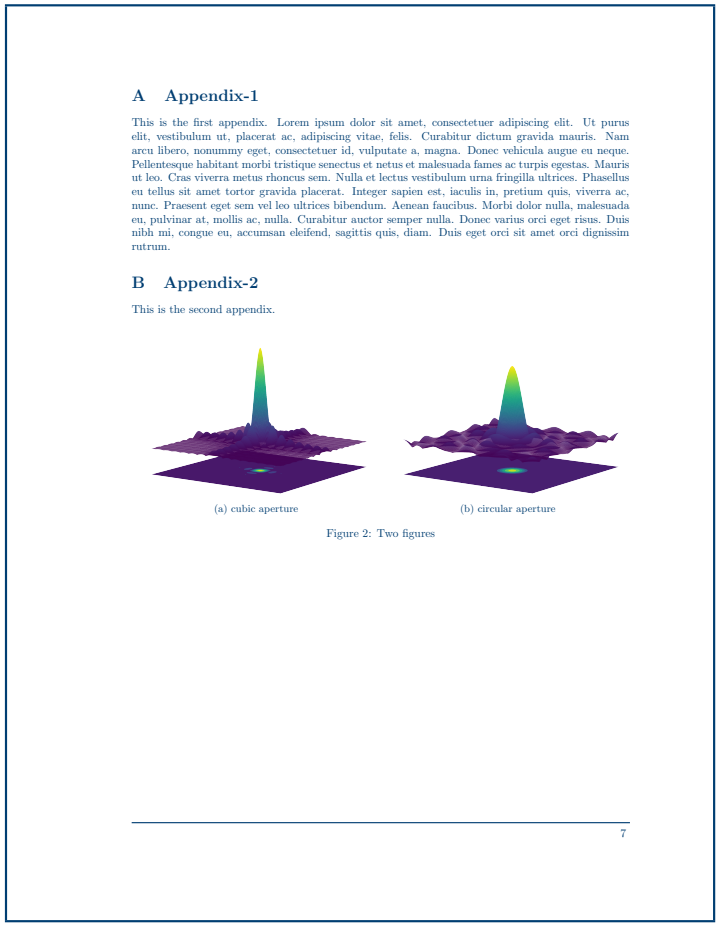
5

References: a word of caution

- I am personally an old user who prefers to use *bibtex* instead of *biblatex*, simply because: (a) most of my bibliography database is built upon *bibtex*, (b) I am **too lazy** to switch.
- However, if you have just began to use LaTeX, do practice your use of *biblatex* as it has a rather more modern implementation.
- In fact, for *bibtex* you would use *BibTeX* as your bibliography tool. Unfortunately, this tool does not support *biblatex*, as it uses *Biber*.

Appendix

```
\cleardoublepage
\appendix
\section{Some data}
This is the first appendix.
\lipsum[1]
\section{Some more data}
This is the second appendix.
\begin{figure}[H]
  \begin{subfigure}{0.5\linewidth}
    \includegraphics[width =
        \textwidth]{Figures/Cubic_
        aperture.png}
    \caption{cubic aperture}
    \label{cubicAperture}
  \end{subfigure}
  \begin{subfigure}{0.5\linewidth}
    \includegraphics[width =
        \textwidth]{Figures/Circular_
        aperture.png}
    \caption{circular aperture}
    \label{circularAperture}
  \end{subfigure}
  \caption{Two figures}
\end{figure}
```



A Appendix-1

This is the first appendix. Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetuer id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. 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 bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

B Appendix-2

This is the second appendix.

(a) cubic aperture (b) circular aperture

Figure 2: Two figures

7

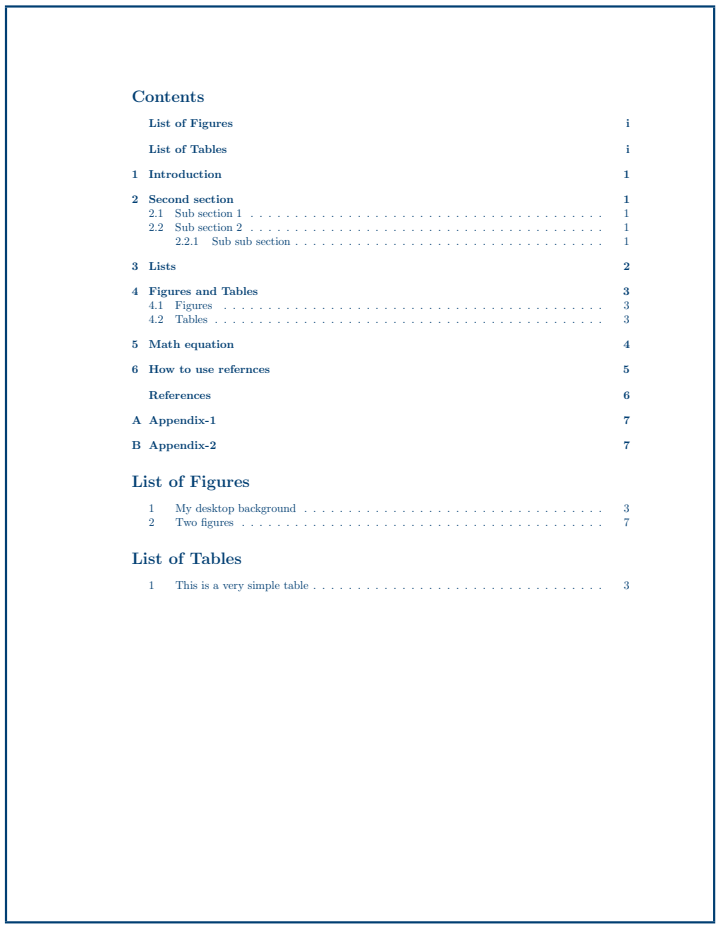
Table of contents, list of figures, list of tables

```
\end{titlepage}
\cleardoublepage
% Table of contents stuff
\pagenumbering{roman}
\tableofcontents
% \cleardoublepage
% List of figures, list of tables
\listoffigures
\listoftables

\thispagestyle{empty}
\addcontentsline{toc}{section}{
    \numberline{}List of Figures}
\addcontentsline{toc}{section}{
    \numberline{}List of Tables}
\cleardoublepage

% Main body stuff
\pagenumbering{arabic}
\setcounter{page}{1}

\cleardoublepage
\section{Introduction}
```



Templates

I will demonstrate some useful LaTeX templates, in particular those in Overleaf, as it has became way too popular these days given most people are lazy and not bothered setting up their own development environments.

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

Other packages

We've mostly looked at LaTeX commands useful for **engineers**.
LaTeX also has packages for linguists, musicians, chemists & other disciplines.
It's worth checking what LaTeX packages are available for your subject!

The last session: Q and A

Hopefully, hopefully and hopefully I will be able to answer your questions with my limited years of experience, because LaTeX is HARD.

Thank you!