

# Student Learning Service: Introduction to Latex

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# Outline

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# What is $\LaTeX$ ?

- $\LaTeX$  is a package based on the  $\TeX$  programming language
- It is used to write documents (including presentations)
- You write a `.tex` file, which you compile to produce the output (`.pdf` or `.dvi` file)
- We will use **Texworks** to write and compile our `.tex` files
- Other available pieces of software are **TexMaker**, **LyX** (higher level)

## Pros and Cons

- Steep learning curve, particularly for those who have no programming background
- You can not see immediately your output
- Editing the document is difficult for multi-author documents

However:

- Access to formatting commands helps keeping the formatting consistent throughout the document
- Large documents can be managed more easily
- Mathematics writing is very neat
- .pdf output is cross-platform and prints consistently

Talk to your supervisor before you embark on writing your dissertation in  $\text{\LaTeX}$ !

# Preamble

A  $\text{\LaTeX}$  document consists in **a preamble** and **a document environment**.

The preamble is a piece of coding which contains information of the overwhole organisation of the document, and libraries that need included.

Within the document environment, you write your text! This is the bit:

```
\begin{document}
```

.

.

.

```
\end{document}
```

# Using the Engineering Template

We will be working from the School of Engineering template.

The preamble is already written for you, all you need is 'fill in the blanks'.

# Creating a $\text{\LaTeX}$ Document

- Download the zip folder 'Examples for PGTs' from the  $\text{\LaTeX}$  section in Toolkit 'abdn.ac.uk/toolkit';  
unzip and save on your H-drive;
- Go to the folder 'Physical Sciences\Natural and Computing Sciences\Mathematical Sciences';
- Open Texworks and File -> Open to open the file 'Dissertation.tex';
- Remember: whenever you make changes to your .tex file, re-run the file by clicking the green arrow at the top-left in order to update the pdf file;

# Creating a $\text{\LaTeX}$ Documents

It is best practise to locate your `.tex` file in a folder:  $\text{\LaTeX}$  produces many intermediate files during compilation. These files contain various types of information, used for referencing in particular.

Compilation errors will usually be explained in the bottom window alongside the error line.

To add the line number in the `.tex` file: Format - Line Numbers.

To add colouring to the `.tex` file: Format - Syntax Coloring - LaTeX.

Try producing your first pdf by compiling the 'Dissertation.tex' file (i.e. press the green arrow).



# Text Formatting

Some useful formatting commands:

- *Italic*: `\textit{your text}`;
- **Bold**: `\textbf{your text}`;
- changing the color :

`\textcolor{name of the colour} {your text}`;

(available colors in this template: red, green, blue, cyan, magenta, yellow, black, white)

- To force a new line: `\\`;
- To start a new paragraph: skip a line in the code;

# Text Formatting

The `itemize` environment allows you to create a list (like this one):

```
\begin{itemize}
```

```
\item your first bullet point;
```

```
\item your second bullet point;
```

```
\end{itemize}
```

The `enumerate` environment works in the same way and creates a numbered list. You can nest `itemize` and `enumerate` environments.

# Creating a Title

The title is generated within the bit:

```
\begin {titlepage }
```

.

.

```
\end {titlepage }
```

You can ‘fill in the blank’.

The list of content, list of figures and list of tables are generated automatically.

# Sections

In this template, the structure is: chapters, sections and subsections.

chapters: `\chapter{chapter's title}`

sections: `\section{your section title}`

subsection: `\subsection{your subsection title}`.

# Exercise

## Exercise 2:

Modify your .tex file to add your title and name, your chapters' titles, try different formatting commands, etc...

You may want to save you .tex file under a different name.

Remember that whenever you make alterations to your .tex file you need to compile it (click the green arrow).

To make comments, you can start a line with the command:

%

# Inserting Figures

To insert a figure saved as an image file, you need to use the following command:

```
\includegraphics[some attributes]{name of the file}
```

Some of the common attributes are:

- width and height:

```
\includegraphics[width=3cm, height=4cm]{file name}
```

the length can be in cm, mm, pt;

- scale: `\includegraphics[scale=0.5]{ }`;
- angle: `\includegraphics[angle=90]{ }`

Image files can be .eps, .jpg, .png or .pdf.

## Inserting Figures

However, inserting figures in this way has very limited flexibility....

Include the command within a ‘figure’ environment:

```
\begin{figure}[placement spec]  
  
\includegraphics[width=. . .]{figure.eps}  
  
\end{figure}
```

If you want the figure to be centered, add the command `\centering` before the `\includegraphics` command.

```
\begin{figure}[placement spec]  
  
\centering  
  
\includegraphics[width=. . .]{figure.eps}  
  
\end{figure}
```

# Inserting Figures

The placement specifiers are:

Specifier	Effect
t	places the float at the top of the page
b	places the float at the bottom of the page
p	places the float on a special float page
h	places the float at the point where the source code appears (or approximately)
!	overrides internal $\text{\LaTeX}$ rules for good positioning of floats
H	places the float precisely at this point (requires the 'float' package). This is useful in multicolumn documents.



# Exercise

## Exercise 3:

Insert a figure to your  $\text{\LaTeX}$  document. You can use the figures in the Figures folder or choose one of your own.

Note: if your .tex file and your figure are not in the same folder, you must indicate the path to the figure in the includegraphics command:

```
\includegraphics[width=8cm]{figures/figure1.jpg}
```

# Inserting Tables

To create a table, you need the tabular environment:

```
\begin{tabular} {column spec}
```

```
First row: first item & second item & ... \\\
```

```
Second row: first item & second item & ... \\\
```

```
etc ...
```

```
\end{tabular}
```

There must be as many column specifiers as there are columns in the table, all added within the same pair of curly brackets.

# Inserting Tables

Specifier	Effect
<code>l</code>	creates a left-justified column
<code>c</code>	creates a centered column
<code>r</code>	creates a right-justified column
<code>p{some width}</code>	creates a column of specified width with text aligned at the top

# Inserting Tables

Again, things become a lot more flexible if you embed your table in a float environment, i.e. a table environment in this case:

```
\begin{table}[placement spec]
```

```
\begin{tabular} {column spec}
```

etc ...

```
\end{tabular}
```

```
\end{table}
```

# Exercises

## Exercise 4:

Insert a table to your  $\text{\LaTeX}$  document.

You can add horizontal lines with the command `\hrule` and vertical lines with the `|` character between column specifiers.

# Captions

You can include a caption in a float with the command

```
\caption[short]{long},
```

where *short* appears in the list of figures (or tables) and *long* appears beside the float in the document.

The *short* option is optional.

The list of figures and list of tables can be generated automatically with the commands (usually just below the `\begin{document}` command):

The list of figures and the list of tables are generated automatically.

# Labels

It is also possible to create labels to reference floats. Referencing is done as following in  $\text{\LaTeX}$ :

Insert:  $\text{\label}\{marker\}$  in the float, where *marker* is a marker (name) you are giving your float. The best is to insert the command in the caption command or after.

In the text, you call the float number in this way: ‘Figure  $\sim\text{\ref}\{marker\}$  ...’. The  $\sim$  sign creates a space before the reference number.

In fact, you may reference any numbered object within your document (float, section, equation ...)

# Exercise

## Exercise 5:

Add a caption to your table.

Add a label to your table and try referencing to it in your text.



# Writing Mathematics

$\LaTeX$  is most useful to write mathematical text.

The mathematics command can be used within a math environment, which may be either inline (within the normal text) or displayed (starting a new paragraph).

---

inline math

`\begin{math}...\end{math}`

`\(...\)`

`$...$`

---

displayed math

`\begin{displaymath}...\end{displaymath}`

`[...]`

`$$...$$` (to avoid)

# Writing Mathematics

To get numbered equations in displayed mode, use the ‘equation’ environment:

```
\begin{equation}...\end{equation}.
```

# Maths Symbols

There are VERY MANY symbols available in the math environment, and there is a [Comprehensive List of LaTeX Symbols](#).

Here are a few common ones:

- Greek letters:

lowercase greek symbols are written  $\$name\$$  and uppercase  $\$Name\$$

Example:  $\mu$ ,  $\Phi$

- Subscript and superscript:

$\$_symbol\$$  and  $\$^symbol\$$

If your symbol has more than one character you need to include them in curly brackets.

Example:  $10^3$ ,  $C_6^{14}$

# Maths Symbols

- Square root:  $\sqrt{\textit{number}}$

Example:  $\sqrt{49}$

- fractions:  $\frac{\textit{top number}}{\textit{bottom number}}$

or  $\dfrac{\textit{top number}}{\textit{bottom number}}$

Example:  $\frac{6}{13}$

- Integration  $\int$  ( $f$ )
- Sum (sigma symbol)  $\sum$  ( $\Sigma$ )
- Trigonometric functions:  $\cos$ ,  $\sin$ ,  $\tan$ ,  $\cotan$

# Matrices

There are several environments to write matrices:

- `\begin{matrix} .... \end{matrix}` creates a matrix with no delimiter;
- `\begin{pmatrix} .... \end{pmatrix}` creates a matrix within brackets;
- `\begin{Bmatrix} .... \end{Bmatrix}` creates a matrix within curly brackets.

# Matrices

These environments require a displayed maths environment. The layout is similar to a table environment:

```
\[ \begin{pmatrix}
```

*first row: first element & second element & etc... \\\*

*second row: first element & second element & etc... \\\*

*⋮*

```
\end{pmatrix} \]
```

The commands `\vdots`:  $\vdots$ , `\dots`:  $\dots$  and `\ddots`:  $\ddots$  may be useful.

# Systems of Equations

For writing systems of equations, or a series of equations, you can use the `align` environment.

If you want none of the equations to be numbered, you can use the starred version: `\begin{align*} ... \end{align*}`, and if some of the equations should not be numbered, then add the command `\nonumber` at the end of the corresponding line.

Each line of equation is ended by a double back-slash (`\`) and equations will be align at the position of the commercial-and (`&`)

```
\begin{align}
```

```
y &= x^2 - 2x + 1 \
```

```
& = (x - 1)^2 \nonumber
```

```
\end{align}
```

# Exercises

## Exercise 6:

In the preamble, add the line: `\usepackage{amsmath}`

directly underneath the line: `\usepackage{aberdeen-eng}`

Try some Mathematics.



# Spaces in Maths Environment

There are usually no space in the maths environment, and to force one you can use either of the following commands:

command	effect
<code>\quad</code>	space equal to font size
<code>\,</code>	space equal to 3/18 of a quad
<code>\:</code>	space equal to 4/18 of a quad
<code>\;</code>	space equal to 5/18 of a quad

To insert some text within the mathematics environment, you can use the command `\text{your text}`.

# Using BibTeX

This template uses BibTeX to generate the bibliography, which requires that references are stored in a .bib file.

This file may be generated from some bibliography softwares (EndNote, RefWorks): items are written in a very particular syntax.

At the end of the document, you will see the following commands:

```
\bibliographystyle{apalike}
```

```
\bibliography{mybibfile}
```

The first command is about choosing the style of the Reference list.

The second command indicates which is your .bib file, where you store your references.

# Using BibTeX

Bibliography items will look like this:

```
@article{ nameXX,  
author = "name",  
title = "some title",  
Journal = "some journal",  
Year = "xxxx"  
}
```

'nameXX' is the marker which you use for in-text referencing. With this template, you can use one of the following commands for in-text citation:

- `\citet{nameXX}` to produce a citation as Author (Year)
- `\citep{nameXX}` to produce a citation as (Author, date)

More styles are available: check with your supervisor which style you should use!

# Using BibTeX

When using a .bib file to store your bibliography, you need to:

- compile the .tex file ('PDFLaTeX' compilation)
- then compile the .bib file ('BibTeX' compilation)
- then compile the .tex file a second time.

You will need to do all this whenever you are modifying your .bib file and/or your references in the text. This allows for all bibliographic items and references to be refreshed.

## Splitting Your .tex File

For big documents such as a thesis, it may be handy to break the document on different .tex files, e.g. write each chapter on a particular .tex file.

In this case, you can write a top-level document which will contain the preamble and the document environment, and use the `\include` command:

```
\documentclass[options]{your class}
```

```
your packages
```

```
\begin{document}
```

```
\include{your chapter file name}
```

```
\end{document}
```

## Include versus Input

The command `\include{file name}` cannot be nested and forces a new page before and after the document. You can use the `\includeonly` command in the preamble to compile part of your document only.

If you want to nest files, or if you do not wish your .tex file to start on a new page, use `\input{file name}`.

Either command will keep consistent numbering.

Only the top-level document contains the preamble. In the subsequent documents, you must start your text directly, e.g.:

```
\section{First Chapter}
```

This is my first chapter.

# L<sup>A</sup>T<sub>E</sub>X on Personal Machine

You will need to install a tex distribution and possibly a L<sup>A</sup>T<sub>E</sub>X editor.

- **for Windows:** you can install the MiKTeX distribution, which includes the TeXworks editor. You can also install the TexMaker editor, or the TeXStudio editor (more advanced editors).
- **for Mac:** you can install the MacTeX distribution (the full one, NOT the basic one), which includes the TexShop editor. You can also install the TexMaker editor, or the TeXStudio editor (more advanced editors).
- **for Linux:** you can install the TexLive distribution, which contains the TeXworks editor, through your repository manager (Synaptic or other). You can also install the more advanced Texmaker or TeXStudio editors.

Alternatively, you can use an online L<sup>A</sup>T<sub>E</sub>X editor, which does not require you to install anything on your computer.

# Softwares and Readings

There are many freely available  $\text{\LaTeX}$  editors: TexMaker, TeXStudio, LyX.

A good place to start is [the beginners' page of TUG](#).

The  [\$\text{\LaTeX}\$  Wikibook](#) is an excellent resource for information on  $\text{\LaTeX}$ .

The [CTAN website](#) has information on most (if not all)  $\text{\LaTeX}$  packages.

There are also many forums of questions and answers about  $\text{\LaTeX}$ , for instance, the [Tex Stack Exchange](#).