Introduction to LaTeX

Winter School Modelling Hub 2021

Victoria University of Wellington

What is LaTeX?

- Is a typesetting language.
- When using LaTeX, you write a plain text file which describes the document's structure and presentation. LaTeXconverts this source text into a typeset document.

For example:

The IPCC assess the science related to `\textit{climate change}`.

The IPCC assess the science related to *climate change*.

Why LaTeX?

- Latex is created by scientists, for scientists and there is a large and active community.
- Is open source, you can find all commonly and most rarely used features online.
- It makes it very simple to handle equations, figures, references, etc. References are handled by BibDesk (Mac users) and it can read EndNote.
- The consistency of the layout: you focus on the content of the document and let Latex focus how to handle how the output is formatted.
- It is a powerful program, you can extend it to write papers, articles, presentations, etc.
- To write huge documents (master, PhD thesis) you can have a file per chapter and join them together with just one click!
- In some journals, you might pay less to publish if your manuscript is done in Latex instead of Word (e.g. half the price per page in Latex than it is in Word).

How does it work?

```
\documentclass{article} % style of the document
\begin{document} %command to start the doc
Hello World % your content goes here
\end{document}
```

Some tips:

- Commands start with `\`
- Every doc starts with `\documentclass`
- The sign `%` starts a comment
- Special characters: `%`, `$`, `&`, `#`. Need to be written as: `\%`, `\$`, `\&`, `\#`

More examples of commands and their outputs

```
\begin{itemize}
\item Clouds
\item Ocean
\item Volcanoes
\end{itemize}
```

- Clouds
- Ocean
- Volcanoes

More examples of commands and their outputs

```
\begin{equation}
\alpha + \beta + 1
\end{equation}
```

$$\alpha + \beta + 1 \qquad (1)$$

More examples of commands and their outputs

```
\begin{figure}
\includegraphics[width=50mm]{figures/cat.jpeg}
\end{figure}
```

What about errors?

1. LaTeXwill stop compiling if there is an error.
2. For example, if you misspell a command or forget a bracket, LaTeXwill stop with a message error showing the line and explaining the error (most of the times!).
3. Advice? Fix errors as soon as they arise.

Exercise 1: Overleaf

- Open the exercise in Overleaf (Exercise1.tex).
- Compile and fix the errors.
- Hint: Watch out for characters with special meanings ...

Exercise 1

Female academics earn $400,000 less than men over life-time. And of professors, only 28% were female in 2019/20.

Packages

- *Packages* are libraries of extra commands and environments.
- We need to load the packages in the *preamble* as: `\usepackage`.
- Example: `amsmath` for maths!

```
\documentclass{article}
\usepackage{amsmath} % preamble
\begin{document}
% write your equations here!
\end{document}
```

Enviroments

- The dollar sign ($) is special, because we can use it to mark math in the text.
- If you want to write a small equation in the text, always use dollar signs in pairs:

```
Let $y=mx+b$ be \ldots
```

Let $y = mx + b$ be ...

- However, if your equation is big and scary, use the `equation` enviroment as:

```
\begin{equation}
% equation goes here
\end{equation}
```

Exercise 2: Overleaf

- Open the exercise in Overleaf (Exercise2.tex).
- Write the following equation.
- Hint: A fraction is written as `\frac{num}{den}` and a partial derivative is `\partial`.

Exercise 2

The momentum equation for vertical velocity is:

$$\frac{\partial w}{\partial t} + u\frac{\partial w}{\partial x} + v\frac{\partial w}{\partial y} + w\frac{\partial w}{\partial z} = -\frac{1}{\rho}\frac{\partial p}{\partial z} + 2\Omega u cos(\gamma) - g \qquad (2)$$

Graphics

- Use the `graphicx` package, which provides the `\includegraphics` command.
- This package supports different formats: JPEG, PNG, PDF.
- Note that the squared brackets [ ] are used for optional arguments.
- For example:

```
\begin{figure}
\includegraphics[width=0.5\textwidth]{image.png}
\caption{Caption of the figure goes here.}
\end{figure}
```

The command *width* = 0.5 makes the image take up 50% of the width of the surrounding text (`\textwidth`).

Tables

- Tables can be tricky, but do not worry as everything comes with some practice.
- You need to add the package: `tabularx`

```
\begin{tabular}{lrr}
Item & Qty & Unit \$ \\
Widget & 1 & 199.99 \\
Gadget & 2 & 399.99 \\
Cable & 3 & 19.99 \\
\end{tabular}
```

Item	Qty	Unit $
Widget	1	199.99
Gadget	2	399.99
Cable	3	19.99

Tables

- You can add horizontal lines with `\hline`

```
\begin{tabular}{| l | r | r |} \hline
Item & Qty & Unit \$ \\ \hline
Widget & 1 & 199.99 \\ \hline
Gadget & 2 & 399.99 \\ \hline
Cable & 3 & 19.99 \\ \hline
\end{tabular}
```

Item	Qty	Unit $
Widget	1	199.99
Gadget	2	399.99
Cable	3	19.99

Structured documents

- `\title` and `\author` go in the *preamble*.
- We can use `\maketitle` to create the title.

```
\documentclass{article}
\title{The title}
\author{Author}
\date{\today}
\begin{document}
\maketitle
\begin{abstract}
Abstract goes here!
\end{abstract}
```

Structured documents

The title

Author

August 17, 2021

Abstract

Abstract goes here!

Sections

- You can use the \section and \subsection commands (or \subsubsection? depending on how brave you are!).
- When you write \section* or \subsection* it means that it will not be numerated.

```
\documentclass{article}
\begin{document}
\section{Introduction}
I always struggle with intros \ldots
\section{Methods}
Whatever methods you used \ldots
\subsection{Fieldwork and laboratory sampling}
\section{Results}
My correlations are $r^2=0.01$ \ldots
\section{Conclusion}
\end{document}
```

Sections

1 Introduction

I always struggle with intros ...

2 Methods

Whatever methods you used ...

2.1 Fieldwork and laboratory sampling

3 Results

My correlations are $r^2 = 0.01$ ...

4 Conclusion

Exercise 4: Overleaf

- Open the exercise in Overleaf (Exercise4.tex).
- Make the script look like Exercise4.pdf
- Hint: You can avoid enumerating equations by typing `\begin{equation*}`.

Referencing

More packages

- `beamer` for presentations
- `tikz` for amazing graphics
- `spreadtab` to create spreadsheets
- `listings` as a source code printer for LaTeX
- `cwpuzzle` for crossword puzzles (not that I have used it before!)

Some extra exercise ?

Maybe add a paper template to show the comment `\include`?

The End