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Introduction
to LaTeX

OTB & LF

Outline

What is
LaTeX?

Why use it?

How does it
work?

Basics

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Introduction to LaTeX

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Outline

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Every single 'Intro to LaTeX' presentation begins this way...

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(Never Lah-tecks)

- Builds on the TeX typesetting program developed in a time before graphical interfaces, the 1970s, by Donald E Knuth.

- It is a *typesetting language*, not a word-processor (more on that shortly).

- Designed so that the author's job is just to specify the kind of document they want, and produce the content.

- In principle a nicely presented document can be produced without the author having ever seen it. Useful on a command line computer system!

All right, but basically it's for writing documents, so why is it different from [MY FAVOURITE WORD PROCESSING SOFTWARE]?

- You use commands to define the style of the document.
- The document is then *compiled*.
- You don't get to see what it will look like until it has compiled.
- You don't necessarily get all that much choice about what it looks like.

- 'Programming' is scary!
- I can't see what I'm doing!
- Graphics handling is painful.
- Tables are a faff.
- The TeX ecosystem is quite diverse with many distributions, IDEs, packages – which do you choose?
- For the above reason, portability can be an issue.
- Intermediate files can cause a lot of clutter (use IDE's 'clean' tool).
- Little to no support for multimedia (that I know of).

- Typesetting maths:
  $\mathcal{L}\{\rho\} = -i[\hat{H}, \rho] - \frac{\gamma}{2}\left(2\hat{a}\rho\hat{a}^\dagger - \hat{a}^\dagger\hat{a}\rho - \rho\hat{a}^\dagger\hat{a}\right)$
- Powerful referencing tool: BibTeX
- Label system makes cross-referencing easy.
- Low file-size, so version control systems like Git can be used.
- Low file-size so large documents won't crash!
- Many journals provide standard article templates.
- In principle allows a very high degree of control over document layout.

- **Hold on.** There's a pretty good chance if you're using a uni computer, any kind of linux machine, or you've installed a LaTeX IDE that you already have it installed!

- Having multiple TeX distributions installed can be quite messy, so it's definitely worth checking.

- If you definitely don't then the easiest way is probably to download the TeX Live package from `http://www.tug.org/texlive/` – be warned, the download can take some time...

- More information on obtaining TeX and LaTeX can be found at `https://latex-project.org/ftp.html`.

Back in the good old days you may have had to enter a command sequence like one of the following...

Listing 1: Command sequence for this presentation.

```
>> pdflatex intro_latex.tex
>> pdflatex intro_latex.tex
>> evince intro_latex.tex
```

Listing 2: Command sequence for a document containing Bib-TeX references.

```
>> pdflatex OTB_phdthesis_v00.tex
>> bibtex OTB_phdthesis_v00.tex
>> pdflatex OTB_phdthesis_v00.tex
>> pdflatex OTB_phdthesis_v00.tex
>> evince OTB_phdthesis_v00.tex
```

In these more enlightened times you'll almost certainly be using an IDE to write and compile your document, so you probably just have to click the 'build' button. As an example, fig. 1 below shows a screenshot of TeXMaker, which I used to create this presentation. You can see it has a 'Quick Build' button at the top, as well as a 'View PDF' button.
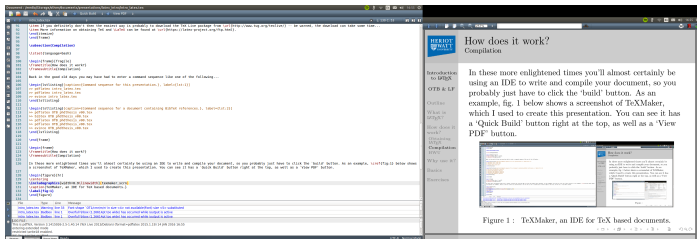

Figure 1 : TeXMaker, an IDE for TeX based documents.

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How does it work?
Using LaTeX at Heriot-Watt

At Heriot-Watt all computers linked to the main system have TeXworks installed. It can be found under 'HW Programs → MikTeX 2.9'.

Warning: TeXworks has a big green 'Typeset' button. It is quite handy. You can also use the keyboard ctrl+T. TeXworks 'Typeset' button, unlike some other TeX IDEs does not just compile the most recent saved version of the .tex file. It **saves** the .tex file and then compiles the document. **You can lose work this way**.

Student: Oliver Thomson Brown (091091738)
First Supervisor: Dr. Sabrina Maniscalco

Figure 2 : ...and then what happens is you miss mistakes you'd corrected between the last backup and the version you accidentally wiped, and ultimately spell your supervisor's name wrong on the front cover of your dissertation. Yup.

- \ identifies a command sequence (\textbackslash typesets a \).
- \ is also an escape sequence for typesetting symbols like {, }, and &.
- \\ *requests* a newline.
- \emph{} for *italics*, \textbf{} for **bold**.
- \section{Section Title} creates sections which are automatically labelled and included in your table of contents.
- \label{} can be used to label sections, figures, equations, etc. and is *highly* recommended. Especially in conjunction with the cleveref and hyperref packages.

The following is a pretty standard 'preamble' for scientific documents:

```
\documentclass[a4paper,twoside]{article}

\usepackage[margin=1.75cm]{geometry}
\usepackage{amsmath}
\usepackage{amssymb}
\usepackage{graphicx}
\usepackage{hyperref}
\usepackage{cleveref}
```

```
\author{Oliver Thomson Brown}
\title{Matrix Product States}
\date{2016-01-15}

\begin{document}

\maketitle

\tableofcontents

...

\end{document}
```

Inline maths:

```
\( E = \frac{1}{2} mv^{2} \)
```

One of Einstein's discoveries was the equation $E = \frac{1}{2}mv^2$, equating energy and mass.

Display maths:

```
\begin{equation}
    \rho = | \psi \rangle \langle \psi |
\label{eq:1}
\end{equation}
```

$$\rho = |\psi\rangle\langle\psi| \qquad (1)$$

Honestly, probably the weakest part of working with LaTeX...

```
\begin{figure}[h!]
\centering
\includegraphics[width=0.6\linewidth]
{two_head_tortoise}
\caption{A two-headed tortoise!}
\label{fig:3}
\end{figure}
```


Figure 3 : A two-headed tortoise!

BibTeX is a simple to use, but powerful referencing tool. First you need a .bib file in the same folder – part of intro_latex.bib is shown here:

```
@book{NR,
year={2007},
author={Press, William H. and
Teukolsky, Saul A. and
Vetterling, William T. and
Flannery, Brian P.},
title={Numerical Recipes --
The Art of Scientific Computing},
publisher={Cambridge University Press},
edition={3E},
}
```

The format is quite straightforward, and many journals provide BibTeX citations which you can copy and paste into your own .bib file. Additionally, EndNote and Mendeley can export .bib files. Next you need to include a

\bibliographystyle{} command, and \bibliography{} in the document:

```
\bibliographystyle{acm}
\bibliography{intro_latex}
```

You then simply use the \cite{citation-key} command to reference things like this conference paper I wrote [1], or the book *Numerical Recipes* [2].

LATEX and BibTeX take care of the rest for you...

[1] BROWN, O. T., TRUESDALE, J., LOUCHART, S., MCENDOO, S., MANISCALCO, S., ROBERTSON, J., LIM, T., AND KILBRIDE, S. Serious game for quantum research. In *Serious Games Development and Applications*, M. Ma, M. Oliveira, S. Petersen, and J. Hauge, Eds., vol. 8101 of *Lecture Notes in Computer Science*. Springer Berlin Heidelberg, 2013, pp. 178–187.

[2] PRESS, W. H., TEUKOLSKY, S. A., VETTERLING, W. T., AND FLANNERY, B. P. *Numerical Recipes – The Art of Scientific Computing*, 3rd ed. Cambridge University Press, 2007.

Unsurprisingly, many journals also provide their own BibTeX style files. Always worth checking before you try and format references manually!

Resources

- Source for this presentation, as well as an example document can be downloaded from: https://github.com/otbrown/HWU16_latex.

- Main LaTeX project website: http://latex-project.org/.

- The LaTeX wikibook is great for quickly looking up standard commands – especially Mathematics: https://en.wikibooks.org/wiki/LaTeX

- For BibTeX, the main Wikipedia page is a little more useful: https://en.wikipedia.org/wiki/BibTeX.

- Ask! There are plenty of LaTeX users in the department (especially theorists!) so if you can't work out how to do something ask around.

Google is your friend.

- Create a template LaTeX 'article' document which you can copy-paste from/refer to in the future.

- Include anything you think you might want to do again in the future – equations, tables, images... If you get stuck check the Resources on the previous slide, or ask one of us!

- Play around with packages a bit too. In particular see what happens if you don't use the *geometry* package to control the margin size.

- You can find an example document in the 'example' folder, in the GitHub repo (https://github.com/otbrown/HWU16_latex).