Introduction to using LaTeX

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Outline

- What is LaTeX?
- The basics
- Getting it working (practical!)
- Styles and margins
- Formatting
- Lists, tables, pictures
- Maths mode
- Plethora of other bits and pieces

What is LaTeX?

- A document markup language (cf. XML, Markdown, etc.)
- TeX first released by D. E. Knuth in 1978
- Leslie Lamport wrote some macros around TeX
  - Released first version of LaTeX ("Lamport TeX") in 1984
- Widely used for professional/academic writing
  - Most academic journals accept manuscripts as *TeX

Our first LaTeX document!

```
1 \documentclass{article}
2 % This comment is ignored
3 \begin{document}
4  Hello, world!
5 \end{document}
```

Your output:

Hello, world!

How to compile

- Save as `hello.tex`
- Run `pdflatex hello.tex` to get `hello.pdf`
- View in our favourite PDF viewer

But terminals scare me...

LaTeX distributions

- LaTeX is available in the MiKTeX or proTeXt package for Windows
  - Full package manager and editor included in MiKTeX
  - Never used proTeXt...
- Mac has MacTeX
- Linux has TeX Live (usually available from repositories)

IDEs (not exhaustive)

- **Windows** MiKTeX has TeXworks bundled. Also TeXstudio
- **Linux** Kile, LyX, TeXworks, TeXmaker
- **OSX** TeXworks, TeXstudio
- Any text editor! (`nano`,`vim`, `emacs`, `sublime`)

masterrace

Some messy details

- Using `pdflatex` has some disadvantages (can't compile `.eps` files)
- Alternatively use `latex`, which gives a `.dvi`
- Then convert to `.ps` then `.pdf`
  - `dvips -Ppdf -o filename.ps filename.dvi`
  - `ps2pdf filename.ps`
- Many IDEs will give you the choice of using `pdflatex` or `latex => ps => pdf`
- **Alternatively** alternatively just use `xelatex` (what I use!)

Paragraphs and new lines

- Make a new paragraph with a line break
- Skip a line between paragraphs with two line breaks
- Force a new line with \\
- Whitespace is ignored by default (force a space with "\ ")

```
1 Some text
2 some       other text \\
3 More
4
5 New paragraph
```

Output:

Some text some other text
More
New paragraph

Font families

- Lots of variety. See www.tug.dk/FontCatalogue for a **large** list
- Default is Computer Modern though many alternatives exist
- Setting fonts is (unfortunately) slightly tricky
- Set for entire document by `\usepackage{times}`
  - or `palatino`, `helvet`, `avant`, `newcent`, `bookman`
- Document styles (like `beamer` or `article`) set their own default font
- Alternatively can use `fontspec` package and then `\setmainfont{Some Font Name}` (Works with XeLaTeX)

Font sizes

`\tiny{\dots}`	Deep Web
`\scriptsize{\dots}`	Gamification
`\footnotesize{\dots}`	Cloud
`\small{\dots}`	Wearable
`\normalsize{\dots}`	Apps
`\large{\dots}`	Big Data
`\Large{\dots}`	Internet of things
`\LARGE{\dots}`	Hyperconvergence
`\huge{\dots}`	Service-oriented Architecure
`\Huge{\dots}`	Data Privacy

Font effects

Two ways of specifying effects:

\textnormal{...}	{\normalfont ...}	Default font
\textrm{...}	{\rmfamily ...}	Roman (Serif) font
\textsf{...}	{\sffamily ...}	Sans-serif font
\texttt{...}	{\ttfamily ...}	`Typewriter font`
\textmd{...}	{\mdseries ...}	Medium Series
\textbf{...}	{\bfseries ...}	**Bold Series**
\textup{...}	{\upshape ...}	Upright (cancel italics)
\textit{...}	{\itshape ...}	*Italics*
\textsl{...}	{\slshape ...}	*Slanted*
\textsc{...}	{\scshape ...}	Small Caps

Subtle difference is that the second column won't work with `\verbatim|...|`

Font colours

- Needs `color` or `xcolor` package
  - `\usepackage[usenames,dvipsnames,svgnames,table]{xcolor}`
- Have some predefined colours
- E.g. `\textcolor{red}{Some text}` or `{\color{red} Some text}`
- Can also define your own with `\definecolor{aName}{modelType}{spec}`
  - `\definecolor{myorange}{rgb}{1,0.5,0}`
  - `\definecolor{myorange}{RGB}{255,127,0}`
  - `\definecolor{myorange}{HTML}{FF7F00}`
  - `\definecolor{myorange}{cmyk}{0,0.5,1,0}`
- Can also use the colours to colour table elements, boxes, pages, etc.

Reserved characters

- LaTeX uses certain characters for control
- Thus need to escape them before writing
- These are: # $ % & _ { }
- Type: `\# \$ \% \& \_ \{ \}`
- Three others are even messier
  - \ → `\textbackslash`
  - ^ → `\textasciicircum`
  - ~ → `\textasciitilde`
- In `verbatim` environments you don't need to escape
  - `\verb|^\~%|` → `^\~%`

Accents and special characters

\'{a}	á	\ddag	‡
\`{e}	è	\textbar	|
\^{i}	î	\textgreater	>
\"{o}	ö	\textendash	–
\~{u}	ũ	\texttrademark	™
\={a}	ā	\textexclamdown	¡
\.{e}	ė	^{a}	ª
\u{i}	ĭ	\pounds	£
\v{o}	ǒ	\S	§
\H{u}	ű	\dag	†
\k{a}	ą	\textbackslash	\
\c{c}	ç	\textless	<
\r{e}	å	\textemdash	—
\d{o}	ọ	\textregistered	®
\b{u}	u̲	\textquestiondown	¿
\o	ø	\textcircled{a}	ⓐ
\P	¶	\copyright	©

Styles

- LaTeX has different *styles* (sets of macros and default fonts, etc.) for different purposes
  - E.g. `book`, `article`, `report`, `slide`, `beamer`, `letter`, `memoir`, `proc` [proceedings]
  - Many more at http://texcatalogue.ctan.org/bytopic.html#classes
- Set with `\documentclass{article}` at the beginning

article structure

An article is a set of sections, each of which is divided into subsections:

- `\section{Section title}`
- `\subsection{Subsection title}`
- `\subsubsection{Subsubsection title}`

To have unnumbered sections, add a *:

- `\section*{Section title}`
- `\subsection*{Subsection title}`
- `\subsubsection*{Subsubsection title}`

Can also have `\paragraph{title}` and `\subparagraph{title}`

book and report structure

- Books and Reports have chapters on top of the sections
  - `\chapter{Chapter title}` or
  - `\chapter*{Chapter title}`
- There also exists an `\appendix` command. Each chapter after `\appendix` is treated as an appendix.
- Extra layer above `\chapter` called `\part`

```
\begin{document}
\tableofcontents
\chapter{Hello World!}
This is a chapter!
\section{And now}
For something completely different
\subsection{Why not}
Zoidberg?
\section{Oh}
Really?
\chapter{Yeah}
Rly
\end{document}
```

Contents

Chapter 1

Hello World!

This is a chapter!

1.1 And now

For something completely different

1.1.1 Why not

Zoidberg?

1.2 Oh

Really?

Chapter 2

Yeah

Rly

Environments

- Region of document subjected to additional formatting rules
- Syntax: \begin{*envname*} …\end{*envname*}
- Example 1: Lists

```
1 begin{itemize}
2 \item This is a simple list
3 \item Each item has a bullet point
4 \item[Or] Optionally a label
5 \end{itemize}
```

- This is a simple list
- Each item has a bullet point

Or Optionally a label

More lists

We can number lists:

```
\begin{enumerate}
\item This is a simple list
\item Each item is numbered
\item[Or] Optionally a label
\item Numbering is paused
\end{enumerate}
```

1. This is a simple list
2. Each item is numbered

Or Optionally a label

3. Numbering is paused

Or have a description:

```
\begin{description}
\item[Header 1] This is a simple list
\item Each item has a description
\item[A label] is expected
\end{description}
```

Header 1 This is a simple list

Each item has a description

A label is expected

Tables

```
\begin{tabular}{lc|r}
entry 1 & second & final \\
new line & 1 & 3 \\ \hline
Final row & filler & text
\end{tabular}
```

entry 1	second	final
new line	1	3
Final row	filler	text

More Tables

```
\begin{tabular}{|c|p{0.3\textwidth}|c|@{same}}
\multicolumn{2}{|c}{apples} & test \\ \cline{1-2}
\multirow{2}{2cm}{Long entry} & another & yay\\
& Eat & Spinach
\end{tabular}
```

apples		test	same
Long entry	another	yay	same
	Eat	Spinach	same

\multirow requires the multirow package

Floats

- Objects which must not be split across pages (figures, tables)
- Encapsulate a region within a special environment (`figure`, `table`)
- Black magic in LaTeXdetermines where the environment is placed
- Can specify with *position specifiers*:
  - "Here" → `h`
  - "Top of page" → `t`
  - "Bottom of page" → `b`
  - "Put on page with other floats" → `p`
  - "Override LaTeX and put here!" → `!`
  - "PUT IT *&%£$@)_ HERE!" → `H` (requires `float`, simil. to `h!`)
- `\begin{figure}[h]…\end{figure}`
- `\begin{table}[tp]…\end{table}`

More floats

```
\begin{table}[h]
 \begin{tabular}{|c|c|}\hline
  Apples & Bananas \\\hline
  Oranges & Pears \\\hline
 \end{tabular}
 \caption{A table as a float}
\end{table}
```

Apples	Bananas
Oranges	Pears

Table 1: A table as a float

Dogs

```
1 \begin{figure}[h]
2 \centering
3  \includegraphics[width=0.4\textwidth]{dog}
4  \caption[DOGGY!]{A cute doggy!}
5 \end{figure}
```

Figure: A cute doggy!

- `\listoffigures` and `\listoftables` will print a list of the floats
- The caption in the brackets is the "short caption", sometime used in the `\listoffigures` (depends on style)

Maths mode

- LaTeX is **very** popular for this reason
- Enter and escape inline maths mode with $ ...$
- Accents work differently in maths mode (later)

```
\begin{equation}
\dots
\end{equation}
```

(Or \equation* for unnumbered)
Example:

```
The solution to $\sqrt{x} = 5$ is $x=25$.
```

The solution to $\sqrt{x} = 5$ is $x = 25$

Piecewise definitions

Use the `array` environment (like a maths-mode `tabular`)

```
\begin{equation}
 \text{fac } x = \left\{
  \begin{array}{ll}
   1 & \text{if } x = 0 \\
   x \cdot \text{fac }(x-1) * \text{if } x > 1
  \end{array}
  \right.
\end{equation}
```

$$\text{fac } x = \begin{cases} 1 & \text{if } x = 0 \\ x \cdot \text{fac } (x-1) & \text{if } x > 1 \end{cases} \quad (1)$$

Matrices

Can use array, or matrix (use amsmath package)

```
1  $\left[
2 \begin{matrix}
3    a & b & c \\
4    d & e & f \\
5    g & h & i
6 \end{matrix}
7 \right]$
```

Everything else

- Boxing around text with, e.g. `\fbox{...}`
- Bibliographies, citations (foot/endnotes), references (BibTeX)
- Changing page strutures (e.g. headers, footers) with `geometry` and `fancypage`
- Indexes
- Including source code with `lstlistings`
- Making/redefining your own commands (`\newcommand`, `\renewcommand`)
- Making graphs with `dot2tex`, `pstricks`, `tikz`, etc.
- `\include{file}` to add pages in from other files
- `\input{file}` to "cat" the contents in
- Slideshows, transition effects, overlays, etc.
- Hyperlinks

Where to go for more information

- David Wilkins' "Getting Started with LaTeX" - http://www.maths.tcd.ie/~dwilkins/LaTeXPrimer/GSWLaTeX.pdf
- Mittelbach and Goossens' "The LaTeXCompanion"
- Oitker *et al.*'s "The Not So Short Introduction to LaTeX2$_\varepsilon$" - https://tobi.oetiker.ch/lshort/lshort.pdf
- "TeX Exchange" - http://tex.stackexchange.com/