Using LaTeX

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Overheads available at:

`www.stat.washington.edu/software`

Introduction to LaTeX

- LaTeX is a typesetting language which can produce professional looking documents (once mastered!) - it is an enhancement over the original program TeX.
- We create `dvi` documents using the `latex` command, and then view these files using the `xdvi` command.
- LaTeX can sometimes give confusing results - be patient when writing in LaTeX and these "quirks" can be ironed out.

My First LaTeX document

- In the file `first.tex` write the following:

```
\documentclass{article}
\begin{document}


\LaTeX is as easy as $\pi$.


\end{document}
```

- Now on a command line type

```
latex first.tex
```

  to process the document. If all goes well you can view the resulting file generated with

```
xdvi first.dvi &
```

- If you have an error, press `X` and `return` to quit LaTeX and go edit your document.

Basic Document Elements

- `\documentclass[options]{class}` sets up the format of the document
- Useful **options** include the **size** of font (10pt, 11pt, 12pt), the **type** of paper (to change from the default letter to A4 use the option a4. The **epsfig** options allows you to include postscript figures. Separate options with a comma.
- Possible **classes** include article (for short papers), report (longer papers), book and letter.
- To define where the document begins and ends we use the **document** environment.

Environments

- **Environments** in LaTeX have the syntax:

```
\begin{environment_name}
...
\end{environment_name}
```

Previously we used:

```
\begin{document}
...
\end{document}
```

Some useful LaTeX symbols

- `\` before a word denotes a LaTeX **command**.
- We enclose **arguments** to a LaTeX command in braces `{ }` - we do not need the braces if the argument is only one character - use `\{` and `\}` for actual braces.
- `\\` stands for a **lines break**.
- Us the `%` symbol to denote **comments**. Anything on the rest of the line is ignored - use `\%` for a percentage sign.
- The `$` symbol starts and ends **math mode** - use `\$` for the dollar sign.
- The `&` symbol is usually used for **column tabs**.

Lengths

- To change the **spacing** of your document use the command

  ```
  \renewcommand{\baselinestretch}{factor}
  ```

  `factor` refers to the size of spacing relative to the text size e.g. 1 for single spacing, 1.5 for one and a half, 2 for double spacing.

- `setlength` and `addtolength` are also useful for changing the size of your document: e.g. I use:

  ```
  \addtolength{\topmargin}{-2cm}
  \addtolength{\oddsidemargin}{-1.5cm}
  \addtolength{\textheight}{3cm}
  \addtolength{\textwidth}{4cm}
  \setlength{\parskip}{0.3cm}
  \setlength{\parindent}{0cm}
  ```

Lengths 2

- These commands change the size of the **margins** and **text spacing**. The last two commands tells LaTeX to skip space when a new paragraph starts, and stops it from indenting new paragraphs.

Defining a Title

- Two ways - The first way is via the **titlepage** environment:

```
\begin{titlepage} text for title \end{titlepage}
```

- The second way is to fill in specific **entries** and then use **maketitle**:

```
\title{title of report}
\author{who did it and where they live}
\date{when was it done}
\maketitle
```

Defining a Title 2

- To separate lines in the entries use the line break `\\` symbol e.g.,

  ```
  \author{Peter Craigmile,\\ Department of Statistics\\,
  Box 354322,\\ University of Washington,\\
  Seattle. WA 98109-4322.}
  ```

  The `\thanks` command allows for footnotes

- The **format** of the title depends on the document **class** chosen

Adding an abstract

- Only valid in the article or report classes - use the **abstract** environment:

```
\begin{abstract}
abstract goes here
\end{abstract}
```

Sections of a Document

- LaTeX provides the following commands for **sectioning** (they are given in their hierarchical ordering from top to bottom):

`\chapter`	`\section`	`\subsection`
`\subsubsection`	`\paragraph`	`\subparagraph`

- **`\chapter`** is not available in the article class
- Syntax for all is:

```
\section_command{title} or \section_command*{title}
```

- Sections are automatically **numbered** in the order they appear
- To **omit** the number use the `*` form of the command (the section number is still incremented though)

References and Labels

- To label a location in a document use `\label` and to refer use `\ref`
- e.g. To **label** the current chapter

```
\chapter{introduction}
\label{intro}
```

- and to **refer** to this label:

```
in chapter \ref{intro} we described ...
```

- PROBLEM - LaTeX can only handle reference properly if you latex the file **twice** - first to interpret, second to handle the references. e.g. if the file is called `first.tex` type:

```
latex first.tex
latex first.tex
```

Lists

- To produce a **list** use the itemize environment: e.g.

```
\begin{itemize}
\item first item
\item second item
\end{itemize}
```

- We use the `\item` command to denote the start of a new item
- To produce numbered lists replace `itemize` with `enumerate`

Changing the look

- To change the **font size**:

`\tiny`	`\scriptsize`	`\footnotesize`	
`\small`	`\normalsize`	`\large`	
`\Large`	`\LARGE`	`\huge`	`\HUGE`

- To *emphasize* text use `\emph{text}`
- For **bold** use `\textbf{text}`
- For underlining use `\underline{text}`
- Use font changes **sparingly** - underlining especially has the effect of removing the reader's attention from the text

- To centre text use

`\begin{center} ... \end{center}`

But I don't want to format my text!

- To print text **without** formatting (especially useful for program text) use the `verbatim` environment:

```
\begin{verbatim}
# Generate 128 random N(0,1) random variables
# and produce a Q-Q plot:
x <- rnorm(128)
qqnorm(x)
qqline(x)
\end{verbatim}
```

Mathematics

- To include math in a **sentence** use the dollar sign .e.g. `$\pi$` for π
- To include **formatted** math (centred and of correct size) use either:

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

- The second environment allows for more formatting, and multiple lines
- By default these two environments include an **equation number** of the right hand side – to not have an equation number, and not increment the counter put a `*` after the `\begin`

Mathematics 2

- To separate lines in `eqnarray` use `\\`. Extra formatting can be obtained using the `&` symbol:

```
\begin{eqnarray}
f(x)  &\equiv&  \int_{0}^{{1 \over 2}} x^2 dx \nonumber\\
      &=&       \left[ \frac{x^3}{3} \right]_{0}^{{1 \over 2}}
\end{eqnarray}
```

produces

$$\begin{aligned} f(x) &\equiv \int_{0}^{\frac{1}{2}} x^2 dx \\ &= \left[\frac{x^3}{3} \right]_{0}^{\frac{1}{2}} \qquad (1) \end{aligned}$$

- The `\nonumber` command informs LaTeX to omit the equation number from the current line

- Can add the `\label` to refer to equation numbers

Useful Math Commands

- For **Greek** symbols use `\letter` e.g. `\theta` for θ or `\Theta` for Θ
- For **superscripts** use the `^` symbol e.g. `x^2` for x^2 or `e^{a+b}` for e^{a+b}
- For **subscripts** use the `_` symbol
- To do sums use `\sum`, for products `\prod` and integrals `\int` - add the `_` and `^` symbols to give limits e.g.

  ```
  \bar{X} = \sum_{i=1}^n X_i
  ```

  produces

  $\bar{X} = \sum_{i=1}^n X_i$

Useful Math Commands 2

- For **fractions** use `\frac` e.g. `\frac{x}{2+a}` for $\frac{x}{2+a}$ (can also use the `\over` command)
- Character in math mode are shown in **italics** - use the `\mbox{text}` to remove the italics - the symbols `\log`, `\sin`, etc. are also available
- Other useful symbols include:

  `\leq` $\leq$

  `\geq` $\geq$

  `\equiv` $\equiv$

  `\in` $\in$

  `\notin` $\notin$

Bigger brackets

- This LaTeX code

```
(\frac{\sin^2(x)}{x})^{-2d}
```

produces $(\frac{\sin^2(x)}{x})^{-2d}$

- For **resizable** brackets in math use:

```
\left[   and \right];
\left(   and \right);
\left\{  and \right\}.
```

- Thus

```
\left(\frac{\sin^2(x)}{x}\right)^{-2d}
```

produces $\left(\frac{\sin^2(x)}{x}\right)^{-2d}$

- The brackets must **match** - if you want only e.g. a left bracket the right bracket must be **`\right.`** - no right bracket will be produced

Including Postscript Figures

- One way is via the **epsfig** package (this is not the only way) - make sure you include the `epsfig` option in the `\documentclass` command
- The template is:

```
\begin{figure}[where]
\centering
\epsfig{file={name.ps},width={wd},height={ht}}
\caption{caption text}
\label{label}
\end{figure}
```

- Make sure you have `\caption` and `\label` in the correct order or the numbering of figures will be wrong!

Postscript Figures II

- Options for `where` are:

  h - may appear here in the document

  t - may appear at the top of a page

  b - may appear at the bottom of a page

  p - may be on a single page with other figures and tables

  ! - ignore the standard rules about sizes

- Note the use of the word **may** - LaTeX has final say over where the figure ultimately appears - this can be hard to get used to, and often hard to change!

Tables

- We illustrate with an example:

```
\begin{table}
\centering
\begin{tabular}{l|cr}
x & y & z \\
\hline
1 & 3 & 4 \\
3 & 2 & 1
\end{tabular}
\caption{caption text goes here}
\label{some label}
\end{table}
```

- As in the figure command we can add `[where]` after `\begin{table}`

Tables 2

- We use `&` to change column, `\\` to take a new lines, and `hline` to draw a horizontal line
- The arguments after `\begin{tabular}` show we have 3 columns - the first is `l`eft justified, the second in `c`entred, the third is `r`ight justified. The `|` symbol means draw a vertical line between the first and second columns.
- The resulting table is:

x	y	z
1	3	4
3	2	1

Table 1: caption text goes here

Printing and viewing DVI files

- To print `dvi` files use:

  ```
  dvips <dvifile>
  ```

  or to **convert** the `dvi` file to a `postscript` file:

  ```
  dvips <dvifile> -Z -q -o <psfile>
  ```

  Can then **print** the postscript file using the `lpr` command or view with `ghostview`

More LaTeX help

- Look at

  `www.cs.uu.nl/pub/tex-archive/info/lshort/english`

- A Document Preparation System: LaTeX , by Leslie Lamport, ISBN 0-201-52983-1, published jointly by the American Mathematical Society and Addison-Wesley Publishing Company.

- The standard reference for TeX is The TeXbook by Donald E. Knuth, ISBN 0-201-13448-9, published jointly by the American Mathematical Society and Addison-Wesley.

- M. Goossens, F. Mittelbach, and A. Samarin, The LaTeX Companion, published by Addison-Wesley, ISBN 0-201-54199-8