A Whistle-Stop Tour of LaTeX (Part 2)

Computing Science and Mathematics Skill Sharing

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Table of contents

More table goodness

More table goodness

The column specification can be altered using the `array` package. This is done in the argument of the tabular environment using `>{\command}` for commands executed right before each column element and `<{\command}` for commands to be executed right after each column element.

As an example: to get a column in math mode enter: `\begin{tabular}{>{$}c<{$}}`.

Another example is changing the font: `\begin{tabular}{>{\tiny}c}` to print the column in a tiny font.

```
1 \begin{tabular}cc{>{\tiny}c}c
2 Hello & Hello & Hello & Hello \\
3 I     & I     & I     & I \\
4 am    & am    & am    & am \\
5 a     & a     & a     & a \\
6 table & table & table & table \\
7 \end{tabular}
```

Hello	Hello	Hello	Hello
I	I	I	I
am	am	am	am
a	a	a	a
table	table	table	table

See https://en.wikibooks.org/wiki/LaTeX/Tables#Column_specification_using_.3E.7B.5Ccmd.7D_and_.3C.7B.5Ccmd.7D

More table goodness

Use `siunitx` to round and align decimals in tables. (this package will also do loads of other stuff with units, not covered here)

```
\usepackage{siunitx}
\sisetup{round-mode=places} % can also use "figures" for sig. figs.

\begin{tabular}{S[round-precision=1]S[round-precision=0]S[round-precision=2]S[
    round-precision=2]S[round-precision=0]}
{Density} & {Number of aircraft} & {QPPTW} & {Buf-QPPTW} & {Fuzzy-QPPTW} \\
  0.8 & 44476 & 43.1 & 3.754500 & 736.5383 \\
  0.9 & 518 & 3.363167 & 4.037117 & 634.6640 \\
  1.0 & 578 & 3.485500 & 4.901850 & 743.5543 \\
\end{tabular}
```

Density	Number of aircraft	QPPTW	Buf-QPPTW	Fuzzy-QPPTW
0.8	44 476	43.10	3.75	737
0.9	518	3.36	4.04	635
1.0	578	3.49	4.90	744

Algorithms

Algorithms

Various packages:

`algorithmic`, `algorithm2e`, `algorithmicx`

...incompatible with each other!

Algorithms

`\usepackage{algorithm,algpseudocode}` (a layout for algorithmicx, which is loaded automatically)

```
\begin{algorithm}[H]
    \caption{Euclid's algorithm}
    \label{alg:euclid}
    \begin{algorithmic}[1] % The number sets where the line numbering starts
        \Procedure{Euclid}{$a,b$} \Comment{The g.c.d. of a and b}
            \State $r\gets a \bmod b$
            \While{$r\not=0$} \Comment{We have the answer if r is 0}
                \State $a \gets b$
                \State $b \gets r$
                \State $r \gets a \bmod b$
            \EndWhile\label{euclidendwhile}
            \State \textbf{return} $b$\Comment{The gcd is b}
        \EndProcedure
    \end{algorithmic}
\end{algorithm}
```

Algorithm 1 Euclid's algorithm

```
1: procedure EUCLID(a, b)                    ▷ The g.c.d. of a and b
2:     r ← a mod b
3:     while r ≠ 0 do                        ▷ We have the answer if r is 0
4:         a ← b
5:         b ← r
6:         r ← a mod b
7:     end while
8:     return b                              ▷ The gcd is b
9: end procedure
```

Source code

Source code

The `listings` package: `www.ctan.org/pkg/listings`

```
\usepackage{listings}
```

```
\begin{lstlisting}[caption={Some source, showing an XML/KML \lstinline|way|
    element.},label={lst:osm-xml-example},float,floatplacement=H,language=xml]
<way id="4232478" visible="true" ... >
  <nd ref="25256057"/>
  <tag k="aeroway" v="taxiway"/>
  <tag k="width" v="23"/>
</way>
\end{lstlisting}
```

Listing 1: Some source, showing an XML/KML `way` element.

```
<way id="4232478" visible="true" ... >
  <nd ref="25256057"/>
  <tag k="aeroway" v="taxiway"/>
  <tag k="width" v="23"/>
</way>
```

Listing Inline & Imported

`You can add a \lstinline|code| snippet`

You can add a `code` snippet

- note the unusual delimiters! They can be almost anything. Syntax is

```
1 \lstinline[<key=value list>]<character><source code><same character>
```

so `\lstinline!var i:integer;!` is possible.

Import source `\lstinputlisting{source_filename.py}` ...

Also possible to use colourful syntax highlighting. See
`http://texblog.org/2011/06/11/latex-syntax-highlighting-examples/`

Listing configuration

Configure in the preamble:

```
\lstset{
  language=XML,
  basicstyle=\small\ttfamily, % font
  keywordstyle=\color{blue},
  stringstyle=\color{red},
  commentstyle=\color{green},
  morecomment=[l][\color{magenta}]{\#}
  numbers=left, % line numbers
  frame=tb, % default float placement
  columns=fullflexible, % char width / col alignment
  captionpos=b,
  showstringspaces=false,
  morekeywords={node,way,tag,lat,lon} % add to language
}
```

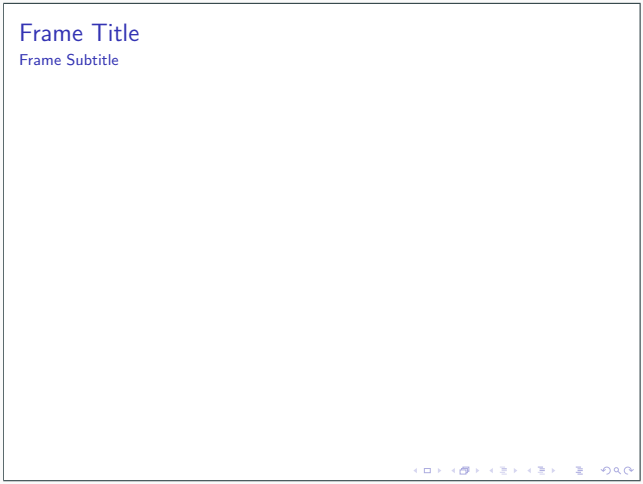
Listing styles

```
\lstdefinestyle{latex}{
  language=[LaTeX]TeX,
  basicstyle=\small\ttfamily,
  keywordstyle={\color{blueaccent}},
  columns=fullflexible,
  showstringspaces=false,
  breaklines=true,
  numbers=left,
  morekeywords=  {subsection,toprule,cmidrule,midrule,bottomrule,subfloat,
      graphicspath,color,eqref,mathbb,text,subtitle,institute,inst,usetheme,
      useoutertheme,tableofcontents,pause},
  moredelim=**[is][\btHL]{}{},
}
```

Beamer Slides

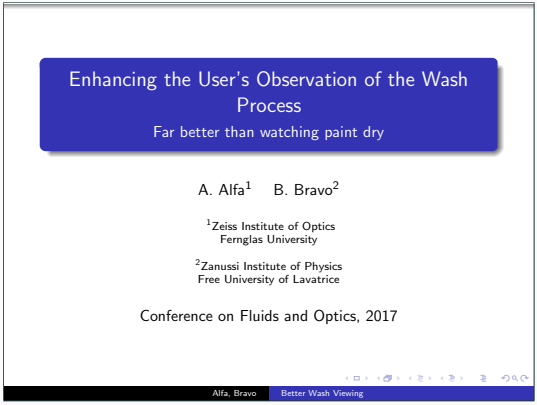
Basic Beamer

```
1  \documentclass{beamer}
2  \begin{document}
3    \begin{frame}
4      \frametitle{Frame Title}
5      \framesubtitle{Frame Subtitle
           }
6      %content here
7    \end{frame}
8  \end{document}
```



Beamer Theme & Title

```
1  \documentclass{beamer}
2  \title[Better Wash Viewing]{Enhancing the
       User's Observation of the Wash
       Process}
3  \subtitle{Far better than watching paint
       dry}
4  \author[Alfa, Bravo]{A. Alfa\inst{1} \and
       B. Bravo\inst{2}}
5  \institute[Fernglas Uni, F. Uni of
       Lavatrice]
6  { \inst{1}%
7    Zeiss Institute of Optics\\
8    Fernglas University
9    \and
10   \inst{2}%
11   Zanussi Institute of Physics\\
12   Free University of Lavatrice}
13 \date[CFO 2017]{Conference on Fluids and
       Optics, 2017}
14 \usetheme{Warsaw}
15 \begin{document}
16   \frame{\titlepage}
17 \end{document}
```



Beamer Theme & TOC

```
\usetheme{Warsaw}
\useoutertheme{infolines}

\begin{document}

...

\section{First Section}

 \begin{frame}{Table of Contents}
 \tableofcontents[currentsection]
 \end{frame}

\section{Second Section}
...
\section{Third Section}
...
\end{document}
```

Modern Beamer Theme

This presentation uses the custom Metropolis theme.

`https://github.com/matze/mtheme`

```
1 \documentclass[aspectratio=1610]{beamer}
2 \usetheme{metropolis}
```

Beamer Blocks

```
\begin{block}{This is a Block}
  This is important information
\end{block}
\begin{alertblock}{This is an Alert block}
  This is an important alert
\end{alertblock}
\begin{exampleblock}{This is an Example block}
  This is an example
\end{exampleblock}
```

This is a Block

This is important information

This is an Alert block

This is an important alert

This is an Example block

This is an example

Beamer Columns

```
\begin{columns}
\begin{column}{0.6\textwidth}
  %something here
\end{column}
\begin{column}{0.4\textwidth}
  %something there
\end{column}
\end{columns}
```

Beamer Overlays (1)

```
1  Something here
2  \pause
3
4  Some more stuff appears
5  \pause
6
7  Surprise surprise
```

Something here

Beamer Overlays (1)

```
1  Something here
2  \pause
3
4  Some more stuff appears
5  \pause
6
7  Surprise surprise
```

Something here

Some more stuff appears

Beamer Overlays (1)

```
1  Something here
2  \pause
3
4  Some more stuff appears
5  \pause
6
7  Surprise surprise
```

Something here
Some more stuff appears
Surprise surprise

Beamer Overlays (2)

```
1 \begin{itemize}
2 \item<1-> Always here
3 \item<2-> Appears second
4 \item<3> Appears on the third slide and then
      disappears
5 \item<3-5> Stays for two slides
6 \item<4-> This one becomes \alert<6>{important}
      at the end
7 \end{itemize}
```

- Always here

Beamer Overlays (2)

```
\begin{itemize}
\item<1-> Always here
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    at the end
\end{itemize}
```

- Always here
- Appears second

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      at the end
7 \end{itemize}
```

- Always here
- Appears second
- Appears on the third slide and then disappears
- Stays for two slides

Beamer Overlays (2)

```
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Beamer Overlays (2)

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7 \end{itemize}
```

- Always here
- Appears second
- This one becomes important at the end

Beamer Overlays (3)

```
1  \begin{itemize}[<+->]
2  \item Simple increment
3  \item Simple increment
4  \item Simple increment
5  \end{itemize}
```

- Simple increment

Beamer Overlays (3)

```
1  \begin{itemize}[<+->]
2  \item Simple increment
3  \item Simple increment
4  \item Simple increment
5  \end{itemize}
```

- Simple increment
- Simple increment

Beamer Overlays (3)

```
1  \begin{itemize}[<+->]
2  \item Simple increment
3  \item Simple increment
4  \item Simple increment
5  \end{itemize}
```

- Simple increment
- Simple increment
- Simple increment

Beamer Overlays (4)

Useful commands

Command	Description
`\textbf<>{}`	controls when to bold text
`\textit<>{}`	controls when to italicize text
`\color<>[]{}`	controls when to change colour of text
`\alert<>{}`	controls when to highlight text (theme-dependent colour)
`\only<>{}`	controls when to reveal text, occupies NO space otherwise
`\uncover<>{}`	controls when to reveal text, DOES occupy space otherwise
`\alt<>{}{}`	reveals first argument when specification is true, otherwise reveals second argument

Beamer Overlays (5)

Also works with environments

```
\begin{theorem}<1->[Pythagoras]
$ a^2 + b^2 = c^2$
\end{theorem}

\begin{corollary}<3->
$ x + y = y + x  $
\end{corollary}

\begin{proof}<2->
$\omega +\phi = \epsilon $
\end{proof}

\begin{onlyenv}<3->
some stuff
\end{onlyenv}
```

Theorem (Pythagoras)

$a^2 + b^2 = c^2$

Beamer Overlays (5)

Also works with environments

```
\begin{theorem}<1->[Pythagoras]
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\end{theorem}

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\end{corollary}

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\end{proof}

\begin{onlyenv}<3->
some stuff
\end{onlyenv}
```

Theorem (Pythagoras)

$a^2 + b^2 = c^2$

Proof.

$\omega + \phi = \epsilon$ □

Beamer Overlays (5)

Also works with environments

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\begin{theorem}<1->[Pythagoras]
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$\omega +\phi = \epsilon $
\end{proof}

\begin{onlyenv}<3->
some stuff
\end{onlyenv}
```

Theorem (Pythagoras)

$a^2 + b^2 = c^2$

Corollary

$x + y = y + x$

Proof.

$\omega + \phi = \epsilon$ □

some stuff

Beamer Overlays (6)

Flatten overlays, usually when printing.

```
\documentclass[handout,notes=show]{beamer}

...

 %keep these two pictures on separate slides
 \only<1| handout:1>{\includegraphics{pic1.eps}}
 \only<2| handout:2>{\includegraphics{pic2.eps}}

...

 %hide a frame in handout mode
 \begin{frame}<handout:0>

...

 %some notes
 \begin{frame}
 \end{frame}
 \note{I need to remember to say this.}
```

Beamer: Fragile

If you wish to use a `verbatim` environment in a frame, you have to add the option `[fragile]` to the `{frame}` environment. The `\end{frame}` must be alone on a single line.

e.g.:

```
1  \begin{frame}[fragile]{Something important}
2  ...
3  \end{frame}
```

Beamer: Backup slides

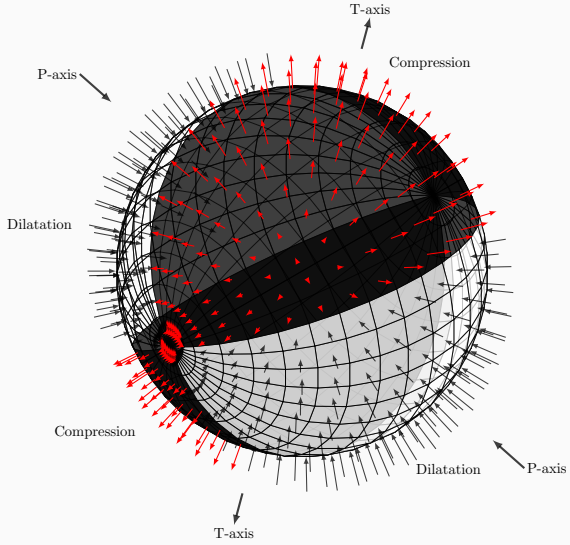
Backup slides: `appendixnumberbeamer` package, calling `\appendix` will turn off slide numbering and progress bars for slides in the appendix.

Vector Graphics

Vector Graphics

Two main options for “writing” vector graphics:

- pstricks
  - Needs to be compiled to PostScript
- PGF/Ti*k*Z
  - PGF is a lower-level language, while Ti*k*Z is a set of higher-level macros that use PGF
  - Same (original) developer as Beamer (tight integration between the two)



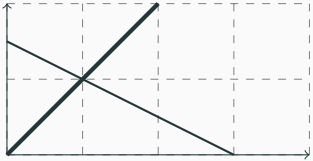
Seismic focal mechanism and Pression-Tension axis.

< 100 lines

http://www.texample.net/tikz/examples/seismic-focal-mechanism-in-3d-view/

TikZ Example: Something simple

```
\usepackage{tikz}
...
\begin{tikzpicture}
\draw [help lines, dashed] (0,0) grid (4,2);
\draw [<->] (0,2) -- (0,0) -- (4,0);
\draw [thick] (0,1.5) -- (3,0);
\draw [ultra thick] (0,0) -- (2,2);
\end{tikzpicture}
```



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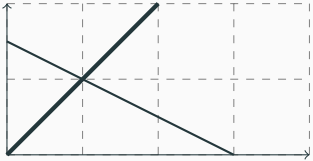
\end{tikzpicture}
```

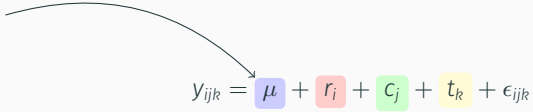


```
\tikz \fill[even odd rule]
      (0,0) circle (1) (1,0) circle (1);
```

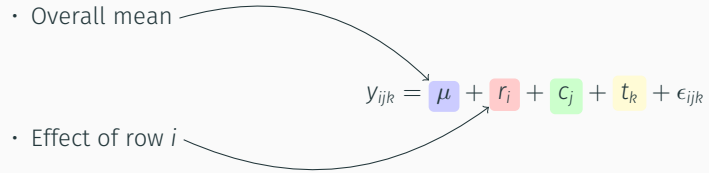
$$y_{ijk} = \mu + r_i + c_j + t_k + \epsilon_{ijk} \tag{1}$$

TikZ/Beamer integration (1)

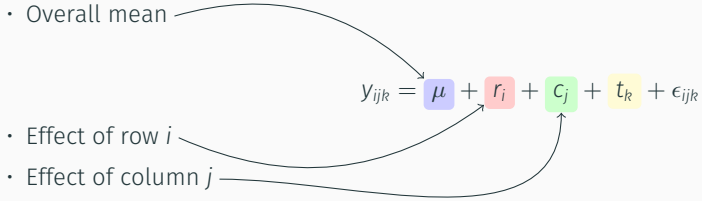
- Overall mean



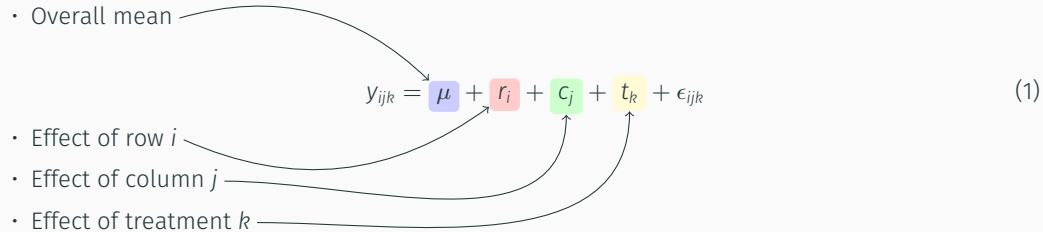
$$y_{ijk} = \mu + r_i + c_j + t_k + \epsilon_{ijk} \tag{1}$$



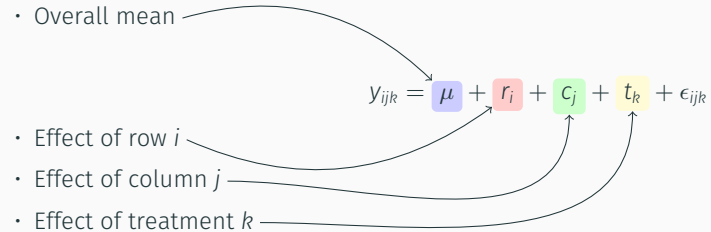
(1)


• Overall mean
$y_{ijk} = \mu + r_i + c_j + t_k + \epsilon_{ijk}$
(1)
• Effect of row i
• Effect of column j

TikZ/Beamer integration (1)



TikZ/Beamer integration (1)



(1)

`http://tex.stackexchange.com/questions/55216/tikz-animated-equation-in-beamer`

TikZ/Beamer integration (2)

```
\tikzstyle{every picture}+=[remember picture]
\tikzstyle{na} = [baseline=-.5ex]

\begin{document}

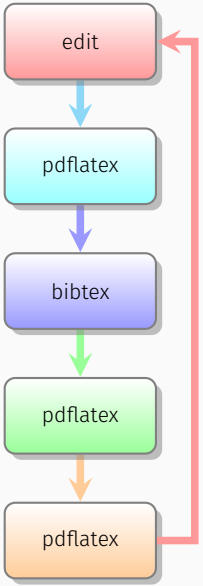
\begin{frame}

\begin{itemize}
\item<2-> Overall mean \tikz[na] \node[coordinate] (s1) {};
\item<1->[]{%
\begin{equation}
y_{ijk} = \tikz[baseline]{ \node[fill=blue!20,anchor=base,rounded corners=2pt]
  (d1) {$\mu$}; }
+ \tikz[baseline]{ \node[fill=red!20,anchor=base,rounded corners=2pt]
  (d2) {$r_{i}$}; }
+ \tikz[baseline]{ \node[fill=green!20,anchor=base,rounded corners=2pt]
  (d3) {$c_{j}$}; }
+ \tikz[baseline]{ \node[fill=yellow!20,anchor=base,rounded corners=2pt]
  (d4) {$t_{k}$}; }
+ \epsilon_{ijk}
\end{equation}}%
```

```
\item<3-> Effect of row $i$ \tikz[na] \node[coordinate] (s2) {};
\item<4-> Effect of column $j$ \tikz[na] \node[coordinate] (s3) {};
\item<5-> Effect of treatment $k$ \tikz[na] \node[coordinate] (s4) {};
\end{itemize}


\begin{tikzpicture}[overlay]
\path<2->[->] (s1) edge [bend left] (d1);
\path<3->[->] (s2) edge [bend right] (d2);
\path<4->[->] (s3) edge [out=0, in=-90] (d3);
\path<5->[->] (s4) edge [out=0, in=-90] (d4);
\end{tikzpicture}
```

```
1  \usepackage{tikz}
2  \usepackage{smartdiagram}
3  ...
4  \smartdiagram[flow diagram]{edit, pdflatex, bibtex,
       pdflatex, pdflatex}
```



Misc

`natbib` replaces the standard `\cite{}` command. Call `\usepackage{natbib}[sort&compress]` to reorder and tidy multiple citations. Call `\usepackage{natbib}[numbers]` or `\usepackage{natbib}[authoryear]` to choose format.

Command	Author/Year mode	Numbers mode
`\citet{jon90}`	Jones et al. (1990)	Jones et al. [21]
`\citet[chap. 2]{jon90}`	Jones et al. (1990, chap. 2)	Jones et al. [21, chap. 2]
`\citep{jon90}`	(Jones et al., 1990)	[21]
`\citep[chap. 2]{jon90}`	(Jones et al., 1990, chap. 2)	[21, chap. 2]
`\citep[see][]{jon90}`	(see Jones et al., 1990)	[see 21]
`\citep[see][chap. 2]{jon90}`	(see Jones et al., 1990, chap. 2)	[see 21, chap. 2]

Useful packages

(sometimes helpful packages are automatically included with styles, e.g. sig-alternate, so check their documentation too)

1. `hyperref` - adds clickable links to urls, citations and internal references. `\usepackage[hidelinks]{hyperref}` hides the boxes drawn around links.
2. `cite` - makes numeric citations pretty! Sorting and compression (e.g. [1-4, 7, 8]), as well as some other formatting. Alternative to natbib - useful if the latter isn't compatible with your document class.
3. `soul` - provides `\hl{stuff}` so you can highlight text (e.g. TODOs) like this: stuff. Also improvements to hyphenation for other formatting like c h a r a c t e r s p a c i n g, underline, ~~strikethrough~~ and SMALL CAPS. Needs `\usepackage{color}` to highlight in colour.

Making your own commands

```
1  \newcommand\todo[2][Yum]{To do: \colorbox{yellow}{#2} -  \textbf{#1}}
2
3  \todo{have cake, eat it}
4
5  \todo[Mmm]{have cake, eat it}
```

To do: have cake, eat it - **Yum**

To do: have cake, eat it - **Mmm**

- `\todo` is the new command's name
- `[2]` is the number of parameters
- `[Yum]` is a default for the first parameter, making it optional
- The rest is the body of the command, with `#1` etc being the parameters
- Use `\renewcommand` in the same way to overwrite an existing one

Sometime we want to squeeze a tiny drop of space out of a paper. Usually we can rewrite to save a few lines, but in case we can't, the following can be used:

```
\noindent
\vspace{-1cm}
\tiny
```

NB - this is a last resort - most "foo" usually breaks the formatting guidelines!

Some more tips..

- **Read the output from LaTeX!**
- Often things can be resolved by deleting temp files and recompiling a couple of times
- Look out for document classes that redefine commands, or load packages that might conflict with the ones you want
- With `\textasciitilde` and many other commands the space after is part of the command, replacing a `{}` so writing this way results in no space after the command, e.g. `Hello \textasciitilde New Word` renders as: Hello ~New Word. `"\textasciitilde "` with two spaces doesn't work because LaTeX ignores redundant whitespace and the two spaces squash into one. Either write `\textasciitilde{}` or `\textasciitilde~` to force a gap