

## MAS115 PRESENTATION LAB 5

Start a new project in Overleaf (or TeXworks/TeXmaker/TeXshop, as you prefer), using the default preamble or one from a recent document. Make sure you include the AMS packages, as usual.

### 1. FURTHER L<sup>A</sup>T<sub>E</sub>X COMMANDS

This week we'll cover some extra L<sup>A</sup>T<sub>E</sub>X features that haven't appeared in the labs so far. In a section called 'Further LaTeX commands', start an `enumerate` environment and enter the following as items.

- (1) Try 'This is the `\LaTeX` logo'. Try removing the second `\`. Why was it needed?  
*The command `\`  (backslash followed by a space) is a command to insert a blank space of standard inter-word width. There are other commands which give slightly different widths, such as `\` , (a thin space), `\quad` (a large space) and `\qquad` (a very large space).*
- (2) Enter 'Let `$$x=u+v\text{and}y=u-v.$$`. Try the `\quad` and `\qquad` to add some extra space either side of the `and`.
- (3) Try entering `This will display % but here is a comment.`
- (4) Try entering `This will make text \texttt{computery}`.
- (5) Put `\usepackage{url}` in your preamble, then try entering the command `\url{http://bbc.co.uk/index_1.htm}`. Does `\texttt` work here instead? If not, what's causing the problem?
- (6) Put `\usepackage{hyperref}` in your preamble, then enter:  
`Here's the real \href{http://bbc.co.uk}{BBC website}.`
- (7) Try using `\texttt` to get L<sup>A</sup>T<sub>E</sub>X to display `\begin{document}` on the PDF. Does it work? If not, try entering '`\verb!\begin{document}!`'. (The `\verb!...!` command allows inline verbatim text.)
- (8) Try entering  
`G\ "odel created a true yet unprovable mathematical statement\footnote{See Wikipedia for more details.}`
- (9) Try entering  
Let's switch to inline maths: `\(x^2=1\)` and `display-math: \[x^2=1\]` using an alternative method.  
Arguably, this is a better way than using `$`-signs for math-mode for reasons which I won't go into. (See, for example, 'Are `\(` and `\)` preferable to dollar signs for math mode?' on Stackexchange.)
- (10) Try putting `\tableofcontents` after your `\maketitle` command and process the L<sup>A</sup>T<sub>E</sub>X twice. (Note: if you are using the `parskip` package with `amsart`, the table of contents doesn't display correctly.

The solution? Remove `parskip`, and set the paragraph indent and skip manually, as we did in Week 1.)

- (11) Try changing some of the `\section{...}` commands in your document to `\section*{...}`. Experiment with the commands `\subsection*` and `\subsubsection*`.
- (12) Type ‘The symbol for the real numbers is  $\mathbb{R}$ ’. Now, go to the preamble to your file and enter `\newcommand{\R}{\mathbb{R}}`. Go back to the earlier sentence and change `\mathbb{R}` with `\R`.

Creating your own L<sup>A</sup>T<sub>E</sub>X commands like in the last question above can be useful for shortening commands that you write frequently.

**1.1. Aligned equations (again!)** Something that we only covered briefly earlier was how to align equations. Start a section called ‘Aligned equations’ and add the following.

```
Since  $e^{it} = \cos t + i \sin t$ , it follows that
\begin{align*}
(\cos t + i \sin t)^n &= (e^{it})^n \\
&= e^{int} \\
&= \cos(nt) + i \sin(nt).
\end{align*}
```

Try removing the `*`, but put it back afterwards. Here, the `align` environment has switched to `display-math` and has lined up all of the `=`-signs. Note that each line is ended with `\\` and the things that are lined up on each line are preceded with an ampersand `&`. The unstarred version numbers the equations, and you can use `\label{...}` and `\ref{...}` to refer to them if required.

**1.2. Tables and arrays.** Creating tables with L<sup>A</sup>T<sub>E</sub>X is easy, and uses the `tabular` environment. In a section called ‘Tables’, try the following. (Note that the `{llr}` bit consists of lowercase ‘L’s and ‘R’s, not ‘l’s.)

```
\begin{center}
\begin{tabular}{llr}
\hline
Name & Brewery & Strength \\
\hline
Pale Rider & Kelham Island & 4.3\% \\
Moonshine & Abbeydale & 3.6\% \\
\hline
\end{tabular}
\end{center}
```

You should find you have a nice-looking table. Try doubling the second instance of `\hline`. Now think about the following.

- (13) What do the `&`-signs do here? What about the `\\` commands?
- (14) Try changing the `{llr}` to `{ccr}`, or `{llc}`, or any other three-letter combination of l, c and r.

(The parameter `{l|l|r}` specifies three columns with the text justified to the left in the first and second columns and to the right in the third. Using `c` gives a centred column.)

- (15) Change the parameters again to `{|l|l|r|}`. What's changed? Change it back.

(Most style guides recommend avoiding the use of vertical lines in tables.)

Notice that the tabular environment is in text-mode. That is, text displays as text. If you want maths as table entries you need to use dollar signs. For a table (or array) that consists entirely of maths, it's better to use the `array` environment. Try it out with the array below, filling in the right-hand column.

```

$$
\begin{array}{c|c}
f(x) & f'(x) \\
\hline
x^2 & \\
e^x & \\
\tan x & \\
\end{array}
$$

```

If you think the array needs stretching out a bit, this is possible by putting `\renewcommand{\arraystretch}{1.5}` before `\begin{array}`. The same command in the preamble will stretch every table and array in your document.

**1.3. The listings package.** As mentioned in an earlier lecture, inserting large chunks of computer code can be done with the `enumerate` environment, but there is a better option.

Start a new section called 'Inserting computer code' and put insert an introductory paragraph reading 'The code below is an implementation of the 'Higher and Lower' game'. Go to the course webpage, and download the `higher_lower.py` file from the extras section. Copy and paste the text into your document inside a `verbatim` environment. How does it look?

Let's improve things.

- (16) Add `\usepackage{listings}` to your preamble, and just below this `\lstset{breaklines=true}`. Change change the `verbatim` environment to `lstlisting` (be careful with the typing!) and process the file. This should have dealt with lines spilling off the page.
- (17) Edit your `\lstset` command to `\lstset{breaklines=true,language=Python}`.
- (18) Try adding the options `basicstyle=\footnotesize`, `showstringspaces=false`, `frame=single`, `numbers=left` and see their effect.
- (19) Google 'listings include code texblog' and look at other options you can use in the top search result.

## 2. FURTHER READING

If there are things you need to do which haven't been covered so far in these classes, they will probably appear in the excellent *Short Introduction to L<sup>A</sup>T<sub>E</sub>X* found at

<http://www.ctan.org/tex-archive/info/lshort/english/lshort.pdf>

Another very useful resource is the L<sup>A</sup>T<sub>E</sub>X Wikibook, which lives at

<http://en.wikibooks.org/wiki/LaTeX>

This is probably more useful as a reference guide to a specific topic. Of course, don't forget Google!

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## HOMEWORK

Create a document with title 'MAS115: Homework 5' and your name on as author. Back in Week 3, you should have received marked homework from your personal tutor for MAS110. Your task is to type up a solution to that homework using your tutor's comments to give a good solution.

- Remember, there should be a difference in style between handwritten and typed solutions.
- Make sure your L<sup>A</sup>T<sub>E</sub>X doesn't just look like a photocopy of your handwritten version.
- Use full sentences and only use display-math when appropriate.
- The align environment might be useful for lining up equations.
- You must make sure the solutions you hand-in are written in your own words. If your solution looks to be plagiarised from the official MAS110 solutions, you may be awarded zero for this homework.

You could consider creating `part` and `solution` environments, by putting the following in your preamble.

```
\newcounter{partcounter}
\setcounter{partcounter}{1}
\newenvironment{Part}{\textbf{Part} \value{partcounter}. }{\stepcounter{partcounter}
\newenvironment{solution}{\begin{proof}[Solution]}\end{proof}}
```

Then, if you enter

```
\begin{Part}
(Type the question here)
\begin{solution}
(Type solution here)
\end{solution}
\end{Part}
```

you will find a numbered part with a solution. (Note the capital 'P' in 'Part', and also make sure you are using the AMS packages.)

Upload the homework before next week's lab, as usual.