

Assessments for CS students:

- Two hours per week lectures, Tuesdays 2-4pm.
- Three in-semester assignments, with feedback de-coupled from assessment:

Assignment 1 Generic paper

Assignment 2 Literature review

Assignment 3 Experimental paper

Details on unit website.

- There is no exam
- Portfolio of written work submitted at end of semester
- Comprises (re-worked) assignments plus CV

Material for the unit will be available at

<http://undergraduate.csse.uwa.edu.au/units/CITS4008/>

An Introduction to L^AT_EX

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What is L^AT_EX?

L^AT_EX is a document preparation system for high quality typesetting. Although it can be used for any form of publishing, it is especially useful for mathematical and scientific documents. L^AT_EX is not a word processor — instead, L^AT_EX takes the worry out of the appearance of the document by its built in *environments*, and instead allows authors to concentrate on writing.

Benefits of L^AT_EX?

- Looks nice (for instance these slides are prepared in L^AT_EX),
- Widely available with platform-independent output,
- Accepted/required by journals and conferences,
- text source takes less memory than Word or pdf document,
- pdf output easily distributed,
- Cross-referencing using symbolic labels,
- Supports indexing,
- easy to make a bibliography,
- Invaluable for writing mathematical formulas.

Disadvantages of L^AT_EX?

- Not “what you see is what you get”, like Word for instance.
- It is a program, so needs to be compiled before you can see the end result.
- Needs to be debugged!

How to install \LaTeX ?

Requires:

- a compiler, for instance miktex.
- a \LaTeX -friendly editor, for instance TexWorks.
- style files, for instance we have style files for UWA thesis and uwamaths.

Since \LaTeX is freeware, free documentation is readily available online. One option is the below:

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

You can also search online for specific \LaTeX commands.

Two options:

- 1 In a terminal (make sure you are in the right folder) type `pdflatex file.tex`. This creates a `file.pdf` that you can then open in acrobat for instance.
- 2 if using an editor like TexWorks, click on `pdflatex`, then on `ViewPdf`.

Often it will first give you a list of errors, that you need to debug, before getting a pdf file.

Basic structure of a document

```
\documentclass[12pt,A4paper]{article}
\usepackage{amsmath,amsthm,amssymb,uwamaths}
\title {An Introduction to \LaTeX}
\author{Alice Devillers}
\date{26 February 2013}
\begin{document}
\maketitle
:
Body of document.
:
\end{document}
```


Sectioning

The sectioning commands available depend on the document class.
Important ones are:

`\chapter`

`\section`

`\subsection`

`\subsubsection`

- Plain English text needs few \LaTeX commands.
- \LaTeX does the formatting.
- Several blanks are treated as a single blank.
- Text is usually set left and right aligned.
- An empty line starts a new paragraph.

Special characters

- `\` starts a \LaTeX command
- `{` and `}` group things in \LaTeX
- `$` starts or ends in-line maths mode
- `$$` starts or ends maths display mode
- `%` starts a comment (until a new line) so will not appear in the compiled document

These special characters can be used in a document by preceding them with a backslash `\`: type `\%` to get `%`.

Exception: type `$$\backslash$$` to get `\`.

Changing fonts

L^AT_EX supports different fonts, e.g. **bold face**, *italics*, typewriter, underline etc.

Bold: `{\bf he}llo` appears as **hello**.

italics: `{\it he}llo` appears as *hello*.

typewriter: `{\tt he}llo` appears as `hello`.

underline: `\underline{he}llo` appears as hello.

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underline: `\underline{he}llo` appears as hello.

calligraphic: `$_{\mathcal{C}}$` appears as \mathcal{C} .

blackboard: `$_{\mathbb{C}}$` appears as \mathbb{C} .

Environments

L^AT_EX supports different environments:

```
\begin{...}
```

```
\end{...}
```

The ... can be: center, theorem, equation, tabular, array, itemize, enumerate, description, and lots more.

Itemising & Enumerating

```
\begin{itemize}
  \item bread
  \item butter
\end{itemize}
```

appears as

- bread
- butter

```
\begin{enumerate}
  \item bread
  \item butter
\end{enumerate}
```

appears as

- 1 bread
- 2 butter

Description Environment

```
\begin{description}  
  \item[bread] multigrain  
  \item[butter] unsalted  
\end{description}
```

appears as

bread multigrain

butter unsalted

Making Tables

```
\begin{tabular}{|l|l|c|r|}  
\hline  
bread & 1 loaf & 500 g & \$ 2.50 \\chocolate & 2 bars & 1200 g each & total $2.40 \\ \hline \end{tabular}
```

appears as

| | | | |
|-----------|--------|-------------|---------------|
| bread | 1 loaf | 500 g | \$ 2.50 |
| chocolate | 2 bars | 1200 g each | total \$ 2.40 |

In the tabular environment,

- Each letter l,c,r represents a column, and mean left-aligned, centered, right-aligned respectively.
- If two columns are separated by a vertical bar | there will be a line between the two columns.
- For each row, & separates the entries in each column (needs to have the right number of &!), and \\ does a line break.
- A \hline makes a horizontal line between the rows.
- More advanced: a \cline command can put a horizontal line spanning a selected number of columns only.

Typing Mathematics

Mathematics is typed in a special mode, the *maths mode*.

\dots or $\{\dots\}$

For example, the intersection of two sets A and B is written $A \cap B$ and appears as $A \cap B$.

Displaying Mathematics

The displayed maths mode is enclosed in the `equation` environment, or

`$$...$$` or `\[...\]`

Displayed mathematics is **centered** on a line by itself.

Underscripting and superscripting

In maths mode:

Underscripts

$$\begin{array}{lcl} x_i & \rightarrow & x_i \\ 3Z_{\{a+b\}} & & 3Z_{a+b} \\ 3Z_{a+b} & & 3Z_a + b \end{array}$$

Superscripts

$$\begin{array}{lcl} x^2 & \rightarrow & x^2 \\ 5x^{\{18\}} & & 5x^{18} \\ 5x^{18} & & 5x^{18} \end{array}$$

Mathematical Symbols

There are **many**. See the references, or in some \LaTeX -specific editors, they have cheat sheets for all the mathematical symbols (not TexWorks). But you'll quickly learn the ones you need often!

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For example,

Greek alphabet α `\alpha`, γ `\gamma`, Γ `\Gamma`
`\sum_{i=1}^n i^2` $\sum_{i=1}^n i^2$

`\prod_{i=1}^n a_i` $\prod_{i=1}^n a_i$

or in displayed math mode $\sum_{i=1}^n i^2$, $\prod_{i=1}^n a_i$.

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or in displayed math mode $\sum_{i=1}^n i^2$, $\prod_{i=1}^n a_i$.

Some symbols require **specific packages** like `amssymb`.

Cross Referencing

```
\begin{equation}
x = y + z \label{eq:sum}
\end{equation}
By equation \eqref{eq:sum} we can see that ...
```



$$x = y + z \tag{1}$$

By equation (1) we can see that ...

if this is the first equation in your document.

Cross Referencing

Similarly, sections of the document may be labelled and referenced. In particular, this is very useful in referencing theorems, chapters, tables and figures.

Example

```
\begin{theorem} \label{mainresult}  
$A>B$  
\end{theorem}
```

Then anywhere in the text:

In Theorem `\ref{mainresult}`, we proved that $A > B$.

When cross referencing, make sure that you run \LaTeX at least twice! Otherwise the references will be incorrect.

More Equations

Multi-line equations are easy to typeset, with the `eqnarray` environment. Longer equations that may not fit on a single line can also be broken up into several lines. See references for details.

Example 1

$$\lim_{n \rightarrow \infty} \sum_{k=1}^n \frac{1}{k^2} = \frac{\pi^2}{6} \quad (2)$$

Fractions are obtained by `\frac{1}{k^2}`.

Example 1

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Fractions are obtained by `\frac{1}{k^2}`.

```
\begin{equation}
\lim_{n \to \infty} \sum_{k=1}^n \frac{1}{k^2}
=\frac{\pi^2}{6}
\end{equation}
```

Example 2

$$\begin{aligned}P(\alpha < x) &= \int_{-\infty}^x f(\alpha) d\alpha \\ &= \int_{-\infty}^x (2\pi\sigma_\alpha^2)^{-1/2} \exp\left\{-\frac{\alpha^2}{2\sigma_\alpha^2}\right\} d\alpha\end{aligned}$$

Example 2

$$\begin{aligned} P(\alpha < x) &= \int_{-\infty}^x f(\alpha) d\alpha \\ &= \int_{-\infty}^x (2\pi\sigma_\alpha^2)^{-1/2} \exp\left\{-\frac{\alpha^2}{2\sigma_\alpha^2}\right\} d\alpha \end{aligned}$$

```
\begin{eqnarray*}
P(\alpha < x) &=& \int_{-\infty}^x f(\alpha) d\alpha \\
&=& \int_{-\infty}^x (2\pi\sigma_\alpha^2)^{-1/2} \\
&& \exp\left\{-\frac{\alpha^2}{2\sigma_\alpha^2}\right\} d\alpha \\
\end{eqnarray*}
```

Including pictures

You can include pdf, png, jpeg, eps files.

- Have `\usepackage{graphicx}` in your heading.
- The file, say `pic.jpg`, has to be in the same folder as your `tex` file.
- Type `\includegraphics[width=60mm]{pic}` or `\includegraphics[height=60mm]{pic}`
- Often you will use a figure environment: easier to manage where \LaTeX puts it and possibility to caption, label, etc.

Including pictures

```
\begin{figure}[htb]
\begin{center}
\includegraphics[width=0.5*\linewidth]{pic}
\caption{This is a figure.}
\label{pic1}
\end{center}
\end{figure}
```

Making your own figures

- You can use programs like Xfig, gimp.
- Export graphics from Maple, Mathematica.
- More advanced: use the Tikz package which programs graphics directly into the tex file.

Ask your supervisor what programs is best for what you want to do.

Homework

Install \LaTeX on your personal laptop/computer. You can also use it in the computer labs.

Homework: take a page of a maths book (with formulas) and try to reproduce it.

Start writing your own work early!!!