

LaTeX Training Course

‘Using LaTeX to write a thesis’

UK-TUG Volunteers

Time: 10:15

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1 An overview of LaTeX

LaTeX is a powerful system

- LaTeX can be used from a one page letter to a 1000 page textbook;
- Most of *our* examples will be simple;
- Complex documents, for example interactive books and these slides, use the same ideas as we’ll explore today;
- By separating input from output, reusing material becomes much easier.

Demo documents here

What is LaTeX, and what is TeX?

- TeX is a typesetting application;
- TeX uses *primitives* to determine how to put text on a page;
- For most practical purposes, we need a *format* built on top of TeX, for example:
 - Plain TeX;
 - LaTeX;
 - ConTeXt;
- You can think of LaTeX as an interpreter between you and TeX.

TeX ‘engines’

pdfTeX

The standard binary program: we’ll be using this today.

XeTeX

A merger of TeX with modern font technology with support for native Unicode input and bidirectional typesetting.

LuaTeX

Also a modern engine: integrates the Lua scripting into TeX.

What do we need to use LaTeX?

- A TeX distribution: TeX Live (Windows, Mac, Linux) or MiKTeX (Windows only);
- A text editor, *e.g.* Notepad, TextEdit, Emacs;
- A PDF viewer, for example Adobe Reader.

Usually, we use a specialist editor

- Coloured syntax;
- Buttons or menus to run LaTeX, *etc.*;
- Most include an integrated spell checker.

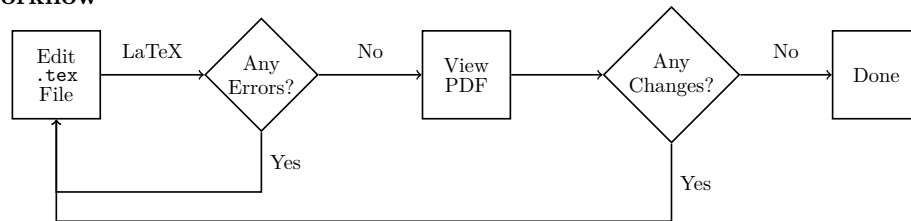
Time: 10:30

2 Getting started

LaTeX is not a word processor

- LaTeX input is stored as plain text files, usually with the extension `.tex`;
- LaTeX input files contain both the text of the document and *commands*;
- Commands start with a backslash, so look like this: `\example`;
- Writing in LaTeX is therefore a bit like *programming* it to produce the document you want;
- *Logical* mark up is important in LaTeX: we'll use some almost straight away!

Workflow



Spacing

- LaTeX treats multiple spaces as a single space;
- By default, the space between sentences is slightly larger than the space between words – can be switched off using `\frenchspacing`;
- The tilde (`~`) is used to create a non-breaking space;
- New line characters are treated as a space;
- Paragraph breaks should be indicated by a blank line;
- LaTeX automatically indents paragraphs, except for the first paragraph after a section heading.

A simple document

Example

```
\documentclass[a4paper,12pt]{article}
% A comment in the preamble
\begin{document}
% This is a comment
This is a simple
```

```
document\footnote{with a footnote}.
```

```
This is a new paragraph.  
\end{document}
```

Show demo
document in
TeXworks,
and mention
SyncTeX

Exercise 1 Use the editor of your choice to create the above document. While you can use a specialist editor, start by doing this example in a basic editor such as Notepad. Save the document with a `.tex` extension, for example `exercise1.tex`, then go to a Terminal/Command Prompt and type:

```
pdflatex exercise1
```

You can then view the resulting PDF file using a PDF viewer such as Adobe Reader.

Try experimenting with white space: what do multiple spaces and multiple lines do? Also try out using the tilde (`~`) for a non-breaking space and `\,` for spaces of different widths.

LaTeX automatically indents new paragraphs: see what the `\noindent` macro does to these cases.

Finish exercise
at 10:50

3 Logical structure

Logical mark up

LaTeX provides us with logical mark up, as well as the ability to directly set the appearance.

Logical mark up

```
\emph{\text}\{\large \text\}
```

Appearance mark up

```
\textit{\text}\{\fontsize{12 pt}\{14 pt\}\selectfont \text\}
```

Usually, logical mark up is best when it is available.

Title Page

First, you need to give the ‘meta-data’:

- `\title{\textit{title}}`
- `\author{\textit{author(s)}}`
- `\date{\textit{date}}` (optional)

Then use `\maketitle` to display the title page.

Sectioning commands

- `\chapter[⟨short title⟩]{⟨title⟩}`
- `\section[⟨short title⟩]{⟨title⟩}`
- `\subsection[⟨short title⟩]{⟨title⟩}`
- `\subsubsection[⟨short title⟩]{⟨title⟩}`
- `\paragraph[⟨short title⟩]{⟨title⟩}`
- `\subparagraph[⟨short title⟩]{⟨title⟩}`

Exercise 2 *Try producing the following document.*

```
\documentclass{report}

\usepackage{lipsum}% provides \lipsum to produce dummy text

\title{My Thesis}
\author{Ann Author}
\date{July 2010}

\begin{document}
\maketitle

\chapter{Introduction}

This is a sample chapter. It includes some \emph{emphasise}
and also some \textbf{bold} text.

\section{Sample Section}

This is a sample section with some dummy text to pad it out. \lipsum[1]

\chapter{Method}

This is another chapter with some more dummy text. \lipsum[1]

\end{document}
```

Experiment with the logical mark up for appearance, for example `\emph`, `\large`, `\Large` and `\Huge`. Compare these with the direct changes brought about by `\textit` and `\textbf`.

Try changing the format of text for a longer block by trapping the formatting changes within `\begingroup` and `\endgroup`, for example

```

\begin{group
  \large
  \itshape
  Some text

  A second paragraph
\end{group}

```

Lists

List with bullets, dashes, etc.

```

\begin{itemize}
  \item This is an unordered list
\end{itemize}

```

List with numbered items

```

\begin{enumerate}
  \item This is the first item.
  \item This will have number 2!
\end{enumerate}

```

Exercise 3 *Make some lists, and nest one list inside another. How does the format of the numbers or markers change? You can only go to four levels with standard LaTeX, but more than four nestings tends to be a bad sign anyway!*

Finish exercise
at 11:30

4 Classes

Document classes

The *document class* sets up the general layout of the document, for example:

- the format of the headings;
- if the document should have chapters;
- if the title should be on a separate page or above the text on the first page;

They can also add new control sequences.

Usage

```

\documentclass[options]{class-name}

```

Base classes

article for short documents without chapters;

report for longer documents with chapters, typically single-sided with an abstract;

book for books, typically double-sided with front matter and back matter;

letter for correspondence;

slides for presentations.

Modern classes

KOMA-Script `scrartcl`, `scrreprt` and `scrbook` to replace `article`, `report` and `book`, respectively;

memoir replaces `book` and `report`;

beamer for slides (used to create the course material).

KOMA-Script Example

```
\documentclass{scrreprt}

\title{A Sample Document}
\author{Ann Author}

\begin{document}
\maketitle
\tableofcontents

\chapter{Introduction}

This is a sample document with some dummy
text\footnote{and a footnote}.

\end{document}
```

Documentation

On your computer

The `texdoc` application will show documentation for material you have installed. From the Command Prompt/Terminal

```
texdoc <name>
```

Online

Try CTAN:

`http://ctan.org/pkg/<name>`

or texdoc online

`http://texdoc.net/pkg/<name>`

Exercise 4 Try creating the above document. The KOMA-Script classes have various options that affect the document's appearance. Try experimenting with some of the following: `chapterprefix`, `headings=small`, `headings=normal`, `headings=big`, `numbers=enddot`, `numbers=noenddot`. For example:

```
\documentclass[chapterprefix]{scrreprt}
```

Also try making simple documents with `memoir`: see how without any other changes the appearance of the PDF file is altered.

To add some 'dummy text' to your files, put the line `\usepackage{lipsum}` before `\begin{document}`, then put `\lipsum` somewhere after `\begin{document}`. This will create a number of filler paragraphs. Use this to see what effect the `twocolumn` class option has on the layouts you see.

Use `texdoc` to look up the documentation for the classes we are using. Some of these are very long: most of the time you only need a small subset of the commands available!

5 Cross-referencing

Cross-referencing

Example input

```
\section{A section}
\label{sec:interesting}
...
\ref{sec:interesting}
```

Two LaTeX runs are needed to get cross-references right.

Mention `clev-`
`eref`

Exercise 5 Try producing the following document.

```
\documentclass[oneside]{scrbook}

\usepackage{lipsum}% provides \lipsum to produce dummy text

\titlehead{University of East Anglia\\
```



```

Norwich\\
NR15 1AJ}
\subject{A thesis submitted for the degree of Doctor of Philosophy}
\title{My Thesis}
\author{Ann Author}
\date{July 2010}
\publishers{Prof.\ My Advisor}

\begin{document}
\maketitle

\frontmatter
\tableofcontents

\chapter{Foreword}

This is the foreword. It is in an unnumbered chapter.

\mainmatter
\chapter{Introduction}

This is a sample chapter with a reference to Chapter~\ref{ch:method}.

\section{Sample Section}

This is a sample section with some dummy text to pad it out. \lipsum

\chapter{Method}\label{ch:method}

This is another chapter with some more dummy text. \lipsum

\appendix % Switch to appendices

\chapter{A Sample Appendix}\label{apd:sample}

This is an appendix. \lipsum

\chapter{Another Appendix}

This is another appendix with a reference to Appendix~\ref{apd:sample}.
\lipsum
\end{document}

```

Experiment with cross-references to sections, subsections and items in ordered lists. Can you see how it works?

Finish exercise
at 12:30 and
go to lunch.
Restart at
13:15.

6 More logical structure

Mathematics

- Mathematical content is marked up in LaTeX in a logical way;
- You can use \dots or $\langle \dots \rangle$ to mark up in-line maths;
- For displayed mathematics, use
$$\dots$$
;
- A lot of spacing is automatic in math mode;
- Maths is an entire area on its own!

Example input

```
\( y = 2 \sin \theta^2 \)
```

Example output

$y = 2 \sin \theta^2$

Mention AMS
material and
Voß's *Math
Mode*

Creating your own commands

Syntax

```
\newcommand*{\langle name \rangle}{\langle replacement text \rangle} \newcommand*{\langle name \rangle}[\langle number \rangle]{\langle replacement text \rangle}
```

Examples

```
\newcommand*{\authorname}{Joseph Wright} \newcommand*{\important}[1]{\textbf{\#1}}
```

Exercise 6 Create some simple mathematical content (for example $y = mx + c$) and compare the effect of $\langle \dots \rangle$ with \dots . Can you work out how to get capitalised Greek letters? Can you guess why some Greek do not seem to work?

Subscripts and superscripts in math mode are created using $_$ and $^$, respectively. Try these out, and think about why you might use `\textsuperscript` rather than $^$ in some cases.

Try creating your own simple commands using `\newcommand`. Think of how to create commands using 1, 2 and 3 arguments.

Finish exercise
at 13:45.

7 Floating material

On packages

The LaTeX kernel is rather limited: to get around that we load *packages*:

```
\usepackage[\langle options \rangle]{\langle package \rangle}
```

or

```
\usepackage{<package1>,<package2>,...}
```

We have already seen the `lipsum` package!

Documentation for packages is available in exactly the same way as for classes.

Including external images

- Load the `graphicx` package to include graphics;
- Use `\includegraphics` to actually place the image;
- Image formats: `pdf`, `png`, `jpg`;
- Images in `eps` format ‘auto-converted’ to `pdf`;
- File extension should be omitted.

Graphics can also be ‘drawn’ in LaTeX using the `TikZ` package: a course in itself!

Perhaps include keyval interface for graphics options

Floating figures

A floating figure ...

```
\begin{figure}[htbp]
  \centering
  \includegraphics{myimage}
  \caption{A Sample Figure}
  \label{fig:sample}
\end{figure}
```

...needs a cross-reference

as is show in Figure~\ref{fig:sample}

Exercise 7 Try producing the following document. (Use an image application, such as *Paint*, to produce a simple picture and save it as *shapes.png*.)

```
\documentclass[oneside,numbers=noenddot]{scrbook}

\usepackage{lipsum}% provides \lipsum to produce dummy text
\usepackage{graphicx}% provides \includegraphics

\titlehead{University of East Anglia\\
Norwich\\
```

```

NR15 1AJ}
\subject{A thesis submitted for the degree of Doctor of Philosophy}
\title{My Thesis}
\author{Ann Author}
\date{July 2010}
\publishers{Prof.\ My Advisor}

\begin{document}
\maketitle

\chapter{Introduction}

This is a sample chapter with a figure and a reference to Chapter~\ref{ch:method}.

\begin{figure}[htbp]
\centering
\includegraphics{shapes}
\caption{Some Shapes}
\end{figure}

\section{Sample Section}

This is a sample section with some dummy text to pad it out. \lipsum

\chapter{Method}\label{ch:method}

This is another chapter with a reference to Figure~\ref{fig:shapes}
and some more dummy text.

\begin{figure}[htbp]
\centering
\includegraphics[scale=0.5,angle=45]{shapes}
\caption{A Sample Figure}\label{fig:shapes}
\end{figure}

\end{document}

Here are some more class options to try that will affect the list of figures:
chapteratlists, chapteratlists=0mm.

```

Tables

- The floating environment for a table is called `table`;
- However, the content can be anything!
- Use the `tabular` environment to make tables;

- Load the booktabs package for rules.

Tables

A simple table

```
\begin{table}
  \centering
  \caption{A caption}
  \label{tab:example}
  \begin{tabular}{lcr}
    \toprule
    Heading & Another one & A third \\
    \midrule
    a & b & c \\
    d & e & f \\
    \multicolumn{3}{c}{Wide text} \\
    \bottomrule
  \end{tabular}
\end{table}
```

Exercise 8

Use the simple table example to start experimenting with tables. Try out different alignments using the *l*, *c* and *r* column types. What happens if you have too few items in a table row? How about too many? Experiment with the `\multicolumn` command to span across columns.

Finish exercise
at 14:45.

8 Bibliographies

Creating a bibliography

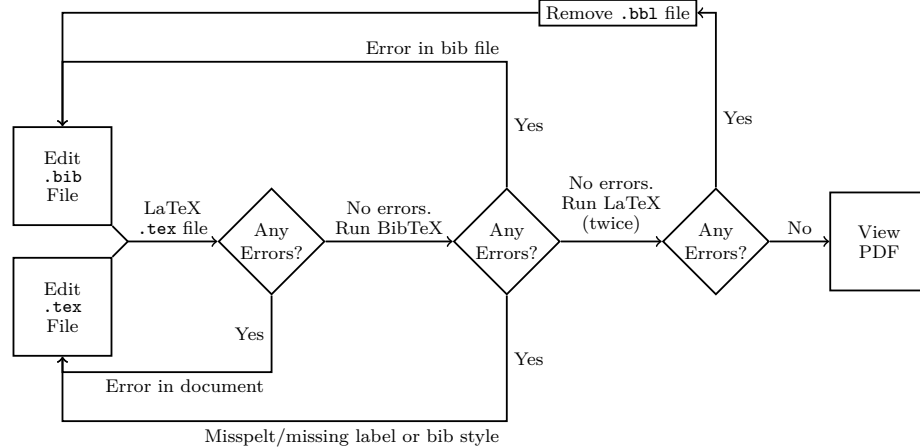
- Entries are stored in a *BibTeX* database;
- Inform LaTeX about it using `\bibliography` command;
- These are cited using `\cite` in the LaTeX file;
- Choose a style using `\bibliographystyle`.

Creating a bibliography

The LaTeX basics

```
\documentclass{article}
\usepackage{natbib}
\bibliographystyle{plainnat}
\begin{document}
Some text \cite{key}.
\bibliography{example}
\end{document}
```

BibTeX workflow



The BibTeX file

A basic article

Example 1

```

@book{lamport94,
  author   = {Leslie Lamport},
  title    =
    {{\LaTeX{}}: a document preparation system},
  edition  = {2nd},
  publisher = {Addison--Wesley},
  year     = 1994,
}
  
```

The BibTeX file

Multiple authors

Example 2

```

@inproceedings{smith05,
  author    = {Smith, Jr, John and Jane Lucy Doe
    and Other, Andrew N. and de Vere, Jo},
  title     = {An example article},
  booktitle = {Proceedings of the Imaginary Society},
  month     = JAN,
  year      = 2005
}
  
```

Citations in LaTeX

- The LaTeX kernel is limited for citations;
- The natbib package is much more powerful;
- A new approach is provided by biblatex.

Citations using natbib

Textual citations

```
\citet[<note>]{<key>}  
  
\citet{lamport1994}          ⇒ Lamport (1994)  
\citet[p.~34]{lamport1994} ⇒ Lamport (1994, p. 34)
```

Parenthetical citations

```
\citep[<prenote>][<postnote>]{<key>}  
  
\citep{lamport94}           ⇒ (Lamport, 1994)  
\citep[p.~34]{lamport94} ⇒ (Lamport, 1994, p. 34)  
\citep[see][ ]{lamport94} ⇒ (see Lamport, 1994)
```

Exercise 9 Create a file called *myrefs.bib* that contains the following:

```
@inproceedings{smith05,  
  author = "Smith, Jr, John and Jane Lucy Doe and Jo de Vere",  
  title = "An example article",  
  booktitle = "Proceedings of the Imaginary Society",  
  month = JAN,  
  year = 2005  
}  
  
@book{lamport94,  
  author = "Leslie Lamport",  
  title = "{\LaTeX} : a document preparation system",  
  edition = "2nd",  
  publisher = "Addison-Wesley",  
  year = 1994  
}
```

Then create a file called, say, *example5.tex* that contains the following:

```
\documentclass{article}  
  
\usepackage{natbib}  
\bibliographystyle{plainnat}  
  
\begin{document}
```

Main matter with citations such as `\citet{lamport94}`.

```
\bibliography{myrefs}  
\end{document}
```

If you are using a terminal or command prompt, you will need to use the following commands:

```
pdflatex example5  
bibtex example5  
pdflatex example5  
pdflatex example5
```

There are various options you can pass to the `natbib` package that affects the formatting. For example:

```
\usepackage[numbers,sort&compress]{natbib}
```

Try experimenting with some of these options: `round`, `curly` and `numbers`. With the `numbers` option, you can also use: `super`, `sort` and `sort&compress`.

9 Long documents

Working with long documents

- Long documents are best split into parts;
- `\input` places the material loaded ‘here’;
- `\include` is used for separate chapters: it always starts a new page;
- Using `\include` allows you to `\includeonly` selected chapters;
- Use `\includeonly` in the preamble.

Exercise 10

Create a master file

```
\documentclass{report}  
\usepackage{lipsum}  
\begin{document}  
  \include{chapter1}  
  \include{chapter2}  
  \include{chapter3}  
\end{document}
```

along with the three chapters, each of which can be as simple as


```
\chapter{A demo}
\lipsum
```

Experiment with this basic structure, and using `\includeonly` to use only some of the files.

Finish exercise
at 15:45 and
break for coffee

10 Further information

Getting help

- www.tex.ac.uk/faq;
- www.latex-community.org;
- tex.stackexchange.com;
- www.dickimaw-books.com/latexresources.html;
- detexify.kirelabs.org/.

Reading

- *Not So Short Introduction to LaTeX2e*, Oetiker;
- *A Guide to LaTeX*, Kopka and Daly;
- *LaTeX for Complete Novices*, Talbot;
- *LaTeX and Friends*, van Dongen.

Time allowing,
simple `hyperref`
demo is good
here