

# CSE 376: Technical Writing and Presentation

## L<sup>A</sup>T<sub>E</sub>X Practicals

Prepared from LaTeX for Beginners, University of Edinburgh.  
Copyright ©IS 2014

November 6, 2022

# Introduction

## What is L<sup>A</sup>T<sub>E</sub>X?

L<sup>A</sup>T<sub>E</sub>X (pronounced *lay-tek*) is a document preparation system for producing professional-looking documents, it is **not** a word processor. It is particularly suited to producing long, structured documents, and is very good at typesetting equations. It is available as free software for most operating systems.

L<sup>A</sup>T<sub>E</sub>X is based on T<sub>E</sub>X, a typesetting system designed by Donald Knuth in 1978 for high quality digital typesetting. T<sub>E</sub>X is a low-level language that computers can work with, but most people would find difficult to use; so L<sup>A</sup>T<sub>E</sub>X has been developed to make it easier.

If you are used to producing documents with Microsoft Word, you will find that L<sup>A</sup>T<sub>E</sub>X is a very different style of working. Microsoft Word is ‘What You See Is What You Get’ (WYSIWYG), this means that you see how the final document will look as you are typing. When working in this way you will probably make changes to the document’s appearance (such as line spacing, headings, page breaks) as you type. With L<sup>A</sup>T<sub>E</sub>X you do not see how the final document will look while you are typing it — this allows you to concentrate on the content rather than appearance.

A L<sup>A</sup>T<sub>E</sub>X document is a plain text file with a .tex file extension. It can be typed in a simple text editor such as Notepad, but most people find it easier to use a dedicated L<sup>A</sup>T<sub>E</sub>X editor. As you type you mark the document structure (title, chapters, subheadings, lists etc.) with tags. When the document is finished you compile it — this means converting it into another format. Several different output formats are available, but probably the most useful is Portable Document Format (PDF), which appears as it will be printed and can be transferred easily between computers.

## Before You Start

The following conventions are used throughout the Practical sheets:

- Actions for you to carry out are bulleted with an arrow ➤.
- Text you type is written in this font.
- Menu commands and button names are shown in **bold**.

# Practical 1: Document Structure

## 1.1 Essentials

- Start TeXworks.

A new document will automatically open.

- Go to the **Format** menu and select **Line Numbers**.

Line numbers are not essential, but will make it easier to compare your code with the screenshots and find errors.

- Go to the **Format** menu and select **Syntax Coloring**, then **LaTeX**.

Syntax colouring will highlight commands in blue and can make it easier to spot mistakes.

- Type the following:

```
\documentclass[a4paper,12pt]{article}

\begin{document}

A sentence of text.

\end{document}
```

The `\documentclass` command must appear at the start of every  $\text{\LaTeX}$  document. The text in the curly brackets specifies the document class. The **article** document class is suitable for shorter documents such as journal articles and short reports. Other document classes include **report** (for longer documents with chapters, e.g. PhD theses), **proc** (conference proceedings), **book** and **slides**. The text in the square brackets specifies options — in this case it sets the paper size to A4 and the main font size to 12pt.

The `\begin{document}` and `\end{document}` commands enclose the text and commands that make up your document. Anything typed before `\begin{document}` is known as the preamble, and will affect the whole document. Anything typed after `\end{document}` is ignored.

The empty lines aren't necessary<sup>1</sup>, but they will make it easier to navigate between the different parts of the document as it gets longer.

➤ Click on the **Save** button.

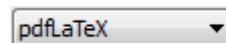


➤ Create a new folder called **LaTeX Practicals in Documents**.

➤ Name your document **Lab1** and save it as a **TeX document** in this folder.

It is a good idea to keep each of your  $\text{\LaTeX}$  documents in a separate folder as the compiling process creates multiple files.

➤ Make sure the typeset menu is set to **pdfLaTeX**.



➤ Click on the **Typeset** button.




There will be a pause while your document is being converted to a PDF file. When the compiling is complete TeXworks' PDF viewer will open and display your document. The PDF file is automatically saved in the same folder as the .tex file.

---

<sup>1</sup>See section 2.5 for information about how  $\text{\LaTeX}$  deals with empty space in the .tex file.

## 1.2 Troubleshooting

If there is an error in your document and TeXworks cannot create the PDF the **Typeset** button will change to red with a white X (**Abort typesetting** button) and the **Console output** at the bottom of the screen will stay open. If this happens:

- Click on the **Abort typesetting** button. 
- Read the **Console output** - the last line will probably include a line number and the command that caused the error.
- Go to the line number in your document and fix the error.
- Click on the **Typeset** button again.

## 1.3 Creating a Title

The `\maketitle` command creates a title. You need to specify the title of the document. If the date is not specified today's date is used. Author is optional.

- Type the following directly after the `\begin{document}` command:

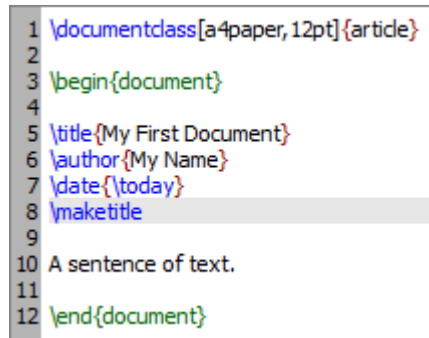
```
\title{My First Document}  
\author{My Name}  
\date{\today}  
\maketitle
```

Your document should now look like figure 1.

- Click on the **Typeset** button and check the PDF.

Points to note:

- `\today` is a command that inserts today's date. You can also type in a different date, for example `\date{December 2018}`.
- **Article** documents start the text immediately below the title on the same page. **Reports** put the title on a separate page (like this Practical Sheet).



```

1 \documentclass[a4paper,12pt]{article}
2
3 \begin{document}
4
5 \title{My First Document}
6 \author{My Name}
7 \date{\today}
8 \maketitle
9
10 A sentence of text.
11
12 \end{document}

```

Figure 1: TeXworks screenshot showing the maketitle command.

## 1.4 Sections

You should divide your document into chapters (if needed), sections and sub-sections. The following sectioning commands are available for the **article** class:

- `\section{...}`
- `\subsection{...}`
- `\subsubsection{...}`
- `\paragraph{...}`
- `\subparagraph{...}`

The title of the section replaces the dots between the curly brackets. With the **report** and **book** classes we also have `\chapter{...}`.

➤ Replace “A sentence of text.” with the following:

```

\section{Introduction}
This is the introduction.

\section{Methods}

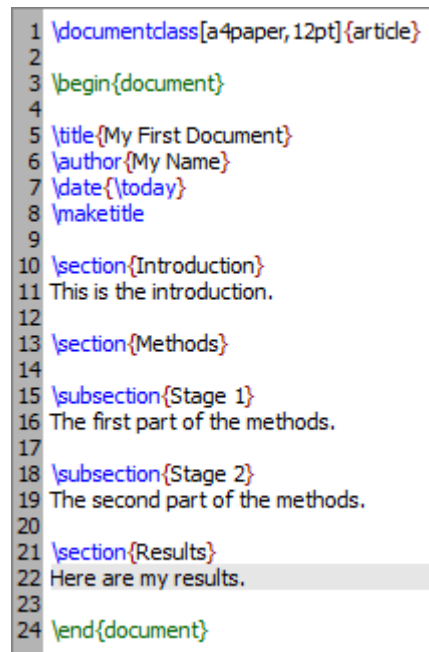
\subsection{Stage 1}
The first part of the methods.

```

```
\subsection{Stage 2}  
The second part of the methods.
```

```
\section{Results}  
Here are my results.
```

Your document should now look like figure 2.



```
1 \documentclass[a4paper,12pt]{article}  
2  
3 \begin{document}  
4  
5 \title{My First Document}  
6 \author{My Name}  
7 \date{\today}  
8 \maketitle  
9  
10 \section{Introduction}  
11 This is the introduction.  
12  
13 \section{Methods}  
14  
15 \subsection{Stage 1}  
16 The first part of the methods.  
17  
18 \subsection{Stage 2}  
19 The second part of the methods.  
20  
21 \section{Results}  
22 Here are my results.  
23  
24 \end{document}
```

Figure 2: TeXworks screenshot of document with sections.

- Click on the **Typeset** button and check the PDF.

## 1.5 Labelling

You can label any of the sectioning commands so they can be referred to in other parts of the document. Label the section with `\label{labelname}`. Then type `\ref{labelname}` or `\pageref{labelname}`, when you want to refer to the section or page number of the label.

- Type `\label{sec1}` on a new line directly below `\subsection{Stage 1}`.



- Type `\ref{sec1}` on page `\pageref{sec1}` in the **Results** section.

Your document should now look like figure 3.

```
1 \documentclass[a4paper,12pt]{article}
2
3 \begin{document}
4
5 \title{My First Document}
6 \author{My Name}
7 \date{\today}
8 \maketitle
9
10 \section{Introduction}
11 This is the introduction.
12
13 \section{Methods}
14
15 \subsection{Stage 1}
16 \label{sec1}
17 The first part of the methods.
18
19 \subsection{Stage 2}
20 The second part of the methods.
21
22 \section{Results}
23 Here are my results. Referring to section \ref{sec1} on page \pageref{sec1}
24
25 \end{document}
```

Figure 3: TeXworks screenshot of document with labels.

- Click on the **Typeset** button and check the PDF. You may need to typeset the document twice before the references appear in the PDF.

## 1.6 Table of Contents

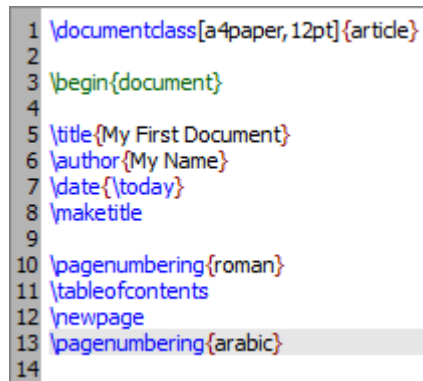
If you use sectioning commands it is very easy to generate a table of contents. Type `\tableofcontents` where you want the table of contents to appear in your document — often directly after the title page.

You may also want to change the page numbering so that roman numerals (i, ii, iii) are used for pages before the main document starts. This will also ensure that the main document starts on page 1. Page numbering can be switched between arabic and roman using `\pagenumbering{...}`.

➤ Type the following on a new line below `\maketitle`:

```
\pagenumbering{roman}  
\tableofcontents  
\newpage  
\pagenumbering{arabic}
```

The `\newpage` command inserts a page break so that we can see the effect of the page numbering commands. The first 14 lines of code should now look like figure 4.



```
1 \documentclass[a4paper,12pt]{article}  
2  
3 \begin{document}  
4  
5 \title{My First Document}  
6 \author{My Name}  
7 \date{\today}  
8 \maketitle  
9  
10 \pagenumbering{roman}  
11 \tableofcontents  
12 \newpage  
13 \pagenumbering{arabic}  
14
```

Figure 4: TeXworks screenshot of document showing table of contents command.

➤ Click on the **Typeset** button and check the PDF.

## Checkpoint 1

When all the tasks are done, show your final tex file and pdf file to your instructor.

## Practical 2: Typesetting Text

- Change your previous practical .tex file's **article** document class into **report**. Arrange each practical title as chapter title, such as:

```
\chapter*{Practical 1: Document Structure}  
\chapter*{Practical 2: Typesetting Text}
```

Note that, here `\chapter` creates numbered chapter title and `\chapter*` creates unnumbered chapter title. The unnumbered chapter will create two issues. Firstly, the section and subsection number of the chapter will start with prefix 0; such as 0.1, 0.2 etc. Secondly, chapter title will not be visible in the table of contents. To solve the first issue, increment the Chapter number first.

- Type `\setcounter{chapter}{1}` on the line before `\begin{document}`.

To solve the second issue, use the `\addcontentsline` command.

- Type `\addcontentsline{toc}{chapter}{Chapter title}` just before the `\chapter*{Chapter title}`.

### 2.1 Font Effects

There are  $\text{\LaTeX}$  commands for a variety of font effects:

<code>\textit{words in italics}</code>	<i>words in italics</i>
<code>\textsl{words slanted}</code>	<i>words slanted</i>
<code>\textsc{words in smallcaps}</code>	WORDS IN SMALLCAPS
<code>\textbf{words in bold}</code>	<b>words in bold</b>
<code>\texttt{words in teletype}</code>	words in teletype
<code>\textsf{sans serif words}</code>	sans serif words
<code>\textrm{roman words}</code>	roman words
<code>\underline{underlined words}</code>	<u>underlined words</u>

- Add some more text to your document and experiment with different text effects.

## 2.2 Coloured Text

To put coloured text in your document you need to use a **package**. There are many packages that can be used with L<sup>A</sup>T<sub>E</sub>X to enhance its functionality. Packages are included in the **preamble** (i.e. before the `\begin{document}` command). Packages are activated using the `\usepackage[options]{package}` command, where **package** is the name of the package and **options** is an optional list of keywords that trigger special features in the package.

The basic colour names that `\usepackage{color}` knows about are black, red, green, blue, cyan, magenta, yellow and white:

Red, green, blue, cyan, magenta, yellow and white.

The following code to produces coloured text:

```
{\color{colour_name}text}
```

Where `colour_name` is the name of the colour you want, and `text` is the text you want to be coloured.

- Type `\usepackage{color}` on the line before `\begin{document}`.
- Type `{\color{red}fire}` in your document.
- Click on the **Typeset** button and check the PDF.

The word ‘fire’ should appear in red.

It is possible to add options that allow `\usepackage{color}` to understand more colour names, and even to define your own colours. It is also possible to change the background colour of text (as for white and yellow in the example above), but this is beyond the scope of this workbook. If you want more information about see the Colors chapter in the L<sup>A</sup>T<sub>E</sub>X Wikibook<sup>2</sup>.

## 2.3 Font Sizes

There are L<sup>A</sup>T<sub>E</sub>X commands for a range of font sizes:

<code>{\tiny tiny words}</code>	tiny words
<code>{\scriptsize scriptsize words}</code>	scriptsize words
<code>{\footnotesize footnotesize words}</code>	footnotesize words
<code>{\small small words}</code>	small words
<code>{\normalsize normalsize words}</code>	normalsize words
<code>{\large large words}</code>	large words
<code>{\Large Large words}</code>	Large words
<code>{\LARGE LARGE words}</code>	LARGE words
<code>{\huge huge words}</code>	huge words

- Experiment with different font sizes in your document.

## 2.4 Lists

L<sup>A</sup>T<sub>E</sub>X supports two types of lists: **enumerate** produces numbered lists, while **itemize** is for bulleted lists. Each list item is defined by `\item`. Lists can be nested to produce sub-lists.

- Type the following to produce a numbered list with a bulleted sub-list:

```
\begin{enumerate}
\item First thing
\item Second thing
```

---

<sup>2</sup><http://en.wikibooks.org/wiki/LaTeX/Colors>

```

\begin{itemize}
\item A sub-thing
\item Another sub-thing
\end{itemize}
\item Third thing
\end{enumerate}

```

➤ Click on the **Typeset** button and check the PDF.

The list should look like this:

1. First thing
2. Second thing
  - A sub-thing
  - Another sub-thing
3. Third thing

It is easy to change the bullet symbol using square brackets after the `\item`, for example, `\item[-]` will give a dash as the bullet. You can even use words as bullets, for example, `\item[One]`.

The following code:

```

\begin{itemize}
\item[-] First thing
\item[+] Second thing
\begin{itemize}
\item[Fish] A sub-thing
\item[Plants] Another sub-thing
\end{itemize}
\item[Q] Third thing
\end{itemize}

```

Produces:

- First thing
- + Second thing
  - Fish A sub-thing
  - Plants Another sub-thing
- Q Third thing

## 2.5 Comments & Spacing

Comments are created using `%`. When  $\text{\LaTeX}$  encounters a `%` character while processing a `.tex` file, it ignores the rest of the line (until the **[Return]** key has been pressed to start a new line — not to be confused with line wrapping in your editor). This can be used to write notes in the input file which will not show up in the printed version.

The following code:

```
Believe that life is worth living% Note comic irony
in the very first sentence
, and your belief will help create the fact.
```

Produces:

Believe that life is worth living, and your belief will help create  
the fact.

Multiple consecutive spaces in  $\text{\LaTeX}$  are treated as a single space. Several empty lines are treated as one empty line. The main function of an empty line in  $\text{\LaTeX}$  is to start a new paragraph. In general,  $\text{\LaTeX}$  ignores blank lines and other empty space in the `.tex` file. Two backslashes (`\`) can be used to start a new line.

➤ Experiment with putting comments and blank lines in to your document.

If you want to add blank space into your document use the `\vspace{...}` command. This will add blank vertical space of a height specified in typographical points (pt). For example, `\vspace{12pt}` will add space equivalent to the height of a 12pt font.

## 2.6 Special Characters

The following symbols are reserved characters which have a special meaning in  $\text{\LaTeX}$ :

`#`   `$`   `%`   `^`   `&`   `_`   `{`   `}`   `~`   `\`

All of these apart from the backslash `\` can be inserted as characters in your document by adding a prefix backslash:

`\#` `\$` `\%` `\^{}`  `\&` `\_`  `\{` `\}` `\~{}`

Note that you need to type a pair of curly brackets `{}` after the hat `^` and tilde `~`, otherwise these will appear as accents over the following character. For example, `"\^ e"` produces "ê".

The above code will produce:

`#` `$` `%` `^` `&` `_` `{` `}` `~`

The backslash character `\` can not be entered by adding a prefix backslash, `\\`, as this is used for line breaking. Use the `\textbackslash` command instead.

➤ Type code to produce the following sentence in your document:

Item #1A\642 costs \$8 & is sold at a ~10% profit.

## Checkpoint 2

When all the tasks are done, show your final tex file and pdf file to your instructor.



## Practical 3: Tables

The `tabular` command is used to typeset tables. By default,  $\text{\LaTeX}$  tables are drawn without horizontal and vertical lines — you need to specify if you want lines drawn.  $\text{\LaTeX}$  determines the width of the columns automatically.

This code starts a table:

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

Where the dots between the curly brackets are replaced by code defining the columns:

- `l` for a column of **left**-aligned text (letter *el*, *not* number one).
- `r` for a column of **right**-aligned text.
- `c` for a column of **centre**-aligned text.
- `|` for a vertical line.

For example, `{lll}` (i.e. left left left) will produce 3 columns of left-aligned text with no vertical lines, while `{|l|l|r|}` (i.e. |left|left|right|) will produce 3 columns — the first 2 are left-aligned, the third is right-aligned, and there are vertical lines around each column.

The table data follows the `\begin` command:

- `&` is placed between columns.
- `\\` is placed at the end of a row (to start a new one).
- `\hline` inserts a horizontal line.
- `\cline{1-2}` inserts a partial horizontal line between column 1 and column 2.

The command `\end{tabular}` finishes the table.

Examples of tabular code and the resulting tables:

```
\begin{tabular}{|l|l|l|}
Apples & Green & \\
Strawberries & Red & \\
Oranges & Orange & \\
\end{tabular}
```

Apples	Green
Strawberries	Red
Oranges	Orange

```
\begin{tabular}{rc}
Apples & Green \\
\hline
Strawberries & Red \\
\cline{1-1}
Oranges & Orange \\
\end{tabular}
```

Apples	Green
Strawberries	Red
Oranges	Orange

```
\begin{tabular}{|r|l|}
\hline
8 & here's \\
86 & stuff \\
\cline{2-2}
2008 & now \\
\hline
\hline
2008 & now \\
\hline
\hline
\end{tabular}
```

8	here's
86	stuff
2008	now

## List of Tables

If you use captions for the tables, it is very easy to generate a list of tables. Type `\listoftables` where you want the list of table to appear in your document - often directly after the Table of Contents.

- `\caption{...}` writes the caption of the table.
- `\label{...}` You can label the table so that it can be referred to in other parts of the document.

## Multi-column and multi-row cells

Rows and columns can be combined in a bigger cell. The example below is an example of the `\multicolumn` command to combine columns.

```
\begin{tabular}{|c|c|c|c|}
\hline
\multicolumn{4}{|c|}{Country List} \\
\hline
Country Name & ALPHA 2 Code & ALPHA 3 Code & Numeric Code \\
\hline
Afghanistan & AF & AFG & 004 \\
Albania & AL & ALB & 008 \\
Algeria & DZ & DZA & 012 \\
Angola & AO & AGO & 024 \\
\hline
\end{tabular}
```

Country List			
Country Name	ALPHA 2 Code	ALPHA 3 Code	Numeric Code
Afghanistan	AF	AFG	004
Albania	AL	ALB	008
Algeria	DZ	DZA	012
Angola	AO	AGO	024

## Checkpoint 3

➤ Write code to produce the following tables:

Item	Quantity	Price (\$)
Nails	500	0.34
Wooden boards	100	4.00
Bricks	240	11.50

City	Year		
	2006	2007	2008
London	45789	46551	51298
Berlin	34549	32543	29870
Paris	49835	51009	51970