

# Better typesetting with $\text{\LaTeX}$

A user's guide

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# Introduction

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# Who's who?

Who am I?

- 3rd year PhD student, MSP
- 4 years of  $\text{\LaTeX}$  experience

Who are you? (hopefully)

- Familiar with basics of  $\text{\LaTeX}$  already
- Interested in learning more thoroughly

# Plan

- Workshop runs until 1230
- 3 hours is too long for me to talk
- Teaching will be interspersed with activities
- Follow slides on your PC, many items are hyperlinked
- Need to stay until 1230 for Angela to scan cards for attendance

# Resources

- First point of call: [stack exchange](#)
- [The not so short introduction to L<sup>A</sup>T<sub>E</sub>X 2 \$\epsilon\$](#)
- [More Math into L<sup>A</sup>T<sub>E</sub>X 4th edition](#) (hard copies available at library)
- [CTAN](#): comprehensive T<sub>E</sub>X Archive Network
- You should be aware of: [official university guidelines](#)

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# Packages: a few favourites

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# `\usepackage{booktabs}`

What does it do?

Enhances default table.

Typical  $\text{\LaTeX}$  table:

Item		Price (\$)
Animal	Sold	
Gnat	per gram	13.65
	each	0.01
Gnu	stuffed	92.50
Emu	stuffed	33.33

**Table 1:** Default  $\text{\LaTeX}$  table.



# `\usepackage{booktabs}`

```
\begin{tabular}{|l|l|r|}
\hline
\multicolumn{2}{|c|}{Item} & \\\cline{1-2}
Animal & Sold & Price (\$) \\\hline
Gnat & per gram & 13.65 \\
& each & 0.01 \\
Gnu & stuffed & 92.50 \\
Emu & stuffed & 33.33 \\\hline
\end{tabular}
\caption{Default \LaTeX\ table.}
```

# `\usepackage{booktabs}`

Booktabs table:

Item		
Animal	Sold	Price (\$)
Gnat	per gram	13.65
	each	0.01
Gnu	stuffed	92.50
Emu	stuffed	33.33

**Table 2:** Booktabs improves table spacing.

# `\usepackage{booktabs}`

```
\begin{tabular}{llr}
\toprule
\multicolumn{2}{c}{Item} & \\\cmidrule{1-2}
Animal & Sold & Price (\$) \\\midrule
Gnat & per gram & 13.65 \\
& each & 0.01 \\
Gnu & stuffed & 92.50 \\
Emu & stuffed & 33.33 \\
\bottomrule
\end{tabular}
\caption{Booktabs improves table spacing.}
```

# `\usepackage{pgfplotstable}`

## What does it do?

Reads data from input (e.g. a `.csv` file) and generates code for tabular. Can round numbers to desired precision and print in different formatting styles.

Element ,	Number ,	Mass
H ,	1 ,	1.00794
He ,	2 ,	4.00260
Li ,	3 ,	6.94100
Be ,	4 ,	9.01218

# `\usepackage{pgfplotstable}`

pgfplotstable:

Element	Atomic	
	Number	Mass
H	1	1.00794
He	2	4.00260
Li	3	6.94100
Be	4	9.01218

**Table 3:** pgfplotstable can read input files.

# `\usepackage{pgfplotstable}`

```
\pgfplotstabletypeset[col sep=comma,  
string type,
```

```
every head row/.style={  
  before row={\toprule  
              & \multicolumn{2}{c}{Atomic}  
              \\ \cmidrule{2-3}},  
  after row={\midrule}},
```

```
every last row/.style={after row=\bottomrule}  
]{elements.csv}  
\caption{pgfplotstable can read input files.}
```

# `\usepackage{pgfplotstable}`

pgfplotstable can format numbers as desired:

Element	Atomic	
	Number	Mass
H	1	1.008
He	2	4.003
Li	3	6.941
Be	4	9.012

**Table 4:** pgfplotstable understands precision and rounding.

# `\usepackage{pgfplotstable}`

```
\pgfplotstabletypeset[col sep=comma,  
columns/Number/.style={string type},  
columns/Element/.style={string type},  
columns/Mass/.style={fixed zerofill,  
precision=3},  
:  
: (As in earlier example)  
:
```

```
\caption{pgfplotstable understands precision  
and rounding.}
```



## Even *more* table generators

In addition to `pgfplotstable` there are various other table generators:

- `xtable` (R users)
- `pandas.DataFrame.to_latex` (Python users)
- `Excel2LATEX` (Excel users)

# `\usepackage{cleveref}`

What does it do?

Formats cross-references automatically

See Figure 1.



Figure 1: T<sub>E</sub>X the Lion.

# `\usepackage{cleveref}`

```
% Reference as Figure 1, instead of fig. 1  
\usepackage[capitalise,noabbrev]{cleveref}  
See \cref{fig:lion}.
```

```
\begin{figure}  
  \centering  
  \includegraphics[width=0.4\textwidth]{Lion.png}  
  \caption{\TeX the Lion.}  
  \label{fig:lion}  
\end{figure}
```

# A few others

- hyperref
- tikz
- standalone
- fancyhdr
- multirow
- ifdraft
- titlesec
- microtype
- natbib
- biblatex
- geometry
- todonotes

# Activity / break

Here we take a 10 minute activity break

- Look through master's thesis or publication and see what you could improve with these new packages
- Investigate hyperlinked packages
- Ask me questions

# Custom commands

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# Macros

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Used to simplify repetitive and/or complex formatting

```
\newcommand{\name}[# of parameters]{definition}
```

# Simple commands

The set of real numbers are usually represented by a blackboard capital r:  $\mathbb{R}$ .

```
\newcommand{\R}{\mathbb{R}}
```

The set of real numbers are usually represented by a blackboard capital r:  $\$R\$$ .



# Commands with parameters

Other numerical systems have similar notations. The complex numbers  $\mathbb{C}$ , the rational numbers  $\mathbb{Q}$  and the integer numbers  $\mathbb{Z}$ .

```
\newcommand{\bb}[1]{\mathbb{#1}}
```

Other numerical systems have similar notations. The complex numbers  $\mathbb{C}$ , the rational numbers  $\mathbb{Q}$  and the integer numbers  $\mathbb{Z}$ .

## Commands with optional parameters

```
\newcommand{\name}[# params][default #1]{def.}
```

We make a new command to save time writing expressions of the form  $(x + y)^2$  and  $(a + b)^4$ .

```
\newcommand{\plusbinomial}[3][2]{(#2 + #3)^#1}
```

We make a new command to save time writing expressions of the form  $\$ \backslash plusbinomial\{x\}\{y\}\$$  and  $\$ \backslash plusbinomial[4]\{a\}\{b\}\$$ .

# Managing a bibliography

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**Bibtex** can be used to manage bibliographies. (**Biblatex** is a more sophisticated alternative.)

- Bibtex entries stored in a **.bib** file
- Recommend maintaining a single centralised **.bib** file for duration of thesis.

# Bibtex

A list of entry types which Bibtex understands can be [found here](#).

```
@book{knuth84,  
  title="The texbook",  
  author="{Donald Ervin} Knuth and Duane Bibby",  
  volume="3",  
  year="1984",  
  publisher="Addison-Wesley Reading"  
}
```

# Bibtex

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Reference as `\cite{knuth84}`.

Include bibliography with

```
\bibliography{references}
```

```
\bibliographystyle{plain}
```

## `\usepackage{natbib}`

- `natbib` can be used to implement author-year citations.
- Introduces commands `\citep` and `\citet`, to cite in parenthesis or text.
- `\citep*` and `\citet*` print full author list
- Multiple citations can be made as `\citep{paper1, paper2}`

# Bibtex

BibTeX adds extra complexity to the processing of your manuscript. You will have to run  $\LaTeX$  a number of times.

1. `pdflatex thesis.tex`
2. `bibtex thesis.aux`
3. `pdflatex thesis.tex`
4. `pdflatex thesis.tex`

May create a Makefile to simplify compilation. I'd recommend using `latexmk`.



Google scholar can be used to export citations easily.

The screenshot shows the Google Scholar interface with the search term "the textbook". The search results are sorted by relevance. A red circle highlights the citation icon for the first result. The interface includes a search bar, navigation links, and a list of search results with various icons and links.

Articles About 15,500 results (0.07 sec) My profile My library

Any time Since 2018 Since 2017 Since 2014 Custom range...

Sort by relevance Sort by date

include patents  include citations  Create alert

Did you mean: [the textbook](#)

**[book] The textbook** [PDF] [tug.org](#)

DE Knuth, D Bibby - 1984 - [tug.org](#)  
The Opmac package [1] is a set of plain TEX macros which implements the basic LATEX functionality in a simple way. The Opmac-bib module is part of OP-mac. It provides the " bib manipulation without any external program (such as BibTEX [2] or biber [3]). This allows you ...  
☆ Cited by 2510 Related articles All 108 versions

[CITATION] **The TEXbook**, volume A of Computers and typesetting  
DE Knuth - 1984 - Addison-Wesley, Reading ...  
☆ Cited by 251 Related articles

[CITATION] **The TEXbook** (Computers & Typesetting Volume A)  
DE Knuth - 1986 - Addison-Wesley, Reading ...  
☆ Cited by 141 Related articles

[CITATION] **The PICTEX manual**  
MJ Wichura - 1987 - TEX Users Group  
☆ Cited by 36 Related articles

[CITATION] Computer & Typesetting A: **The TEXbook**  
DE Knuth - 1994 - Addison Wesley  
☆ Cited by 13 Related articles

[CITATION] **The TEXbook** (1989)  
DE Knuth - Addison-Wesley, Reading ...  
☆ Cited by 9 Related articles

**The cultural landscape**  
JM Rubenstein - Upper Saddle River, NJ. Book, 2011 - [qacps.org](#)  
... . Cite examples of universal design for learning (UDL) features. **The textbook** has multiple means of engagement. Each chapter begins with a case study that focuses on current events that will

Google scholar can be used to export citations easily.

The screenshot shows the Google Scholar interface. The search bar contains "the textbook" and the search button is a magnifying glass icon. The page title is "Articles" and it shows "About 15,500 results (0.07 sec)". There are links for "My profile" and "My library".

On the left side, there are filters for "Any time" (with sub-options: "Since 2018", "Since 2017", "Since 2014", "Custom range...") and "Sort by relevance" (with sub-option: "Sort by date"). There are also checkboxes for "include patents" and "include citations", and a "Create alert" button.

The search results list several entries, including "[BOOK] The DE Knuth, D...", "[CITATION] The DE Knuth - 1...", "[CITATION] The DE Knuth - 1...", "[CITATION] The MJ Wichura -", "[CITATION] The DE Knuth - 1...", and "[CITATION] The DE Knuth - 1...".

A "Cite" dialog box is open over the first result. It has a title bar "Cite" and a close button "X". It lists citation styles: "MLA", "APA", "Chicago", "Harvard", and "Vancouver". Each style shows the citation text for "Knuth, Donald Ervin, and Duane Bibby. *The textbook*. Vol. 3. Reading: Addison-Wesley, 1984." The "BibTeX" option is circled in red. Below the styles are links for "BibTeX", "EndNote", "RefMan", and "RefWorks".

There is a link "[PDF] tug.org" to the right of the dialog box.

# Activity / break

Here we take a 10 minute activity break

- Look through master's thesis or publication and see if macros could make your life easier
- Set up a central `.bib` file which you will use for your entire PhD
- Ask me questions

# Working with large documents

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# Structure

A modular structure makes it easier to work with and organise large documents.

```
thesis/  
├── thesis.tex  
├── chapters  
│   ├── chapter_1.tex  
│   ├── chapter_2.tex  
│   └── chapter_3.tex  
├── inputs  
│   ├── preamble.sty  
│   └── bibtex_style.bst  
└── references.bib
```

```
\documentclass[12 pt]{report}
\usepackage{inputs/preamble}
\begin{document}

\include{chapters/chapter_1}
\include{chapters/chapter_2}
\include{chapters/chapter_3}

\bibliography{references}
\bibliographystyle{inputs/bibtex_style}
\end{document}
```

## Other files

**chapters/chapter\_1.tex**

```
\chapter{Literature review}
```

```
\label{cha:lit_review}
```

```
There is a large body of literature \ldots
```

**inputs/preamble.sty**

```
% Preamble, packages, commands etc.
```

```
\usepackage{amsfonts}
```

```
\usepackage{amssymb}
```

```
\usepackage{amsthm}
```

# Compile a single chapter

`\includeonly` allows the compilation of a single chapter, without messing up references.

```
\documentclass[12pt]{report}
\usepackage{inputs/preamble}
\includeonly{chapters/chapter_2}
\begin{document}
```

```
\include{chapters/chapter_1}
\include{chapters/chapter_2}
\include{chapters/chapter_3}
⋮
```



- A thesis template (msthesis) for the school can be found [on the wiki](#)
- The template is modular and has a structure similar to that highlighted earlier
- Includes extras such as spell check and makefile

# Version control

- Version control allows you to track and manage changes in code, and collaborate with others
- Consider using version control to manage thesis
- Sophie Harbrisher (3rd year MSP) and I will be teaching a faculty workshop on version control with git and github

# Spell checking

Spell checking `.tex` files is complicated by latex commands.

For command line users I'd recommend `aspell` (or `ispell` or `hunspell`). Interactive mode:

```
$ aspell -t -c chapters/chapter1.tex
```

Non interactive (list mistakes):

```
$ cat chapters/chapter1.tex | aspell list -t
```

Custom dictionary and commands to ignore can be added with `--add-extra-dicts` and `--conf`.

# Spell checking

Some IDEs have inbuilt spell checkers:

- **Texmaker** (checks contents of commands still)
- **Texstudio** (seems best)
- A good **list of editors** and their features

# Word count

For final submission you need to submit a word count.

Word count is complicated by latex commands.

For command line users i'd recommend `detex` and `wc`

```
$ detex -l -e equation , table thesis.tex | wc -w
```

# Word count

- **Online tool** (chapters counted one at a time)
- **Texmaker's** integrated pdf viewer has wordcount (right click pdf)
- **Texstudio** (tools → analyze text; chapters one at a time)

# Common mistakes

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# Binding room

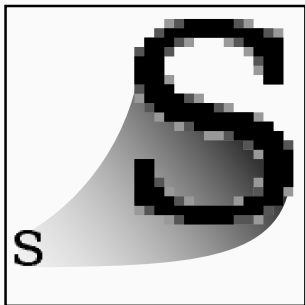
---

You must allow binding room on the inside margin.

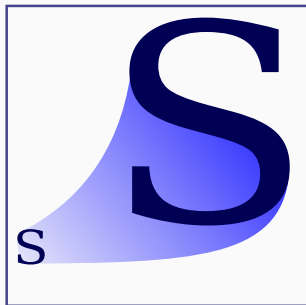


# Figures — image format

Use vector graphics where appropriate. (Recommend .pdf)



Raster  
.jpeg .gif .png



Vector  
.svg

# Figures — aspect ratio

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## Hyphen, en-dash and em-dash (-, —, —)

- The **hyphen** (–) is used to join words in a compound construction. “A long-term solution”
- An **en-dash** (—) appears in page ranges. “See pages 1–3”
- An **em-dash** (—) is typically used as a stand-in for a comma or parenthesis to separate out phrases. “Against all odds, Pete — the unluckiest man alive — won the lottery.”

# Quotes

$\LaTeX$  requires you to use separate markup for opening and closing quotes.

Opening quotes are “

Closing quotes are ”

Quotes should look “like this” not ”like this”.

# Capitalisation in BibTeX

Your BibTeX style will handle most capitalisation. For some words (names, places, ...) capitalisation must be ensured

```
@book{springer57,  
  title="Introduction to {R}iemann surfaces",  
  author="Springer, George",  
  volume="473",  
  year="1957",  
  publisher="Addison-Wesley Reading"  
}
```

# Typing maths

Brackets should be large enough to completely enclose all they contain.

$$\left(\sum_{i=1}^{n-1} i\right) + n$$

$$(\text{\color{orange}\sum}_{i=1}^{n-1} i) + n$$

$$\left(\sum_{i=1}^{n-1} i\right) + n$$

$$\text{\color{orange}\bigg}(\text{\color{orange}\sum}_{i=1}^{n-1} i \text{\color{orange}\bigg}) + n$$

# Typing maths

*a, b, c, d, e and f*

`$a, b, c, d, e \text{ and } f$`

*a, b, c, d, e and f*

`$a$, $b$, $c$, $d$, $e$ and $f$`

*i = 1, ..., 10*

`$i=1,...,10$`

*i = 1, ..., 10*

`$i=1,\ldots,10$`

*sin(x)<sup>2</sup> + cos(x)<sup>2</sup> = 1*

`$\sin(x)^2 + \cos(x)^2 = 1$`

*sin(x)<sup>2</sup> + cos(x)<sup>2</sup> = 1*

`$$\sin(x)^2 + \cos(x)^2=1$`

# Activity / break

Here we take our final 10 minute activity break

- Look through previous documents you've wrote for common mistakes
- MSP students: download and play around with thesis template (masthesis) [on the wiki](#)
- Ask me questions



# Conclusion

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# Perspective

Leslise Lamport, initial developer of  $\LaTeX$ , was asked what three  $\LaTeX$  mistakes people should stop making:

1. Worrying too much about formatting and not enough about content.
2. Worrying too much about formatting and not enough about content.
3. Worrying too much about formatting and not enough about content.

Source

# Feedback and the future

- Please (please) complete workshop evaluation
- First year running workshops aimed more at MSP students, any feedback would be very informative
- Look out for teaching opportunities if you would like to run a workshop for MSP students

# References



Donald Ervin Knuth and Duane Bibby.

***The texbook, volume 3.***

Addison-Wesley Reading, 1984.