AucklandThesis.cls

A LaTeX class for
University of Auckland
doctors' and masters' theses

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CONTENTS

GLOSSARY

blackletter A typeface category, derived from medieval European scripts as far back as the Carolingian period. Sometimes these are called 'Old English' but Old English was actually written in different scripts, long before blackletter was invented.

cap. Abbreviation for 'chapter', from Latin 'caput'.

doctor The highest degree conferred by British Commonwealth universities. 'Doctor' is the Latin word for 'teacher', so named because the original doctorates (established in 1213) were formal licenses to teach in a university. These were conferred in professional disciplines — medicine, law, theology. The modern research PhD (or DPhil) degree originates in the reorganisation of higher education in 19th-century Germany, spreading to the USA in 1861 and to the UK in 1921.

em A typographic unit of relative length, equal to the font size. Typographic spacing is commonly measured in multiples, halves, thirds, quarters and fifths of ems. For the font in use here, a 1-em square — called a 'quad' — is this big: ■

ex The width of the letter x, or something like that.

font A specification of typeface family, typestyle, and inter-baseline spacing. For example, "Times New Roman Italic 10/12" is at the 10-point size, with 2 points of interlinear spacing ("leading") added to achieve 12 points between successive baselines.

font size Specified in points (q.v.), and equal to the height of the metal pieces used for printing. Many typefaces do not fill the whole space available, many typefaces have small x-heights (q.v.), and some even overhang the type edge, so font size does not actually tell you the size of the text.

gothic Most people say 'gothic' to mean the 'blackletter' typeface category, which Renaissance people degraded by calling 'gothic', but palaeographers mean the script of the Gothic language, and typographers mean sans-serif typefaces built from clear geometric shapes from about 1900 onwards.

italic A typeface category: based on the handwriting of Renaissance Italy.

point A typographic unit of absolute length, subject to multiple definitions. The definition in LaTeX puts 72.27 points into one inch. The following lines are 8, 9, 10, 11, 12 pt high: ‖‖‖

ligature	Letters linked together. Spacing is difficult with certain letter pairs. For example, because f overhangs to the right in many typefaces, it leaves a distracting gap (which some word processors deal with by making it overlap clumsily with the next character — look closely at the fi pair). Ligatures merge pairs of characters into a single glyph to allow a smooth transition. The most common ligatures are for ff, fi, fl. You might also find a few others in some fonts, e.g. for cl, ffi, ffl, st.
pt	Abbreviation for 'point' (q.v.)
roman	A typeface category: based on the carved lettering of ancient Rome. The archetype is on Trajan's column.
rule	A typographic line. Its thickness is called *weight* and is typically measured in points.
thesis	An argument for or against an hypothesis. Metaphorically, a dissertation for degree examination. It is debatable whether a dissertation must include a thesis; thus theses may well be ironic.
x-height	A unit of length: the height of the letter x in a font.

Table 0.2: Typographic lengths. The points are absolute, but the ex and em are relative to the font. LaTeX also takes lengths in millimetres, centimetres, inches, picas, didôts, ciceros.

		height		
		1 pt	6 pt	1 ex	1 em
width	1 pt	.	ı	ı	|
	6 pt	–	■	■	▮
	1 ex	–	■	■	▮
	1 em	—	■	■	■

using the Auckland Thesis class

The aucklandthesis LaTeX class provides a simple, widely applicable infrastructure for typesetting University of Auckland theses. It meets the requirements in the School of Graduate Studies style guide, 2016.

The class (and this user guide) were written by Alistair Kwan in CLEaR, the Centre for Learning & Research in Higher Education. Dr Kwan has a multidisciplinary background so has endeavoured to design the class to accommodate multiple needs alike. Please do check that, as University regulations progress, the output generated by this class meets your needs. Updated class files may be issued from time to time.

You are encouraged to further adapt the class, or take it as an inspiration to write one of your own. There is one proviso: fiddling with formatting won't make your thesis go any faster.

1 Installation

If you can find your way around your hard drive, install the file, aucklandthesis.cls in a new folder called, texmf/tex/latex/aucklandthesis. You'll need to find the existing texmf directory branch first. On a Mac or Linux, this is likely to be ~/texmf. On Windows, somewhere in your user account directory. Running kpsewhich -var-value=TEXMFHOME at the command line is one way to find it.

If that doesn't make sense or if you need to carry the file around (e.g. if you're compiling on multiple computers), put aucklandthesis.cls somewhere more convenient, e.g. into the same folder as your thesis text.

The file template.tex is a starter that you can use to avoid setting up so much yourself.

There is more information later in this guide about .cls, .sty and .tex files.

2 Incipit: declaring the class and options

Every thesis written using this class begins as follows:

```
\documentclass[11pt]{aucklandthesis}
```

The 11pt can be changed to 10pt or 12pt for smaller or larger text, as needed. This parameter specifies the size of the body text; all other text — headings, footnotes, etc. — will be scaled to match. Several further options can also be specified in the square brackets:

examcopy	Adds examination confidentiality paragraph to the title page.
partial	For theses that *partially* fulfil degree requirements.
doublespace	Wider line spacing.
singlespace	Narrower line spacing (not acceptable for submission, but may be useful for drafts).
oneside	Single-sided printing. The default is double-sided.
draft	Adds a datestamp to the page footer, substitutes place-holder boxes for external graphics, marks overflowing lines with a black block in the margin.

3   OPTIONAL PACKAGES

Because the class has to cater for such a wide range of disciplinary needs, it in fact does very little. Many students will need to add LaTeX packages appropriate to their work, for example:

\usepackage[utf8]{inputenc} Allows you to work with files typed directly in Unicode characters. In other words, you can type accented Latin characters (needed in most European languages) instead of encoding them as compounds of accent plus letter, and Greek characters.

You can alternatively encode as compounds if you prefer (see Table 3.1, though you may need to \usepackage[T1]{fontenc} to make these work with certain fonts.

Cyrillic, Asian and other scripts usually require further packages and typefaces, such as the CJK and XeCJK packages for Chinese, Japanese and Korean text.

\usepackage{graphicx} allows you to insert graphics files. These could be scanned photographs, charts from Excel or MatLab, diagrams from Illustrator. The preferred formats are png, jpg and pdf.

\usepackage{appendix} allows you to add appendices with their own numbering sequence.

\usepackage{booktabs} provides good rules for tables.

\usepackage{microtype} improves justification.

\usepackage{tikz} for drawing diagrams. TikZ has various extensions for drawing electrical circuitry, tree diagrams, organic chemistry, ...

\usepackage{tipa} for the International Phonetic Alphabet.

4   CHANGING THE TYPEFACE

The default typeface in LaTeX is well known in mathematical disciplines, but a bit unusual elsewhere. Table 1.1 lists some packages available for switching to other typefaces. Note that LaTeX typically runs with four typefaces at a time — serif, sans-serif, mathematics, and typewriter. Some packages set just one of these; some set more. Some advanced users combine elements from multiple typefaces, e.g. a particular run of Greek letters for mathematical use, if italic v and Greek ν look too similar, or a cobbling-together of many glyphs from multiple typefaces to transcribe idiosyncratic manuscripts.

In general, typefaces are very difficult to install in LaTeX, but a recent variant, called XeLaTeX, makes typeface selection much easier. With XeLaTeX and files saved using the

Table 1.1: Some typeface options that don't require LuaTeX or XeLaTeX.

Package	Typeface
Serif	
\usepackage{BaskervaldX}	Baskervald, like Baskerville.
\usepackage{fourier}	Fourier, including mathematics.
\usepackage{gentium}	Gentium, strong multilingual.
\usepackage{libertine}	Libertine, strong multilingual, with serif Biolinum.
\usepackage{mathpazo}	Palatino, including mathematics.
\usepackage{mathptmx}	Times New Roman, including mathematics.
Sans-serif	
\usepackage{AlegreyaSans}	Alegreya.
\usepackage{avant}	URW Gothic, like Avant Garde.
\usepackage[scaled]{helvet}	Nimbus, like Helvetica.
\usepackage{PTSansNarrow}	PT Sans Narrow.
Mathematics	
\usepackage{eulervm}	Euler.
\usepackage[baskervaldx]{newtxmath}	Baskervald, a Baskerville variant.
\usepackage[libertine]{newtxmath}	Libertine.
\usepackage[utopia]{newtxmath}	Utopia.
Typewriter	
\usepackage{AnonymousPro}	Anonymous Pro.
\usepackage[scaled]{beramono}	Bera Mono.
\usepackage{inconsolata}	Inconsolata.
\usepackage{sourcecodepro}	Source Code Pro.

Unicode system (menu options might read 'UTF-8' or 'UTF-16'), you can use nearly any font file on your computer, and type directly in multiple languages including Chinese, Japanese, Hebrew, Greek, Egyptian, Old English, Arabic. Māori macrons are no problem at all. Nor are Medieval European scripts, using the Junicode font, which was developed to work with XeLaTeX. Junicode also covers Sanskrit, the IPA, and a generous handful of fleurons.

XeLaTeX is still in a relatively early stage of development, however, so it has not been selected as the default compiler for the Auckland Thesis class. If you want to use it, you will have to select it yourself.

If you need only a few of the less common symbols, for example in a thesis on linguistics, electronics, astrology, music or alchemy, see the Comprehensive LaTeX Symbol List at https://http://www.ctan.org/pkg/comprehensive

5   DECLARING DEGREE INTENTIONS

\title{} The thesis title.

\author{} Your name, in its full legal format.

Many students include postnominal degree abbreviations though, if your thesis passes, these will be outdated. There are strict abbreviation protocols — one from each of Oxford and Cambridge in widespread international use, another from the Association of Commonwealth Universities, plus Auckland's own system for internally produced documents, and more. Your thesis is a submission for examination, not a University-produced document, so choose for yourself which system to follow. Someone is sure to let you know if you pick the wrong one.

\degreesought{} Most likely 'Doctor of Philosophy', 'Master of Arts', 'Master of Science' or 'Master of Professional Studies' written out in full, but this class accommodates also other doctors', masters' and bachelors' degrees with honours. It does not accommodate certificates or diplomas. Copy the degree name from the University Calendar.

\degreediscipline{} The title page specifies the discipline (subject area), not the department (or institute or school). Copy the discipline name from the Calendar.

\degreecompletionyear{} Enter here the year in which you complete all requirements for admission to the degree. (You may submit years before completing requirements, and your graduation year could be after completing requirements, presuming that you choose to graduate at all.)

6   TITLE PAGE

The title page (see Figure 1.1) is composed using the command, \maketitlepage.

7   TABLE OF CONTENTS

The level of detail is set using the \settocdepth{} command.

> chapter lists chapters only,
>
> section lists chapters and sections,
>
> subsection lists chapters, sections and subsections,
>
> and so on.

Lists of figures and tables are optional.

8   INCORPORATING THESIS CONTENT

It is easier to manage your thesis if all of your lengthy content elements are saved in separate files: one for each of the abstract, each chapter, each appendix.

1. Abstract. Begin the file with the command, \chapter*{Abstract} The asterisk prevents the heading from being numbered or entered into the table of contents. If you want it in the table of contents, do it like this:

   ```
   \chapter*{Abstract}
   \addcontentsline{toc}{chapter}{Abstract}
   ```

   The argument toc in there stands for 'Table of Contents'. You can also add unnumbered entries at the section or subsection levels by switching out 'chapter'.

One fish, two fish
Red fish, blue fish

*a piscine hermeneutics
by Seussian enumeration*

Ivana Paßnau-Plies

A thesis submitted in fulfilment of the requirements for the degree of
Doctor of Letters in Hermeneutic Studies,
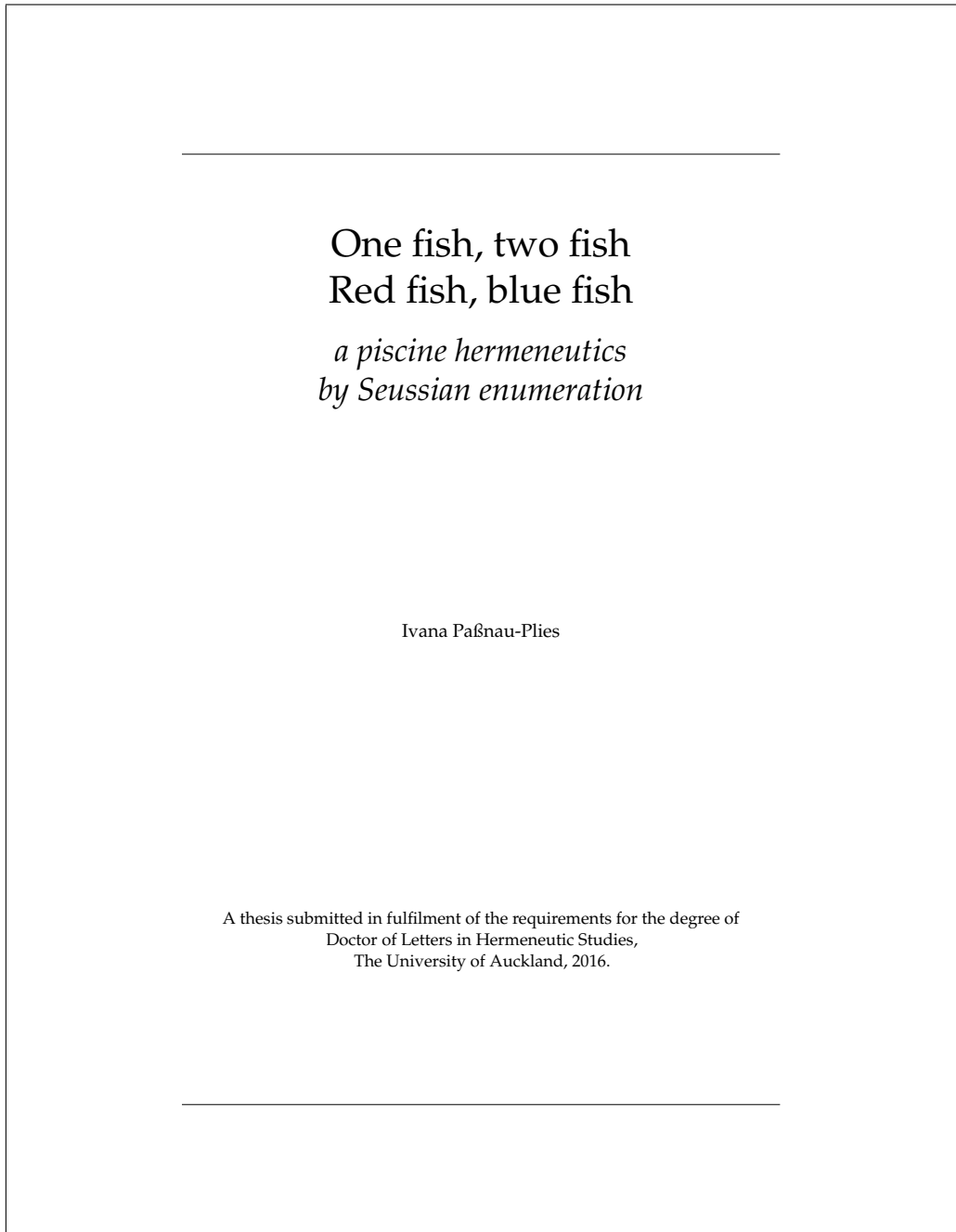The University of Auckland, 2016.

Figure 1.1: A title page.

2. Dedication. The dedication is usually very short, so there is a command for entering it directly into your master document rather than as an external file: `\thesisdedication{}`

3. Acknowledgements. Your supervisors are not listed on the title page on the understanding that they did not write your thesis for you, but you may mention them and their contribution here. You might also list librarians, archivists, laboratory technicians, other academics who supported you. Family members, pets and friends are often mentioned in acknowledgements, as are funding agencies.

   This section may also be titled 'Preface' or 'Preface and acknowledgements'. A preface would describe your rationale and perhaps broader motivations for writing this work. The rationale is sometimes personal, sometimes intellectual, and often both. In some disciplines, the preface is the only part of the thesis or book in which you can be completely open about what you are really doing.

4. Glossary. Begin with `\chapter*{Glossary}`.

5. Chapters. Each begins with the `\chapter{}` command. The headings automatically generate entries in the table of contents.

   Save each chapter in its own file, and use the `\input{}` command (or `\include{}`) to incorporate them.

   The `chapter`, `section`, `subsection`, etc. commands have up three parts:

   \chapter[*toc-title*][*header-title*]{*title*}

   If the actual *title* is long, optionally specify a shorter *toc-title* for the table of contents and page headers. If you want yet a different entry in the headers, specify that with the *header-title*.

   If you need to force a line break in a title, use the `\newline` command.

6. Appendices. The appendices are preceded by the command `\appendix` to get appendix-style headings and numbering when you start each appendix with the `\chapter{}` command. You must also reset the page counter to 1 at this point.

7. Bibliography.

9 UNIVERSITY FORMS

Further forms need to be obtained from the University for lodgement and to assert your copyright. This class does not provide those forms; ask at the School of Graduate Studies or look on the Doctoral Skills Program website hub.

10 MEMOIR INHERITANCES

Further documentation

At some point, most of us want to implement further customisation. *Some* people want things that lead to clashes between classes and packages. If you are one of *those* people, it will help to know that this class is based on the **Memoir** class, which provides many commands not available in the standard book class. There is a long, detailed manual for the Memoir class, available from CTAN (http://www.ctan.org/pkg/memoir)

Other page styles

The Memoir class includes a range of page styles that can break the monotony of seeing the same document over and over, and that may protect the short months of your candidacy from diversions into formatting. Changing typeface and layout from time to time on your drafts can make editing and proofreading more reliable.

If you need a break from the default layout, try these (more are listed in the *Memoir manual*):

- \chapterstyle{companion}

- \chapterstyle{bianchi}

- \chapterstyle{brotherton}

- \chapterstyle{chappell}

- \chapterstyle{dash}

- \chapterstyle{dowding}

- \chapterstyle{madsen}

- \chapterstyle{thatcher}

- \chapterstyle{veelo}

- \chapterstyle{verville}

For the style used in this user guide, \chapterstyle{Forder}. The Forder style, named after one of Auckland's first professors, numbers chapters and sections, but not smaller divisions. There's also another, named after Forder's colleague, Sewell.[1]

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[1]Future versions of this class may include refinements to the Forder and Sewell styles, and new styles. If you happen to write a style of your own (e.g. if you finish your thesis with a month to spare, or if you're waiting around for an examination), consider offering it for inclusion in future class revisions: contact alistair.kwan@auckland.ac.nz.

BEGINNING LaTeX

1   HOW TO LEARN LaTeX

Starting LaTeX can be hard. The learning curve is steep, and on top of LaTeX, you have to deal with an editor and a compiler as well (though many fluent users don't seem to know the difference, and it doesn't hold them back).

There are numerous tutorials on-line, including some interactive ones (see list below). The interactive tutorials take advantage of an important principle: that the most important way to become fluent in anything is to do it.

A web search for LaTeX tutorials provides a long, up-to-date list.

For active learning with an interactive system, you could try the following:

- https://www.sharelatex.com/learn

- http://www.tutorialspoint.com/online_latex_editor.php

For trying out mathematical constructs:

- http://arachnoid.com/latex/

- http://www.codecogs.com/latex/eqneditor.php

- http://www.hostmath.com/

2   GETTING HELP

The usual ways to find help are informal.

Around the University of Auckland

If you want to write in LaTeX, chances are that at least some of your colleagues are already doing it. Some disciplines (for example, mathematics, physics, electrical engineering) have a large population of LaTeX users who are only too willing to lend a hand. In other disciplines, LaTeX users may be rarer, but LaTeX can make a big difference in medieval studies (textual criticism and parallel translations), philosophy (logic notation), linguistics

(IPA and grammatical diagramming), and anything multilingual. You can often spot users by their handouts and slides.

It may be worth asking in your own department whether one of the LaTeX-fluent academics could run a workshop for a group of you.

There are also introductory workshops offered by Libraries and Learning Services. See https://www.library.auckland.ac.nz/workshops/ for schedules and to sign up.

Self-diagnosis

Isolate your problems by creating 'minimal working examples', the least amount of code possible that makes your problem happen.

Documentation

Nearly all packages come with a manual, nearly always in pdf format. Even if you do not understand the expert-pitched parts, you are likely to find out about package options that you'll want to try.

The web

Searching on an error message, or a how-to question, often surfaces what you need. If not, you can ask. There is a community associated with LaTeX, and a community attitude. One place to find it is at http://tex.stackexchange.com/ where, as your LaTeX skills develop, many would welcome your assistance. Another place is in the University's Yammer group at https://www.yammer.com/auckland.ac.nz, open to PhD students and staff. There are many LaTeX users on campus who are keen to see more students join the LaTeX culture.

3   RESOURCES

BibTeX editor and generator: http://truben.no/latex/bibtex/

CTAN, the Comprehensive TeX Archive Network, whence practically everything to do with LaTeX is downloaded: https://www.ctan.org

Detexify, for looking up the code for a symbol: http://detexify.kirelabs.org/classify.html

StackExchange: http://tex.stackexchange.com

Table generator: http://www.tablesgenerator.com

TeX showcase: https://www.tug.org/texshowcase/

Wikibooks LaTeX manual: https://en.wikibooks.org/wiki/LaTeX

4   HOW TO THINK LIKE A LATEX EXPERT

Perhaps there has been no study of how LaTeX experts think, but here is a guess at what you should do:

- Look for your own answers: on-line, in books about LaTeX.

- Ask questions on-line, in public: StackExchange, the University's Yammer site.

- Answer questions on-line, in public.

- Experiment.

- Embrace the opportunity to get things right — if this were a word processor, you might not have a choice.

- Practice top-down, structure-driven writing habits:

  1. Write your chapter titles first, and work them into a good order.
  2. Then write the section headings, and work them into a good order.
  3. Adjust chapter titles and order if needed.
  4. Make a separate file for each chapter.
  5. Write the content last. Many of us do this by writing the first sentence of each paragraph to develop the sequence of ideas, then go back to fill in the details afterwards.

- If it compiled a moment ago and won't compile now, delete the .aux, .bbl, .bcf and other service files created during compilation. Sometimes one of those will have an error in it, especially over networked drives. The university's network is not always consistent about letting LaTeX update the auxiliary files.

- Read the .log files generated during compilation.

- Be creative about word counts. Many LaTeX experts dismiss the possibility because there is no strong definition of what counts as a word — how do you count hyphenated and compound words, or equations? Do captions count? But some editors have a word count function, you can count the number of word-terminations in the resulting pdf, and you can produce an old-fashioned estimate by manually counting mean words per line and mean lines per page on a few representative pages, and multiplying by the number of pages.

- Focus on your writing, not your formatting. You can set formatting parameters, but leave the formatting details to LaTeX.

- When the text runs into the column, that's because LaTeX can't come up with anything better. This is a moment when you should think about formatting. Options include re-phrasing the text, allowing sloppy spacing parameters for that paragraph, adding more hyphenation possibilities (these are often essential in words that are already hyphenated), adjusting the line breaks. Occasionally, you might decide to leave it as it is.

5   WHAT SOFTWARE IS NEEDED?

Distributions

LaTeX is a language, not an application, and you have to choose and install a compiler to read your files and generate the final output. The compiler comes with other things — such as packages, editors, helper applications — that, together, comprise a *TeX distribution*.

TeXLive is produced by a substantial collaboration, and comes in variations for Unix, OS X, Windows. Linux typically has a TeX system installed already.

https://www.tug.org/texlive/

MacTeX is the Mac-specific version of TeXLive.

> https://www.tug.org/mactex/

MikTeX is a Windows TeX system, available in a range of sizes. The smallest size is a minimal system that installs packages when needed (presuming an Internet connection). The largest size includes all packages. There is a version that runs on a USB drive, good for use on institutional computers where security settings get in the way.

> http://miktex.org

ProTeXt is a full Integrated Development Environment (IDE, i.e. the editor and compiler are rolled together into an application). It is based on MikTeX, and hence for Windows only.

> https://www.tug.org/protext/

All of these distributions are free.

Editors

Distributions typically come with an integrated editor (or several), and there is always the old advice that all you need is Notepad, Textedit or Pico. Most of us prefer an editor more modern.

There are a lot of editors. Some provide a lot of buttons and helper prompts so you can search for things that you can't remember; others tend towards a minimalist interface that avoids distracting you from the writing process. Some of the more traditional editors, from the text-only era, are still going strong in the Unix world especially.

For work involving long footnotes, 'code-folding' can let you see your main text better without the footnotes (and citations, for that matter) getting in the way.

For a comparison, see https://en.wikipedia.org/wiki/Comparison_of_TeX_editors

You may also want a bibliography editor. Distributions typically include those, too.

Legibility and readability

LaTeX is often recommended as a way to produce beautiful text. Do not be misled by this recommendation: LaTeX's default typesetting is better than you will usually get from a word processor but not the best possible, and meeting the higher-level typographical aspirations requires a lot of careful tweaking that you should not prioritise (at least not without luxuriant funding and an extra six months of registration). The reason you should not do it is that your focus must be on content. Beautiful typesetting will not be your examiners' primary criterion. If you want a beautiful book, choose a good publisher later, one that specialises in 'fine press' work.

LaTeX is also commonly praised for producing readable, legible text. This matters because it gives your examiners better access to your content. They will be better able to engage with your ideas if poor typesetting does not get in their way. This can be especially the case for examiners with reading disabilities. For the same reasons, be conservative. Innovative, unconventional typography can be very satisfying from a creative standpoint, but every moment an examiner spends admiring, puzzling through, or battling to overcome your fonts and layout is a moment not admiring your argument.

WRITING YOUR THESIS IN LaTeX

1 CLASSES, STYLES AND DOCUMENTS

LaTeX involves three kinds of file:

Class files end with `.cls` and provide the overall infrastructure of document categories. There are classes for reports, articles, letters and more.

Style files end with `.sty` and provide extension services, mostly to do with formatting, but also for coding, drawing and so on. Most extensions are called 'packages,' and packaged in style files.

Document files end with `.tex`. These are where your writing goes.

2 COMMON COMMANDS

`\chapter{}` marks a new chapter. LaTeX handles the numbering automatically, as it also does for `\section{}`, `\subsection{}`, `\subsubsection{}`. For University of Auckland theses, avoid dividing any further than sub-subsections.

`\chapter*{}`, with an asterisk, produces an *un-numbered* heading at the same level as the chapter. It does not appear in the table of contents. You can similarly add an asterisk to the section, subsection and sub-subsection commands for un-numbered headings.

Long chapter and section names usually have a short form for the headers and table of contents. These are specified like this:

`\chapter[Northwards Ho!]{Northwards Ho! Our hero sails the Neckar and Rhein}`

If you need a different short name for the header, the notation is:

`\chapter[`*contents title*`][`*header title*`]{`*chapter title*`}`

`\emph{}` is the usual command for emphasing text by *italicisation.* You may see people using `\it{}` for italicisation, but `\emph{}` is better.

`\textbf{}` makes **boldface text**.

`\footnote{}` inserts footnotes. These are automatically numbered.

- inserts a hyphen: -

-- inserts an en dash: –

--- inserts an em dash: —

That is probably enough to get you started. If you read the source code for this chapter, you'll find examples of other commands as well.

3   MORE LANGUAGES

If you need to type just the occasional character from a non-English, Latin-alphabet language, there are a few options. One is to use the multilingual input capabilities of your computer.

Another is to use commands for diacritics and other marks, shown in Table 3.1.

There are a few characters in Irish, Middle English, Old English and Icelandic that are not so easy to get. Either load an extra package or type them directly.

4   INSERTING FIGURES AND TABLES

Figures and tables are inserted using the `figure` and `table` *environments*. These differ from the formatting commands listed above: the special thing about figures and tables is that they float around (and LaTeX experts call them 'floats'), and the LaTeX compiler finds the best place for them.

The figure environment that produced Figure 3.1:

```
\begin{figure}[tp]
      \includegraphics[width=\textwidth]{cassini-headpiece}
      \caption[Three observatories]{Three observatories
      in the headpiece of an article by Cassini
      \citep{AcadRoyale1693}.
      You could make some highly intellectual observation
      here using the words, `juxtaposition' and `suggests'
      and the passive voice.}
      \label{fig:observatories}
\end{figure}
```

Line by line, the code works like this:

`\begin{figure}[tp]` opens the environment for this figure. The `t` in `[tp]` says to put the figure at the top of a page if possible. If not possible, the `[p]` says put it on a page of its own.

`\includegraphics[width=\textwidth]{cassini-headpiece}` brings in a picture from a separate file. It's probably called cassini-headpiece.png or cassini-headpiece.jpg (the LaTeX compiler will work out which). It will be the full width of the column, and LaTeX will calculate its height to maintain the aspect ratio. You could set the width in points, ems, picas, centimetres, inches. You could alternatively set the picture's height. Or you could set both, which can be handy if you want to adjust its aspect ratio.

If you have numerous pictures, you will likely want to put them into a graphics folder of their own. You can include the folder name in the `includegraphics` command, or specify the graphics folder (or multiple graphics folders) using the `graphicspath` command.

Table 3.1: Diacritical marks and other non-English characters. Some of these (such as the breve, háček and cedilla) need a space between the diacritic command and the letter it's applied to. Some diacritics automatically remove the dot on the i and j; others need the dotless variant specified.
Note that 'guillemet' does indeed have to be misspelt 'guillemot'.

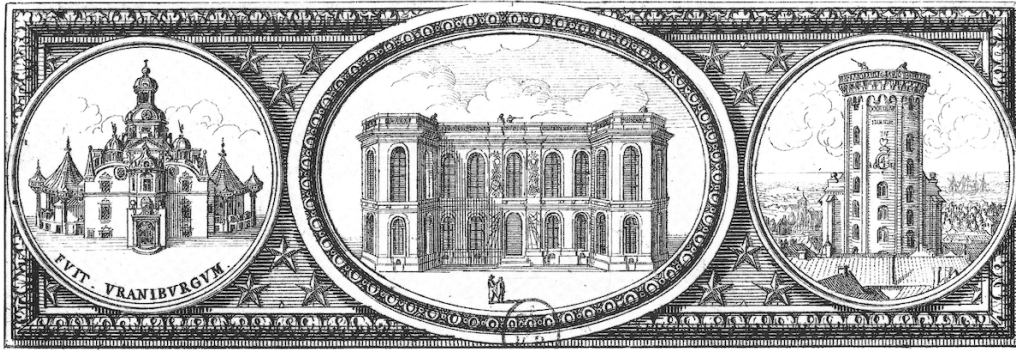| Mark	Notation	Examples
acute	\'	á é í ń
breve	\u	ă ĕ ĭ ň
cedilla	\c	á é í ń
circumflex	\^	â ê î ñ
dot over	\.	ȧ ḃ ċ ġ ṡ
dot under	\d	ạ ḅ ç g ṣ
double acute	\H	ã ĕ ĭ ń
grave	\`	à è ǹ ì
háček	\v c	ǎ b̌ č ǧ š
macron	\=	ā ē ī ō ū Ā Ē Ī Ō Ū
undotted i, j	\i \j	ı ȷ
umlaut, diaeresis, trema	\"	ä ë ï ñ
tilde	\~	ã ẽ ĩ õ ũ ñ ỹ
ogonek	\k	ą ḅ ç g ṣ
æ, Æ, œ, Œ	\aa \AA \aa \AA	Hwæt! L'œuf!
å, Å	\aa \AA	Ångström
ø, Ø	\o \O	Øresund, Samsø
ß	\ss	Straße, offenß
¡	\textexclamdown	
©	\textcopyright	
®	\textregistered	
£	\textsterling	
™	\texttrademark	
«	\guillemotleft	
»	\guillemotright	

Figure 3.1: Three observatories in the headpiece of an article by Cassini (Académie des Sciences, *Recueil d'observations*). You could make some highly intellectual observation here using the word, 'juxtaposition' and 'suggests' and the passive voice.

The \caption command has two parts. The bit in curly braces gets printed under the figure. This is too long for the table of figures, so the optional part in square brackets specifies what to use there.

\label{fig:observatories} gives you an anchor for cross-references. Wherever you need the figure number in the document, use \ref{fig:observatories}. The numbering automatically updates as needed. Many of us start figure labels with fig: to help us mentally keep track of the labels — and also tab:, eq:, ch:, sec: for labelling tables, equations, chapters, sections. You, however, can call them whatever you like. The LaTeX compiler doesn't care very much.

This is section 4, referred to as \ref{sec:figuresandtables}.

label commands come immediately after whatever *numbered* thing it is that they're labelling. In a figure or table, that's the caption — not the picture or the table.

\end{figure} completes the figure environment.

Notice that the figure caption comes below the picture. For tables, on the other hand, captions would go at the top, as the first command inside the table environment. So a table environment looks like the example below (rendered as Table 3.2):

```
\begin{table}[htp]
    \caption{Food for the horse.}
    \label{tab:horsefoods}
    \begin{center}
       \begin{tabular}{llc}
       \toprule
       Foodstuff & Colour & Quantity \\
       \midrule
       grass & green & 7 kg \\
       sugar & white & 2 cubes \\
       carrot & orange & 14 \\
       \bottomrule
       \end{tabular}
    \end{center}
\end{table}
```

There are two differences to note.

First, the table environment is positioned with [htp]. The first preference, indicated by h, means 'here'. If it can't go 'here', then it goes at the 'top' of a page. If it can't go at the top of a page, it goes on a page of its own.

Second, the table environment does not produce the table; it only ensures that the caption gets a table numbering and that the contents entry goes to the list of tables. The table itself is constructed using a **tabular** environment.

Here is the result:

Table 3.2: Food for the horse.

Foodstuff	Colour	Quantity
grass	green	7 kg
sugar	white	2 cubes
carrot	orange	14

5   EQUATIONS

LaTeX has a whole sub-language for describing mathematical notation. This code:

```
\begin{equation}
   -\frac{\hbar^2}{2m} \frac{\partial \psi}{\partial x} + V \psi
   = i \hbar \frac{\partial \psi}{\partial t}
   \label{eq:schrodinger}
\end{equation}
```

produces a favourite in physics:

$$-\frac{\hbar^2}{2m}\frac{\partial \psi}{\partial x} + V\psi = i\hbar\frac{\partial \psi}{\partial t} \tag{3.1}$$

and

```
\begin{equation}
   \mathbb{P}
   \left( \frac{X_1+\cdots+X_n}{\sqrt{n}}\le y \right)
   \to \mathfrak{N}(y)
   \coloneq
   \int_{-\infty}^y
   \frac{\mathrm{e}^{-t^2/2}}{\sqrt{2\pi}} \, \mathrm{d}t
   \; \textrm{as} \; n \to \infty
   \label{eq:centrallimittheorem}
\end{equation}
```

makes heartbeats skip among quantitative methods fans in the social sciences:

$$\mathbb{P}\left(\frac{X_1+\cdots+X_n}{\sqrt{n}} \le y\right) \to \mathfrak{N}(y) \coloneq \int_{-\infty}^y \frac{\mathrm{e}^{-t^2/2}}{\sqrt{2\pi}}\, \mathrm{d}t \text{ as } n \to \infty \tag{3.2}$$

The equation numbers at the right margin are automatic. You can prevent equation numbers from being added to mundane steps during derivations using the \nonumber command. The next example (that every PhD student will remember from high school) shows how to do this, and also how to align multiple equations on the equation sign:

```
\begin{align}
    ax^2 + bx + c &= 0 && \textrm{General quadratic}
        \label{eq:quadratic} \\
    x^2 + \frac{b}{a}x  &= -\frac{c}{a} && a \neq 0 \nonumber \\
    x^2 + \frac{b}{a}x  + \left(\frac{b}{2a}\right)^2
        &= - \frac{c}{a} + \left(\frac{b}{2a}\right)^2  \nonumber \\
    \left(x+\frac{b}{2a}\right)^2
        &= \frac{b^2-4ac}{4a^2} \nonumber \\
    x  &= - \frac{b}{2a} \pm \sqrt\frac{b^2-4ac}{4a^2} \nonumber \\
        &= \frac{-b \pm \sqrt{b^2-4ac}}{2a} && \textrm{Quadratic formula}
        \label{eq:quadraticformula}
\end{align}
```

$$ax^2 + bx + c = 0 \qquad\qquad \text{General quadratic} \qquad (3.3)$$

$$x^2 + \frac{b}{a}x = -\frac{c}{a} \qquad\qquad a \neq 0$$

$$x^2 + \frac{b}{a}x + \left(\frac{b}{2a}\right)^2 = -\frac{c}{a} + \left(\frac{b}{2a}\right)^2$$

$$\left(x + \frac{b}{2a}\right)^2 = \frac{b^2 - 4ac}{4a^2}$$

$$x = -\frac{b}{2a} \pm \sqrt{\frac{b^2 - 4ac}{4a^2}}$$

$$= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \qquad\qquad \text{Quadratic formula} \qquad (3.4)$$

The points marked & all line up. The && marker is used to align equations and comments.

The two named equations are also labelled in this case, so `Equation \ref{eq:quadratic}` and `Equation \ref{eq:quadraticformula}` produce "Equation 3.3" and "Equation 3.4".

Function and operator names are given by commands, so that readers perceive them as functions or operators rather than as the multiplication of many variables, viz. $cosx = c \times o \times s \times x$ vs $\cos x$.

$$\int_b^a \cos x \; dx = \sin a - \sin b + c \qquad (3.5)$$

Notice also that there's a big space between $\cos x$ and the dx making the integral easier to read at a glance than $\int \cos x dx$ (because $xdx = x^2d$). That space is specified using the command, \;. You can also make narrower spaces with \, or \. and a wider space with \:.

There are a few more such functions. Your niche function may not be listed in table 3.4, but can be improvised. For the Zut measure in bibliometric meta-analysis, for example, you could write `$\mathrm{Zut}_a(L^{0, r}_s)$` to make $\mathrm{Zut}_a(L_s^{0,r})$.

Table 3.3: Mathematical spacing commands. Some of these work outside math mode, too.

Space	Command
2 em	\qquad
1 em	\quad
3/18 em	\,
4/18 em	\:
5/18 em	\;

Table 3.4: Standard mathematical functions

sin	csc	sinh	arcsin	log	min	lim	arg	Pr
cos	sec	cosh	arccos	lg	inf	liminf	deg	gcd
tan	cot	tanh	arctan	ln	sup	limsup	dim	ker
		coth		exp	max		det	hom

If you need mathematical notation within your paragraphs instead of as stand-alone paragraphs, use dollar signs to invoke 'math mode' like this: $F = m \times a$.

The dollar sign always does that in LaTeX. If you need to write about all your $$$, put a backslash before: \$.

6 VERSE AND QUOTATIONS

LaTeX provides verse, quote and quotation environments. All three of these indent at both the left and the right.

```
\begin{verse}
L'autre jour, au fond d'un vallon \\
un serpent piqua Jean Fréron.

Que pensez-vous qu'il arriva? \\
Ce fut il serpent qui creva. \\

\hfill --- Voltaire.
\end{verse}
```

The double slash marks the end of a line, just as it does in the tabular environment. A blank line separates the stanzas.

The \hfill command fills out the line horizontally, pushing the poet's name to the far right. The result is as follows:

> L'autre jour, au fond d'un vallon
> un serpent piqua Jean Fréron.
>
> Que pensez-vous qu'il arriva?
> Ce fut il serpent qui creva.
>
> — Voltaire.

Try the quote and quotation environments yourself. I

7 CUSTOM CHARACTERS

Occasionally scholarship requires special characters, such as symbols for units of currency or weight, or astrological or alchemical signs. Many of these are provided by LaTeX packages (look for the *Comprehensive LaTeX Symbol List* at https://http://www.ctan.org/pkg/comprehensive). The most common present-day mathematical symbols are built-in.

Sometimes, you can improvise using math mode, raising and lowering glyphs, and overtyping with negative spaces. For example, to get an O with an asterisk inside (⊛), you can do this: `O\hspace{-0.55em}\raisebox{-0.15em}{*}`

If you use those things often, you can assign them to a command:

`\newcommand\ostar{O\hspace{-0.55em}\raisebox{-0.15em}{*}}`

Specify the distances in ems and exes to ensure that they scale correctly if you need them in other type sizes.

8 OVERHANGING TEXT

When text overhangs into the right margin, this is because it was too hard to justify. Wordprocessors just cram it in, or add gigantic spaces, and pretend that there was never a problem. LaTeX, on the other hand, admits its limitations and hands the problem back to you. There are three things you can do about it:

1. Alter the phrasing. Whether this is acceptable depends heavily on your discipline: readers who read closely, paying attention to prosody and semantic stress will be affected. Readers who skim, looking more at your figures than your words, might not notice.

2. Alter the hyphenation by specifying optional hyphenation points.

   Optional hyphenation points may be essential if the protrusion is due to a hyphenated word because LaTeX presumes that explicit hyphens are the only places where a hyphen is allowed.

   For example, the place-name `Sutton-under-Whitestonecliffe` will never be broken except at the hyphens, but you could give LaTeX more options by doing something like this: `Sut\-ton-un\-der-White\-stone\-cliffe`.

   If you think for long enough, you'll come up with examples of hyphenated compounds whose reading would be perverted if the optional hyphens were put into certain places. That's why LaTeX doesn't do it. LaTeX ain't no pervert.

   Hyphenation for proper names, jargon and other words can be specified in the preamble, like this:

   `\hyphenation{Bour-ba-ki Kep-le-ri-an Fou-caul-di-an}`

3. Temporarily (or entirely) change the spacing parameters with `\fussy`, `\midsloppy` or `\sloppy`. The *Memoir manual* explains what these do.

9 TYPOGRAPHIC MYSTERIES, REVEALED

Standard conventions

'Serious' books follow most or all of the following conventions:

- Odd pages are always on the right, even pages on the left.

- Chapters and the table of contents always start on odd pages.

- When the first lines of paragraphs are indented, an exception is made for the first paragraph after each heading.

- When paragraphs are marked by indenting a line, they are not spaced out. (LaTeX often breaks this rule.)

- No underlining.

- Tables have only horizontal rules, not vertical rules.

- Captions are above tables, and below figures.

Why are books paginated in roman numerals, then in arabic numerals?

In the old days of printing by hand, you could not write the table of contents until you knew which pages everything would be on. That had to wait until the text had been typeset by arranging little metal letters, one by one, page by page. So the text — the mainmatter — was done first. Afterwards, the frontmatter was typeset — a title page, the table of contents, and prefaces and dedications. The prefaces and dedications were also often left until the end in case political and financial imperatives necessitated a last-minute change. All of this required that the frontmatter be paginated separately. The French dealt with it differently, putting the table of contents at the end, often on the back cover.

The endmatter often has its own page numbering as well. Often the endmatter is done completely separately, for example as an advertising supplement.

Now that computers re-typeset and adjust the page numbers on the fly, it is no longer necessary to paginate the three parts separately. But many printers still do, because many readers still subconsciously anticipate the long-established norms.

Why two title pages?

Books usually have both a full title page and a short title page. The full page used to be what customers saw when browsing a book stall, back when books were sold without covers. Old title pages usually have a lot of content because they serve the same advertising pitch as today's dust jackets. The short title page is believed to date from back when books were stored flat on the shelf, with their spines facing the wall. The short title page was there to be torn out and folded over the fore-edge, providing a way to tell which book was which.

Why no underlining?

Western print has historically not been underlined, nor was handwriting under normal circumstances. Typesetters distinguished between different kinds of text by switching between italic, roman and blackletter fonts, just as people did in handwriting. In the English tradition, blackletter was for working-class topics like tradesmen's book-keeping methods, while upright roman was for educated topics like science and literature, and italics were for outbursts of Latin, French or Italian.

When marking-up a printed draft, underlining indicates where an italic font *should* be used in the final version. This convention was taken up in typewriting (not all typewriters had interchangeable typefaces), and has carried over into common use. Underlining proves invaluable to students whose handwriting does not distinguish between upright and slanted. But not in high-end print.

abcdefghijklmnopqrstuvwxyz

1 alphabet

abcdefghijklmnopqrstuvwxyzabcdefghijklmnopqrstuvwxyzabcdefghijklmnopqrstuvwxyz
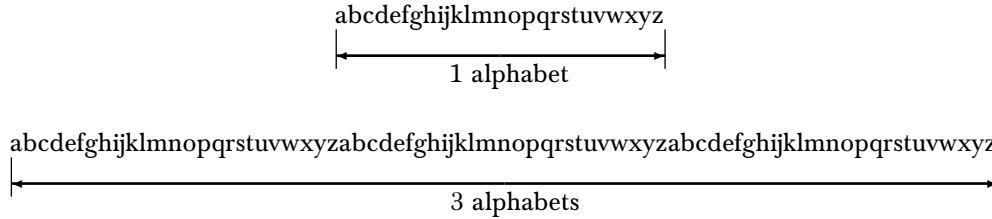
3 alphabets

Figure 3.2: The alphabet, a unit of length useful in book design. The alphabet depends on the font, and is shown here for the font used for this user guide's body text. A common recommendation, based on readability studies and historical design culture, is to set columns three to four alphabets wide.

Why not print all the way to the edges?

Printing to the edges would save paper. But there are a few reasons why wide lines make reading harder.

1. Returning the eye from the far right of the page to the far left involves more effort to land at the start of the next line, and the risk of hitting the wrong line increases as the line width increases.

2. Many readers make notes in the margin.

3. The bookbinders trim all sides of the paper, narrowing the margins, and perhaps cutting into your text if you went too close to the edge.

On the other hand, if the column is too narrow, there is much more jumping for the eyes to do, and it gets hard to justify the text evenly.

How wide is ideal? The rule of thumb is three to four 'alphabets', where an alphabet is the length taken by the lower-case alphabet, as shown in Figure 3.2. If the interlinear spacing (the 'leading', made in the old days from lead strips) is a bit wider, you can also increase the column width. Some typefaces need a narrower column width than others. Helvetica and Arial, for example, tend to be more readable in a narrower column, and to need more leading. The more conservative serif typefaces tend to tolerate wider columns.

In general, as you increase column width, increase the leading as well. Ensure that the space between lines is always conspicuously wider than the spaces between words, and that the spaces between words are always conspicuously wider than the spaces between adjacent letters.

Lead and leading

Printers speak of 'lead' as a metonym for metal type, which is made from lead. The lead is actually not just lead, but an antimony-rich lead alloy called 'type metal'. The antimony makes the alloy harder, and the alloy hardly shrinks when it sets. That is important for controlling the size of type, which was made by casting the liquid metal in copper-faced molds. We do not know how early printers came up with that alloy, nor if they did so deliberately. You can solve that problem for your next PhD.

Plates versus figures

Printers used to separate the slickest illustrations into a section of their own, and labelled them as 'plates' rather than figures. This is because they were printed using a different technology and had to be printed separately from the text. The first plates were engraved or etched into copper, and the prints from these, done on a high-pressure roller press, and often on a different kind of paper, came to be called 'plates' as well. The line figures printed in with the text were more typically woodcuts or wood engravings, though some books involved passing the paper through both presses, printing text in the gaps around the plates.

Engraved copper plates were supplanted by other technologies such as lithographs, which involve printing off a stone slab, and various metal plates roughened in all sorts of ways. With the new printing technologies came new kinds of paper to match them, which is why twentieth-century plates are usually on hard, glossy paper while seventeenth-century plates are on soft, matte paper. By the time these new technologies came in, the word, 'plate' was stuck.

BIBLIOGRAPHIES WITH BIBLATEX

Compiling a bibliography in LaTeX requires some investment, just as it would if you wrote your thesis using other tools. The demonstration here shows how to use a supplementary application called *BibLaTeX*. BibLaTeX offers considerable flexibility in automating the citation style, but here you will see only a beginning: BibLaTeX does much more than this. For example, BibLaTeX allows historians to separate published primary, unpublished primary, and secondary sources into three separate listings.

If your thesis involves only a short list of citations, and you don't need to cite very heavily, you could use the simpler features of BibTeX. Mathematics, science and engineering theses are commonly done with BibTeX, and commonly involve fewer than a hundred references. If you have only a few tens of references, LaTeX's in-built citation system may be enough. Its downside is that you will have to manually encode every reference. This may be bearable if you do not need to change citation systems later.

For further details about LaTeX's internal bibliography system, BibTeX and BibLaTeX, see https://en.wikibooks.org/wiki/LaTeX/Bibliography_Management

1 INFRASTRUCTURE

BibLaTeX needs a few things in your master document.

Preamble

In the preamble, add this:

```
\usepackage[
    style=authoryear,
    citestyle=authortitle,
    backend=biber
    ]
    {biblatex}

\addbibresource{kwan-bibliography}
```

The first command loads the BibLaTeX package with three options. It sets the bibliography style and the citation style. The style here sets the bibliography entries to be given and

Table 4.1: BibLaTeX citation commands.

Citing like this...	does this in 'authortitle':
`\cite{Bringhurst1999}`	Bringhurst, *Elements*
`\cite[12, 14--16]{Schmutz2006}`	Schmutz, "Juan Caramuel", pp. 12, 14–16
`\cite[chap. 3]{Lassels1698}`	Lassels, *Italian voyage*, chap. 3
`\cite[sec. 6]{Wren1669}`	Wren, "Engin for grinding hyperbolical glasses", sec. 6
`\parencite[72]{Bringhurst1999}`	(Bringhurst, *Elements*, p. 72)
`\Textcite[72]{Bringhurst1999}`	Bringhurst (*Elements*, p. 72)
`\cite{Bringhurst1999, Nielsen1968, Chambers1728}`	Bringhurst, *Elements*; Nielsen, "Ole Rømer"; Chambers, *Cyclopædia*

sorted by author, then year. The citations, however, will be by author and title (see section 2 below.) The 'back end', i.e. the engine that does database handling, is set to Biber, which handles multilingual work much better than BibTeX can. You probably don't need to know much more about Biber than that.[1]

The second command nominates your bibliography file (ending in *.bib*). You can name multiple files here, separating them with commas. This particular file contains a mixture of entries so you can see what a realistic *.bib* file might look like.

Endmatter

At the very end of your master file, where you want the bibliography to appear, add this:

`\printbibliography[title={Works cited}, heading=bibintoc]`

Those two options set the title (the default title is 'Bibliography'), and put an entry into the table of contents.

2   CITING OTHER PEOPLE'S WORK

Citing a work, a chapter or a page range

The main citation command is `\cite{}`. It comes in a few variants, shown in Table 4.1. The output shown depends on the citation style; the style used here is humanities-friendly 'authortitle'. Notice that an abbreviated title appears in the citation, while the reference list at the end of this document lists full titles.

Citing with style

BibLaTeX comes with a lot of in-built styles including the famously difficult style of the Chicago University Press. There are more that you can download, and you can make your own.

Why so many styles? In some disciplines, you discuss other researchers' work by referring to the researchers by name, and their work by date. In-line citations by name and year serve well in a he-said, she-said discourse. This is especially helpful when you are referring to

---

[1] You may one day want to know that Biber sometimes crashes when its cache has been corrupted, complaining with a horrendously opaque error message saying that the file, `recode_data.xml` cannot be found. The quick solution is to delete the cache. A web search will tell you how.

Table 4.2: BibLaTeX styles. Specifying the sorting order as 'none' for numeric entries results in works being listed in the order cited. Otherwise, they can be sorted by author, title, year.

`numeric`	Numbers the entries.
`alphabetic`	Creates an alphanumeric reference for each entry.
`authoryear`	Author and year.
`authoryear-ibid`	Author and year, and the erudite *ibidem.*
`authortitle`	Author and title.
`verbose`	A full citation at first, and a short form afterwards.
`chem-acs`	American Chemical Society.
`nature`	*Nature.*
`science`	*Science.*
`phys`	American Institute of Physics
`chicago-authordate`	Chicago.
`ieee`	Institute of Electrical and Electronics Engineers.
`mla`	Modern Languages Association. Now we're talking.

very recent work in a fast-paced disciplinary conversation, playing authors off against each other or setting their work up for your coming coup de grâce. It is also very compact, which proves especially helpful for gratuitous and pre-emptively defensive citations.

When publication years don't matter so much, e.g. in disciplines in which timeless ideas stick around for a years, decades or centuries of reflection and critique, the author's name often matters but citing the year is usually silly (except, perhaps, to indicate a particular edition or translation). You might also feel a need to cite titles. Long-winded titles with a colon in the middle make citations unwieldy, so often a shortened title is used, and the citation goes into footnotes or endnotes rather than in the body text.

Citing in notes also gives plenty of space in which to summarise your position on a work. A note gives space to explain, for example, that, though the title claims that it tackles your topic, the article's argument, presuming that it has one, has proven too rarefied to grasp.

Footnotes or endnotes? Footnotes are usually easier to read because they're right there on the same page when you need them. LaTeX does a very good job of arranging them. But if you are writing in a way that doesn't need citations and notes to be so immediately present, endnotes allow you to get them completely out of the way.

There are three main reasons for choosing your style: what you want your citations to do, what your readers are familiar with, and because your supervisor told you so.

Table 4.2 shows some of the in-built style options.

Listing works not cited

Sometimes a work needs to appear in the bibliography even though it hasn't been cited. The command for this is `\nocite{}`.

This document includes the command,

    `\nocite{Imhof1996, Zeiller1655, Delambre1806}`

to get those three works in from the bibliography file, even though they haven't been cited. Jump ahead to the sample bibliography to see whether it worked.

If you want every listed work included, say `\nocite{*}`.

3 THE .BIB FILE

All of your citations are detailed in a separate *.bib* file. You can get the entries from Google Scholar, Zotero or Refworks. You can also enter them manually by yourself.

Each entry is composed of fields specifying bibliographic metadata — authors, title, short-title, URL, publication date and location, publisher, editor and so on.

There are several kinds of entry: 'article' and 'book' are the most common, but there are more as well, described in detail on-line. Book entries look like this:

```
@book{Bringhurst1999,
    author = {Robert Bringhurst},
    title = {The elements of typographic style},
    shorttitle = {Elements},
    edition = {2},
    address = {Point Roberts, WA},
    publisher = {Hartley \& Marks},
    date = {1999}
}
```

You do not have to use the 'correct' entry type. If you find that the 'book' type works best for dissertations, for example, you can use it instead of the 'phdthesis' type.

For tricky cases, there is a 'misc' type.

Various databases and citation management apps provide BibTeX entries, but check them carefully to see that they are correct. Some do not reliably select the correct format. Many databases get authors' names wrong, and capitalise names and titles in odd ways.

4 COMPILING

Compiling with a bibliography requires four steps.

1. Compile with LaTeX.

2. Run Biber to get the citation entries from the *.bib* file.[2]

3. Compile with LaTeX again to form the citations.

4. Compile with LaTeX a third time to finalise the citation references.

---

[2]Running Biber may require an adjustment to your editor configuration. Some editors are set up to run BibTeX, but BibLaTeX works better with Biber, especially if you are writing in multiple languages. If the compiler complains that it cannot find any citation entries, it is often because you are running BibTeX rather than Biber.

SIMPLE BIBLIOGRAPHIES

LaTeX also has an in-built citation system that may suffice if you do not cite very much. Many mathematics theses, for example, need only a few tens of citations. Among the benefits: simpler notation, less setup investment, less risk of compilation going wrong.

Downsides: references have to be manually crafted, citation style is not very flexible, changing style can involve re-doing everything from scratch.

To use this system, your document needs an environment like this:

```
\begin{thebibliography}{8}

\bibitem{Dieudonne1969}
    Dieudonné, Jean A. (1969)
    \emph{Linear algebra and geometry}.
    Paris: Hermann.

\bibitem{Lang2010}
    Lang, Serge (2010)
    \emph{Linear algebra}.
    New York: Springer.

\end{thebibliography}
```

The environment's specification includes a number: what that does is reserve a space the width of the number (here, the '8') for the bibliography's reference numbers. The single-digit '8' will work if you have fewer than ten entries. If you have ten to ninety-nine entries, enter '88' to reserve width for two-digit reference numbers. You don't have to use numbers, incidentally — whatever specifies the width will work. We commonly use '8' because it's the right width.

Notice that the citation key for Dieudonné's book has no accented characters. This is because the citation engine crashes on them.

There is no command to print the bibliography: it prints wherever you put the bibliography environment (usually at the end). It can be entered into a separate file and incorporated using the `input` command.

Cite like this:

- `\cite{Dieudonne1969}`.

- `\cite[p.~32]{Lang2010}`.

- `\cite{Dieudonne1969, Lang2010}`.

Set the citation style like this:

- `\bibliographystyle{abbrv}`

- `\bibliographystyle{acm}`

- `\bibliographystyle{alpha}`

- `\bibliographystyle{ieeetr}`

- `\bibliographystyle{plain}`

- `\bibliographystyle{siam}`

For APA and Harvard-style citations, you'll need to add a package like `natbib` or `apacite`. Or upgrade to BibLaTeX.

SAMPLE REFERENCE LIST

Académie Royale des Sciences, Messieurs de l'. *Recueil d'observations faites en plusieurs voyages par ordre de sa majesté pour perfectionner l'astronomie et la géographie avec divers traités astronomiques.* Paris: Imprimerie royale, 1693. Two pages by Jean Picard and Giovanni Domenico Cassini on-line at http://gallica.bnf.fr/ (Bibliothèque Nationale de France).

Bringhurst, Robert. *The elements of typographic style.* 2nd ed. Point Roberts, WA: Hartley & Marks, 1999.

Chambers, Ephraim. *Cyclopædia, or, an universal dictionary of arts and sciences.* London: printed for J. and J. Knapton [et al], 1728.

Delambre, Jean Baptiste Joseph. *Base du système métrique décimal, ou mesure de l'arc du méridien compris entre les parallèles de Dunkerque et Barcelone...* Paris: Baudouin, 1806–1810.

Imhof, Arthur Erwin and Thomas Robisheaux. *Lost worlds: how our European ancestors coped with everyday life and why life is so hard today.* Charlottesville: University Press of Virginia, 1996.

Lassels, Richard. *An Italian voyage, or, a compleat journey through Italy.* London: printed for Richard Wellington, 1698.

Nielsen, Axel V. "Ole Rømer and his meridian circle". In: *Vistas in Astronomy* 10 (1968), pp. 105–112.

Schmutz, Jacob. "Juan Caramuel y Lobkowitz (1606–1682)". In: *Centuriae latinae II. Cent et une figures humanistes de la Renaissance aux Lumières.* Ed. by Colette Nativel. Genève: Droz, 2006.

Wren, Christopher. "A description of Dr. Christopher Wren's engin, designed for grinding hyperbolical glasses". In: *Philosophical Transactions* 4.53 (1669), 1059–1060 (H4f$^{\text{r–v}}$).

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