WRITING YOUR THESIS WITH LATEX WITH A VERY, VERY, VERY LONG TITLE

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WRITING YOUR THESIS WITH LATEX WITH A

VERY, VERY, VERY LONG TITLE

by

LIM LIAN TZE

**Thesis submitted in fulfilment of the requirements
for the degree of
Doctor of Philosphy**

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ACKNOWLEDGEMENT

Many thanks to Prof. Donald Knuth for giving us TEX, and Leslie Lamport for LATEX.

I first learned LATEX as an undergraduate student in Computer Science at the University of Warwick. Back in Malaysia, I picked it up again while doing my M.Sc. at USM, as part of some productive procrastination (there I've admitted it!!). This coincided with Dr. Dhanesh's and Dr. Azman's efforts in raising awareness about LATEX at USM during NaCSPC'05 – somehow one thing led to another, and I now conduct trainings and consultatons on LATEX. ☺

Since then, many friends and fellow LATEX users have given feedback and helped relayed important updates from IPS to me, to help improve the class and template. It has actually come to a point where you are too numerous to name! Thank you all, as well as everyone who has attended my talks and workshops, used my various templates, downloaded examples from my website (`http://liantze.penguinattack.org/latextypesetting.html`).

Hope everyone graduates quickly then!

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LIST OF ABBREVIATIONS

IPS   Institut Pengajian Siswazah

PPSK Pusat Pengajian Sains Komputer

USM   Universiti Sains Malaysia

UTMK Unit Terjemahan Melalui Komputer

LIST OF SYMBOLS

lim   limit

θ angle in radians

PENULISAN TESIS DENGAN LATEX

xi

ABSTRAK

Ini merupakan abstrak Melayu untuk tesis USM. Ianya disediakan dengan sistem penyediaan dokumen LaTeX.

WRITING YOUR THESIS WITH LATEX WITH A VERY, VERY, VERY

LONG TITLE

ABSTRACT

This is the English abstract of a USM thesis. It was prepared with the LATEX document typesetting system.

CHAPTER 1

HOW TO USE THE USMTHESIS LaTeX TEMPLATE

Hello and welcome, Universiti Sains Malaysia (USM) research postgrad! The usmthesis package and template files were written in the hope that they may help you prepare your research thesis using LaTeX, based on the Institut Pengajian Siswazah (IPS) requirements (IPS USM, 2007). **Please note that this version is based on the *new* guidelines, in force 17 Dec 2007 onwards, incorporating feedback received from IPS in August 2015.**

LaTeX is powerful and produces beautiful documents. However, there is definitely a learning curve to it – one that is worth the effort. If you find any errors in these templates or documents, or have any suggestions or feedback, do e-mail me about it (liantze@gmail.com). The author cannot always guarantee prompt response, however. ☺

1.1 Bundled Files

The bundled *.tex files are meant as template files which you modify or replace to suit your own needs: they hold the actual contents of your own thesis. Let's see how to do this, step by step.

You should have the following files:

usmthesis.cls The USMthesis document class file which contains most of the format

specifications and configurations, conforming to the requirements set out in the thesis preparation guide issued by IPS.

usmthesis.tex The "main driver" file. Think of this as the equivalent of `int main()` or `public static void main(String [])`.

mybib.bib The bibliography database file.

acknowledgements.tex File containing the acknowledgements.

abs-mal.tex File containing the Malay abstract.

abs-eng.tex File containing the English abstract.

loa.tex (Optional) Contains the lists of abbreviations and symbols.

mainchaps.tex Listing of files containing the main chapters.

appendices.tex (Optional) Listing of files containing the appendices.

chap-*.tex The main chapters, one in each file.

app-*.tex The appendices, one in each file.

*.pdf, *.png, *.jpg Any graphic files that need to be included.

There is no need for creating separate files for the cover page, table of contents, and list of figures and tables. These will be automatically generated when LaTeX processes the input files.

1.2 Class Options

`usmthesis.cls` defines the various layout and formatting as according to IPS' guidelines. Therefore, under normal circumstances, there should be no need for fiddling with the formatting: simply concentrate on writing the thesis chapters.

Nevertheless, there are some (minor) class options that you can set:

1.2.1 Body font (default: `times`)

IPS has allowed either Times (12pt) or Arial (11pt) to be used as the thesis' body font. Available options are:

- `times` to use a serif or roman font (Times) as body font;

- `arial` to use a sans serif font (Helvetica, a look-alike for Arial) as body font.

The default is `times`.

1.2.2 URL font (default: `urltt`)

URLs should be typeset with a `\url` command like this, to take care of special characters and proper line-breaking of long URLs:

`\url{http://www.cs.usm.my}`

You may select a font style for URLs, so that they stand out from the main body font selected. Available options are:

- `urlrm` to use a serif or roman font (Times)

- `urlsf` to use a sans serif font (Helvetica/Arial)

- `urltt` to use a typewriter font (TX Typewriter)

The default is `urltt`.

1.2.3 Framed figures (default: `noboxfig`)

Some people may prefer to have a frame around their figures; others don't. You may specify your preference with the following class options:

- `boxfig` to put full-width boxes around all your figures;

- `noboxfig` to have figures without frames.

The default is `noboxfig`.

1.3 Using Class Options

Specify the above class options like this:

`\documentclass[urlsf]{usmthesis}`

This would typeset your thesis using sans seris font (Helvetica) for URLs and no boxes around your figures (by default). You may give any combinations of these options, in any order, like so: `\documentclass[urlsf,boxfig]{usmthesis}`.

1.4 Providing details about your thesis

Telling the world who you are, and what your research thesis is about, is a good place to start. Open up `usmthesis.tex` (your "main" file) and look for the line

`%% Enter particulars about your thesis HERE`

Now on the lines that follow, replace the default text between the curly braces:

```
\author{Your Name e.g. Ace Student}
\title{Your Thesis Title in English e.g. Doing Research}
\titlems{Your Thesis Title in Malay e.g. Kerja Penyelidikan}
\submityear{Year Submitted e.g. 2006}
\submitmonth{Month Submitted e.g. August}
\degreetype{Degree Type e.g. Doctor of Philosophy}
```

1.5 Acknowledgements and Abstracts

Open up `acknowledgements.tex`, `abs-mal.tex` and `abs-eng.tex`, and replace the default text there with your own material. The titles for your English and Malay abstracts will be inserted automatically in the Preview/PDF.

1.6 List of Acronyms and Symbols

If you don't have any list of acronyms or symbols, open `usmthesis.tex` and comment out the line that includes the loa.tex file. This is done by adding a percentage sign (%) in front of the line, like this:

```
%\include{loa}
```

If you *do* need such a list, open up `loa.tex`. It contains a *List of Abbreviations* as well as a *List of Symbols*. You may delete off one or the other if you don't need either of them.

You can list down abbreviations and symbols that are used in your thesis following the examples there. Also, specify the longest acronym in your list in the square brackets: `\begin{acronym}[HERE]`. This will align your list nicely.

For more information, see the documentation of the `acronym` package at `http://`

```
texdoc.net/pkg/acronym.
```

1.7 Main Chapters

I recommend that you have a separate file for each individual chapter. Each file should start off with the chapter title, so `chap-review.tex` might start with:

```
\chapter{Literature Review}
```

Next, in `mainchaps.tex`, list down the *file names* of your main chapter files. Notice that you may omit the `.tex` suffix when doing so.

1.8 Appendices

This goes pretty much the same way as the main chapters, but you specify the files containing your appendix material in `appendices.tex` instead.

If you do not have any appendix to include, you may comment out the lines starting with \appendix, right up until after **\input**{appendices}, which are near the end of `usmthesis.tex`.

1.9 Bibliographies and Citations

You can replace `mybib.bib` with your own bibliography database `.bib` file. For more information on how to do citations inside the main text, see Chapter 3 in the sample `usmthesis.pdf` for a brief overview, including how to select an author-year or numbers only citation system. (Author-year is the default in the sample files.)

1.10 List of Own Publications

First, make sure that you enter details about your own publications in `mybib.bib`. Then in `usmthesis.tex`, search for the following line:

```
\nociteown{lim:2005}
```

Replace the BibTeX key between the curly braces with that of your own publication. If you have more than one publications, simply separate them with commas inside the curly braces, like this:

```
\nociteown{lim:tang:2004,lim:2005}
```

If you don't have a list of own publications, comment out both these lines like this:

```
%\nociteown{lim:2005}
...
%\bibliographyown{mybib}
```

CHAPTER 2

INTRODUCTION: SAMPLES OF BASIC LaTeX

Hello and welcome, fellow USM research postgrad! The `usmthesis` package and template files were written in the hope that they may help you prepare your research thesis using LaTeX, based on the IPS requirements (IPS USM, 2007). **Please note that this version is based on the *new* guidelines, in force 17 Dec 2007 onwards.**

LaTeX is powerful and produces beautiful documents. However, there is definitely a learning curve to it – one that is worth the effort. If you find any errors in these templates or documents, or have any suggestions or feedback, do e-mail me about it (`liantze@gmail.com`). The author cannot always guarantee prompt response, however. ☺

MiKTeX, my recommended LaTeX distribution for Windows, is available on the CSPC'07 CD. A step-by-step installation walkthrough is available at (Lim, 2007).

2.1 Some Simple Command Usages.

There are plenty of free LaTeX tutorials online, some of which are listed in the bibliographies or available at `http://e-office.cs.usm.my`. This sample thesis includes some examples to do some common tasks. We start with some examples for lists (both bulleted and numbered), highlighting texts in bold and italic, and URLs:

1. bulleted and numbered lists,

```
\begin{enumerate}
\item bulleted and numbered lists,
\item footnotes\footnote{This is a footnote. However note that
    footnotes are not encouraged for the sciences.},
\item font effects such as

\begin{itemize}
\item \textbf{bold},
\item \emph{italic}, and
\item \texttt{typewriter-like}
\end{itemize}

\item URLs and e-mail addresses: \url{http://www.cs.usm.my/~llt/}, \
    url{dummy.add@hotmail.com};
\item citations: see Chapter \ref{chap:review}.
\end{enumerate}
```

Figure 2.1: Common Layout and Formatting Tasks. Note how this long title wraps around I hope it works anyway. Look it needs more, so here's some more longer text. Is that enough? I hope it is.

2. footnotes[1],

3. font effects such as

- **bold**,

- *italic*, and

- `typewriter-like`

4. URLs and e-mail addresses: `http://www.cs.usm.my/~llt/`, `dummy@hotmail`

   `.com`;

5. citations: see Chapter 3

Incidentally, if you feel that the lists above are too far apart vertically, you can customise them using the `enumitem` package. The effect is then like the following:

---

[1]This is a footnote. However note that footnotes are not encouraged for the sciences.

```
\begin{enumerate}[nosep]
\item item one,
\item item two,
\item item three.
\end{enumerate}

\begin{itemize}[nosep]
\item item one,
\item item two,
\item item three.
\end{itemize}
```

Figure 2.2: Compact Lists

1. item one,

2. item two,

3. item three.

- item one,

- item two,

- item three.

Granted, the lists are still wide, but this is because we need to honour the require-ment for double line-spacing.

2.2 Special Characters

Bear in mind that certain characters are special LATEX symbols and need to be es-caped, as shown in Table 2.1.

Note that for quotation marks, you might prefer ``this'' and `that' ("this" and 'that') instead of "this" and 'that' ("this" and 'that').

If you need to typeset special characters (such as ☢, ☣, ☺, ⌢, etc), take a look

Table 2.1: Special Characters in LaTeX

Symbol	Name	Escape code
#	hash, pound	\#
$	dollar	\$
%	percent	\%
^	"hat"	\^{}
&	ampersand	\&
_	underscore	_
{	left brace	\{
}	right brace	\}
~	tilde	\~{}
∼	wide tilde	$\sim$
"	open double quotes	``
"	close double quotes	''

at the Comprehensive LaTeX Symbol List. It should be under `C:\ProgramFiles\`

`MiKTeX2.9\doc\info\symbols\comprehensive\symbols-a4.pdf` if you installed

MiKTeX on a Windows machine.

2.3 Useful Resources

(Mittelbach, Goossens, Braams, Carlisle, & Rowley, 2004) is a *very* useful book —

but it's quite an investment at RM180++. A worthy one, nevertheless. Roberts (2005)

has a website with very good LaTeX tutorials at `http://www.comp.leeds.ac.uk/`

`andyr/misc/latex/`, too. Don't forget the famous `lshort` tutorial (Oetiker, Partl,

Hyna, & Schlegl, 2006).

I've also compiled a list that I find useful at `http://liantze.penguinattack`

`.org/latextypesetting` (Lim, 2007).

CHAPTER 3

CITATIONS AND BIBLIOGRAPHY

This chapter should have been a survey on the history of TeX and LaTeX, and a comparison to conventional word processors in preparing academic documents. Due to lack of time on the author's part, and also the abundance of such discussions on the web, we look at ways to prepare the bibliography and citations instead.

3.1 The `*.bib` File

First of all, bear in mind that your bibliography file (`*.bib` files) is like a database. That means you can maintain a centralised list, and reuse it for all your publications. LaTeX will only list sources that you actually cite in the text for each document, according to the bibliography and citation style you select in each document. But you can still hack it so that your own publications are listed, even if you did not cite it.

```
@BOOK{latex:companion,
  title = {The \LaTeX{} Companion},
  publisher = {Addison-Wesley},
  year = {2004},
  author = {Frank Mittelbach and Michel Goosens and Johannes Braams
      and David Carlisle and Chris Rowley},
  series = {Addison-Wesley Series on Tools and Techniques for
      Computer Typesetting},
  address = {Boston, MA, USA},
  edition = {2nd}
}
```

Figure 3.1: A BibTeX Entry

As an example, in `mybib.bib` I created a BibTeX entry with JabRef, the source

text of which is shown in Figure 3.1.

One thing to note about authors' names: BibTeX recognises "Mittelbach" as the last name for both `Frank Mittelbach` and `Mittelbach, Frank`. So for a name like "Lim Lian Tze", you would have to specify it as either `Lian Tze Lim` or `Lim, Lian Tze` for BibTeX to recognise "Lim" as the last name correctly. In addition, if the surname or family name of an author consists of multiple words, enclose it with braces to avoid surprises, like so: `Syed Muhammad Naquib {al-Attas}`.

3.2 Citations using the `natbib` package

The `usmthesis` package imports the `natbib` and `apacite` package which provides flexible citation mechanisms, so see its documentation for more details. On a MiKTeX installation, use the command prompt to issue `mthelp --view natbib` and `mthelp --view apacite` to access the documentation. On TeXLive, simply type `texdoc natbib` and `texdoc apacite` and the documentation will be displayed automatically, if it's found on your machine.

The basic citation commands are `\citet` and `\citep`, which stands for *textual* and *parenthetical* citation respectively. They take extra arguments, too, for adding notes in the citations.

3.2.1 Author-Year System

The default bibliography style is APA:

- `\citet{latex:companion}` → Mittelbach et al. (2004)

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- `\citet[chap.~2]{latex:companion}` → Mittelbach et al. (2004, chap. 2)

- `\citep{latex:companion}` → (Mittelbach et al., 2004)

- `\citep[chap.~2]{latex:companion}` → (Mittelbach et al., 2004, chap. 2)

- `\citep[see also][]{latex:companion}` → (see also Mittelbach et al., 2004)

- `\citep[see also][chap.~2]{latex:companion}` → (see also Mittelbach et al., 2004, chap. 2)

- `\citet{latex:companion,roberts}` → Mittelbach et al. (2004); Roberts (2005)

- `\citep{latex:companion,roberts}` → (Mittelbach et al., 2004; Roberts, 2005)

You may also want to write only the author's name or year occassionally:

- `\citeauthor{latex:companion}` → Mittelbach et al.

- `\citeyear{latex:companion}` → 2004

- `\citeyearpar{latex:companion}` → (2004)

3.2.2 Numeric System

If you prefer the plain, numerical system, do the following steps first:

1. In `usmthesis.cls`, search for the line `\RequirePackage{natbib}` and modify it to:

   `\RequirePackage[numbers]{natbib}`

2. In `usmthesis.tex`:

   - comment out the line starting with `\citestyle{...}`

   - modify the `biblography` styles to:

     `\bibliographystyle{plainnat}`

```
\bibliographystyleown{plainnat}
```

or any other number system style that you prefer.

You will then get the following citation outputs:

- `\citet{latex:companion}` → Mittelbach et al. [1]

- `\citet[chap.~2]{latex:companion}` → Mittelbach et al. [1, chap. 2]

- `\citep{latex:companion}` → [1]

- `\citep[chap.~2]{latex:companion}` → [1, chap. 2]

- `\citep[see also][]{latex:companion}` → [see also 1]

- `\citep[see also][chap.~2]{latex:companion}` → [see also 1, chap. 2]

- `\citet{latex:companion,roberts}` → Mittelbach et al. [1], Roberts [3]

- `\citep{latex:companion,roberts}` → [1, 3]

- `\citeauthor{latex:companion}` → Mittelbach et al.

- `\citeyear{latex:companion}` → 2004

- `\citeyearpar{latex:companion}` → [2004]

CHAPTER 4

FIGURES, TABLES, EQUATIONS, ALGORITHMS, ETC

(This is supposed to be the design or methodology chapter. Instead, we include examples on inserting figures, tables, mathematical equations... i.e. things that you might want to include in your thesis.)

4.1 Inserting Figures

You can draw diagrams with special LaTeX commands, but this may take some extra time to learn. I've had some forays into the `pgf` and `tikz` packages and must say I quite like the results; but as I said, they take time to learn. If you want a faster solution, you can draw your diagrams using other applications, and saving them as graphic files (EPS, PNG, JPG, PDF).

LaTeX requires EPS (encapsulated postscript) graphic files when generating DVI output, and PNG, JPG or PDF when generating PDF output.

For exporting to EPS, try `http://www.cloudconvert.com`. It's like a Swiss knife for converting from almost any format, to almost any format.

Do note that IPS **discourages** the use of colours in your thesis, including diagrams and figures. Phographs and colour plates are exceptions to this rule: see Section 4.3.

Here's how to insert a picture with the filename `pythag.eps` or `pythag.png`. I'm

going to display it here with 5cm width, and the caption "Pythagoras' Theorem".

```
\begin{figure}[hbt!]\centering
\includegraphics[width=50mm]{pythag}
\caption{Pythagoras' Theorem}\label{fig:pythagoras}
\end{figure}
```

Figure 4.1: Including a Graphics File

The result would be:
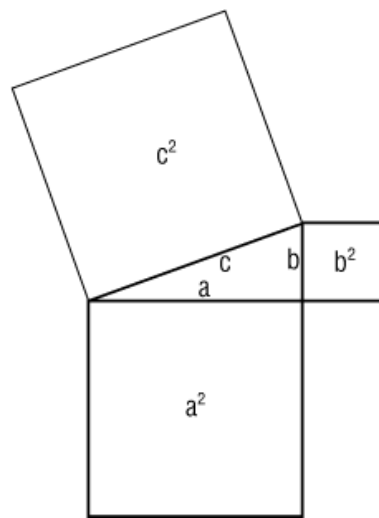
Figure 4.2: Pythagoras' Theroem

Don't specify the extension of the graphic file. The template will automatically look for the EPS or the PNG (or otherwise) versions, depending on whether `latex` or `pdflatex` was used. The `figure` environment will also ensure that that an entry is inserted into the *List of Figures* automatically – including the figure numbering, caption and page number.

In addition, the width of the included graphics can also be specified as a percentage of the text width, e.g. `width=.2\textwidth` would cause the graphics to occupy 20% of the text width.

Notice that I inserted a `\label` just after the `\caption`. This can be used for referencing the figure number, like this:

`Figure \ref{fig:pythagoras}` → Figure 4.2

This works the same for chapters, sections, tables, equations too. In `chap-intro.tex`, I labelled the Introduction chapter with `\label{chap:intro}`. I also labelled the section on inserting figures, `\label{sec:figure}`. So now I can do

`Chapter \ref{chap:intro}` → Chapter 2

`section \ref{sec:figure}` → section 4.1

Everytime the numbering of the heading changes, the reference will change automatically as well. **This is another advantage of using LATEX**: you do not need to manually update the reference counters (nor the Table of Contents, List of Figures and Tables) whenever you add or remove figures, tables, sections or chapters.

You might also want to try out `JpgfDraw`: it is a vector graphics and drawing application (requiring Java), and can export to LATEX code which you can paste into your LATEX source. `JpgfDraw` is available from `http://theoval.cmp.uea.ac.uk/~nlct/jpgfdraw/index.html`.

4.2 How Do I Do Subfigures?

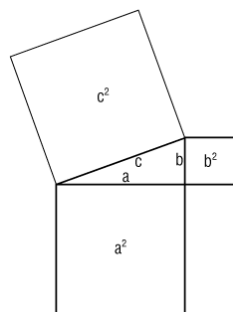Here's an example on how to do subfigures (and similarly subtables):

```
\begin{figure}[hbt!]
  \begin{minipage}{.49\textwidth}
  \centering
  \subfloat[First caption]{\includegraphics[width=3cm]{pythag}} \
      label{fig:sub1}
  \end{minipage}
  \hfill
  \begin{minipage}{.49\textwidth}
  \subfloat[Second caption]{\includegraphics[width=0.8\textwidth]{
      USMScience}}\label{fig:sub2}
  \end{minipage}

  \caption{This is the main caption of the figure.}
  \label{fig:main}
\end{figure}
```

Figure 4.3: Creating subfigures within figures

(a) First caption
(b) Second caption

Figure 4.4: This is the main caption of the figure.

4.3 Inserting Plates

Colour photographs are now regarded as *plates*. They must be listed in the *List of Plates* instead of the List of Figures, and should be printed in colour on glossy photo paper (IPS USM, 2007).

The usmthesis document class defines a new plate environment, as well as a corresponding \listofplates command. (The \listofplates command is already placed in the sample template file usmthesis.tex.) In short, all you need to do to insert a photograph or plate (as a graphics file USMScience.{eps,png,jpg}) is shown

in Figure 4.5, and you will then get Plate 4.1 as the result.

```
\begin{plate}[hbt!]\centering
\includegraphics[width=.9\textwidth]{USMScience}
\caption{School of Computer Sciences, USM}\label{plate:ppsk:usm}
\end{plate}
```

Figure 4.5: Inserting a Plate

Plate 4.1: School of Computer Sciences, USM

4.4 Inserting Tables

Typesetting tables can be a little troublesome especially with complex layouts. Look up (Roberts, 2005) to learn about some tips, or you can use the LaTable program (`http://www.g32.org/latable/`) to help you.

If using LaTable, when you're done designing the table, copy the whole table as LATEX code, and paste it in your source file. (You may add additional formatting com-

mands, like bold, italics, etc.) If this is going to be a numbered table, remember to surround it with \begin{table} and \end{table}, and give it a caption, like this:

```
\begin{table}[hbt!]\centering
\begin{tabular}{| l | c || r |}
\hline
\textbf{Name} & \textbf{Category} & \textbf{Quantity} \\
\hline\hline
Apple & Fruit & 10 \\
\hline
Cucumber & Vegetable & 25 \\
\hline
Daisy & Flower & 5 \\
\hline
\end{tabular}
\caption{Sample Table Only} \label{table:sample}
\end{table}
```

Figure 4.6: Typesetting Tables

Table 4.1: Sample Table Only

Name	Category	Quantity
Apple	Fruit	10
Cucumber	Vegetable	25
Daisy	Flower	5

Note also that usmthesis is configured such that captions for figures are placed *below* the figures, and captions for tables are placed *above* them, in accordance with the formatting guidelines.

Many of us would have had massive headaches about lining up decimal places in table columns (as mentioned in the IPS guidelines) if not for this tip from (Mittelbach et al., 2004, pp. 274–276). This method uses the dcolumn package (already loaded by usmthesis.cls). Instead of using l, c or r as the column type in the tabular declaration, use

D{*input sep*}{*output sep*}{*decimal places*}.

```
\begin{table}[htb!]\centering
\begin{tabular}{| c | D{.}{.}{2} |}
\hline
Item & \multicolumn{1}{c|}{Reading}\\\hline
A & 1.11\\\hline
B & 3.99\\\hline
C & 2.27\\\hline
\end{tabular}
\caption{A table with decimal data}
\end{table}
```

Figure 4.7: Aligning decimal data in tables

The LATEX code in Figure 4.7 will give you Table 4.2.

Table 4.2: A table with decimal data

Item	Reading
A	1.11
B	3.999
C	22.2

Without using `dcolumn`, you'd get something like this:

Table 4.3: A table with decimal data (mis-aligned)

Item	Reading
A	1.11
B	3.999
C	22.2

4.5 Full-paged, Sideways Figures and Tables

To make a figure appear on a landscape, full-page layout, put your `\includegraphics` command in a `sidewaysfigure` environment (Figure 4.8).

```
\begin{sidewaysfigure}\centering
\includegraphics[width=\textheight]{latex-win-comp}
\caption{A full-page, sideways figure}\label{fig:sidewaysfig}
\end{sidewaysfigure}
```

Figure 4.8: Including a sideway, full-page graphic

The resultant figure (Figure 4.9) should appear on the next page.

For a sideways table, use the `sidewaystable` environment instead around your usual `tabular` material.

4.6 Mathematical Equations

Typesetting mathematical material is one of, if not *the*, strongest capabilities of LaTeX. After all, that was the Knuth's main motivation for creating TeX. As it is impossible to enumerate all possible mathematically-related commands and macros here, we will just give some examples. The reader is directed to the many well-written online tutorials, such as (Roberts, 2005), for more elaborate examples. TeXnicCenter also provides many shortcut buttons for inserting mathematical symbols.

$$z^2 = x^2 + y^2 \tag{4.1}$$

$$\phi = \frac{1}{2}(1 + \sqrt{5}) \tag{4.2}$$

$$\phi = 1 + \sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{F_n F_{n+1}} \tag{4.3}$$

Equation 4.1 is the Pythagoras Theorem. (4.2) gives the golden ratio ϕ, and (4.3) relates it to the Fibonacci series.
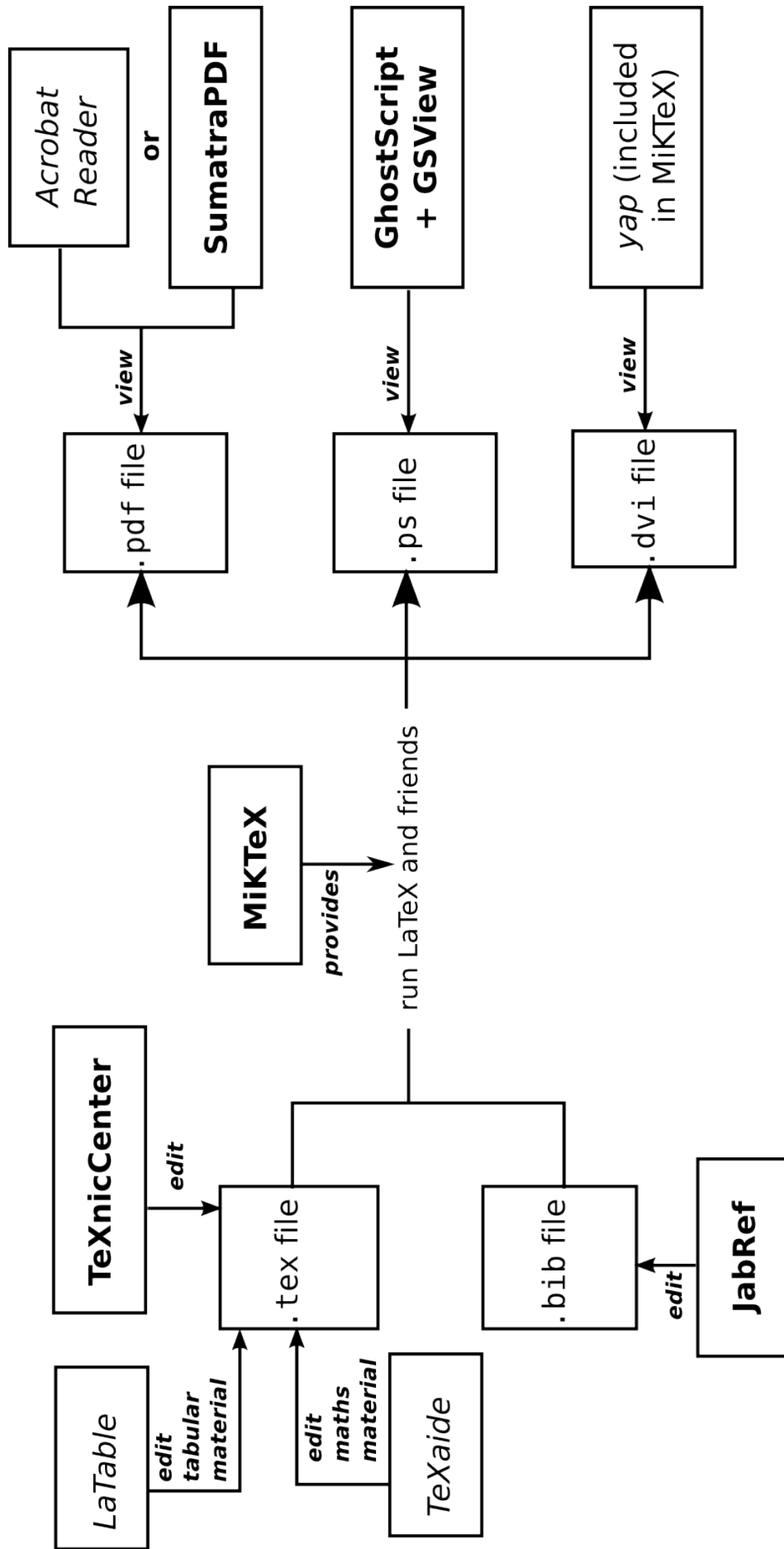
Figure 4.9: A full-page, sideways figure

```
\begin{equation}\label{eq:pythagoras}
z^2 = x^2 + y^2
\end{equation}

\begin{equation}\label{eq:golden:ratio}
\phi = \frac{1}{2} (1 + \sqrt{5})
\end{equation}

\begin{equation}\label{eq:golden:ratio}
\phi = \frac{1}{2} (1 + \sqrt{5})
\end{equation}
\begin{equation}\label{eq:golden:ratio:fibonacci}
\phi = 1 + \sum ^ {\infty} _ {n=1}
            \frac{ (-1) ^ {n+1} }{ F_n F_{n+1} }
\end{equation}

Equation~\ref{eq:pythagoras} is the Pythagoras Theorem.
\eqref{eq:golden:ratio} gives the golden ratio $\phi$, and
\eqref{eq:golden:ratio:fibonacci} relates it to the Fibonacci
series.
```

Figure 4.10: Typesetting Mathematical Equations

The LATEX code to generate the above mathematics materials are shown in Figure 4.10. As you can see, references to equations can be achieved with either `\ref` or `\eqref`.

A disclaimer: if you think the mathematic equations don't look as great as all those LATEX advocates make them out to be, that's because IPS requires Times to be used and the current offerings of free LATEX math fonts for Times don't look great. It would've been a different picture if we used Computer Modern.

4.7 Acronyms

If you have a list of acronyms or symbols, edit the file `loa.tex` as in Figure 4.11.

You can also use this acronym list to help expand it the first time you mention it in your text. For example, the first time you use `\ac{USM}`, 'Universiti Sains Malaysia

```
\begin{acronym}[UTMK] %% replace 'UTMK' with the longest acronym in
    your list
\acro{IPS}{Institut Pengajian Siswazah}
\acro{PPSK}{Pusat Pengajian Sains Komputer}
\acro{USM}{Universiti Sains Malaysia}
\acro{UTMK}{Unit Terjemahan Melalui Komputer}
\end{acronym}
```

Figure 4.11: The template `loa.tex` for acronyms

(USM)' will be the output (without the quotes). After that, all calls to `\ac{USM}` will give 'USM' (without the quotes). For more information, see the documentation for the `acronym` package.

4.8 Typesetting Algorithms

As computer scientists, it is quite common to include algorithms and/or pseudocode. There are a number of different packages available, but unfortunately they tend not to work well together! I'm using `algorithmicx` here.

```
\begin{algorithm}[hbt!]
\begin{algorithmic}
\Require $n \geq 0$
\Ensure $y = x^n$
\State $y \Leftarrow 1$
\State $X \Leftarrow x$
\State $N \Leftarrow n$
\While{$N \neq 0$}
\If{$N$ is even}
  \State $X \Leftarrow X \times X$
  \State $N \Leftarrow \frac{N}{2} $ \Comment{This is a comment}
\ElsIf{$N$ is odd}
  \State $y \Leftarrow y \times X$
  \State $N \Leftarrow N - 1$
\EndIf
\EndWhile
\end{algorithmic}
\caption{Computing $x^n, n > 0$}
\end{algorithm}
```

Figure 4.12: Typesetting Algorithms

Algorithm 1 Computing $x^n, n > 0$

Require: $n \geq 0$
Ensure: $y = x^n$
  $y \Leftarrow 1$
  $X \Leftarrow x$
  $N \Leftarrow n$
  while $N \neq 0$ **do**
    if N is even **then**
      $X \Leftarrow X \times X$
      $N \Leftarrow \frac{N}{2}$ $\triangleright$ This is a comment
    else if N is odd **then**
      $y \Leftarrow y \times X$
      $N \Leftarrow N - 1$
    end if
  end while

4.9 Program Listings

You may have noticed that I used the `lstlisting` environment to typeset some of the LaTeX examples – with pretty-printing[1], too, including automatic line-breaking. For more information, see the documentation for the `listings` package: it's available online at `http://www.texdoc.net/pkg/listings`.

Just to give some simple example here. For example, to typeset a "Hello World" Java program with syntax highlighting, you can use the following code:

```
\lstset{basicstyle=\small\ttfamily, language=Java, breaklines=true,
    columns=fullflexible, tabsize=2}
\begin{lstlisting}
public class HelloWorld {
        public static void main( String arg[] ) {
        for (int i = 0; i < 10; i++) {
                        System.out.println( "Hello World!" + i);
                }
        }
}
\end{lstlisting}
```

Figure 4.13: Typesetting a Java program listing

---

[1]Whether you agree that it *is* pretty is another story altogether.

```
public class HelloWorld {
  public static void main( String arg[] ) {
        for (int i = 0; i < 10; i++) {
      System.out.println( "Hello␣World!" + i);
    }
  }
}
```

Figure 4.14: A pretty-printed Java program listing with syntax highlighting

If you want to turn off the syntax highlighting, set language={}. (See the listings documentation for a list of programming languages for which syntax highlighting is supported.) You can also change the basicstyle value to get different effects: e.g. a different font family, size or text formatting.

Here's another example for a C program:

```
\lstset{basicstyle=\sffamily, language=C, breaklines=true, columns=
    fullflexible, tabsize=2}
\begin{lstlisting}
int main() {
        int c = 0;
        c = c + 1;
        printf( "%d", c );
        return 0;
}
\end{lstlisting}
```

Figure 4.15: Typesetting a C program listing

```
int main() {
    int c = 0;
    c = c + 1;
    printf( "%d", c );
    return 0;
}
```

Figure 4.16: A pretty-printed C program listing with syntax highlighting

And here is the same C program listing *without* syntax highlighting (by setting

```
language={}):
```

```
int main() {
    int c = 0;
    c = c + 1;
    printf( "%d", c );
    return 0;
}
```

Figure 4.17: A C program listing without syntax highlighting

CHAPTER 5

IMPLEMENTATION

Now is the time to "implement" your thesis with LATEX. Go forth and typeset! Happy LATEXing! ☺

5.1 Printing Your Thesis

This is *very* important. Assuming you're printing your thesis from Acrobat Reader, make sure the following settings are chosen correctly in the Print window:

- A4 paper size is selected.

- Make sure your Printer settings is using A4 too.

- No page scaling.

Otherwise, the margins of your printed outputs may go horribly wrong. Print one or two pages first to make sure everything looks fine before printing your entire thesis.

CHAPTER 6

DISCUSSION

Just a placeholder for the discussion chapter.

CHAPTER 7

CONCLUSION

T-that's all folks. Have fun with LaTeX!

REFERENCES

Institute of Graduate Studies, Universiti Sains Malaysia. (2007). *A guide to the preparation, submission and examination of theses*. Penang, Malaysia.

Lim, L. T. (2007). *LaTeX: Beautiful typesetting*. Retrieved from `http://liantze.penguinattack.org/latextypesetting.html`

Mittelbach, F., Goossens, M., Braams, J., Carlisle, D., & Rowley, C. (2004). *The LaTeX companion* (2nd ed.). Boston, MA, USA: Addison-Wesley.

Oetiker, T., Partl, H., Hyna, I., & Schlegl, E. (2006). The not so short introduction to LaTeX 2_ε (4.2 ed.) [Computer software manual].

Roberts, A. (2005). *Getting to grips with LaTeX*. Retrieved from `http://www.andy-roberts.net/misc/latex/index.html`

APPENDICES

APPENDIX A

DATA USED

Put some test data here.

APPENDIX B

UML DIAGRAMS

Yet another dummy placeholder for appendix material.

LIST OF PUBLICATIONS

37

Lim, L. T. (2007a). *LaTeX: Beautiful typesetting.* Retrieved from `http://liantze`
`.penguinattack.org/latextypesetting.html`

Lim, L. T. (2007b). *Writing your thesis with LaTeX.* Internal circulation, School of
Computer Sciences, Universiti Sains Malaysia.