

# Using $\text{\LaTeX}$ for writing a Thesis

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**Abstract**  $\text{\LaTeX}$  has been successfully used for typesetting widely different document format. However, the complexity of typesetting some commonly used documents, normally acts as a deterrent for various people, who would like to use  $\text{\LaTeX}$  for their work. Over the years, I have noticed that students who come to  $\text{\LaTeX}$ , eager in their anticipation of using  $\text{\LaTeX}$ , loose their enthusiasm, midway, and revert back to using MS Word. In this article, I have tried to described my own experiences of typesetting a doctoral thesis using widely available packages; in the hope that students can see the the ease with which  $\text{\LaTeX}$  can be used for complex work.

## 1 Introduction

A Thesis or a dissertation is probably the most complex document that a student of higher studies is compelled to write at some point of his academic career. The complexity of thesis arises from various factors some of which are beyond the control of student and have to be taken for granted. For example, the discipline in which the student is pursuing his studies may require use of special characters, shapes or formulas which may be difficult to typeset in a word processor. The university in which the student is enrolled may have its own requirements as to how to format the various parts of the thesis. Besides these, the viewpoint put forward by the student in the thesis may have its own peculiar requirements. Furthermore, the thesis normally requires that bibliography be provided in a particular style. Social sciences, for example, mostly require in-line citations where as more rigorous science may well require numerical citation.

So when a student first sits down to write the thesis, his first choice is the word processor with which he is most familiar with. Unfortunately, word processors are normally not designed for writing thesis. Their forte lies in writing

official documents like letters, small reports etc. — documents which do not require complex formatting; but which may require a plethora of eye candy.

L<sup>A</sup>T<sub>E</sub>X is a T<sub>E</sub>X macro package, originally written by Leslie Lamport, that provides a document processing system [Lam]. It allows markup to describe the structure of the document and the underlying T<sub>E</sub>X program reads the markup and format the document accordingly. This allows for significant advantage, in the sense, that the person can focus more on content, than on formatting the document. Beside this generic advantage, various other advantages are offered by L<sup>A</sup>T<sub>E</sub>X. The B<sub>I</sub>B<sub>T</sub>E<sub>X</sub> program helps to insert the citation's in the document and provides the bibliography in almost any desired format. L<sup>A</sup>T<sub>E</sub>X can also be used for creating glossaries and indexes and of course, L<sup>A</sup>T<sub>E</sub>X excels in typesetting mathematical formulas. There are other advantages also — the L<sup>A</sup>T<sub>E</sub>X source code is a text file which is editable on almost any computer and operating system and does not run the risk of being corrupted with viruses. This makes the task of making backup simpler. Larger documents in L<sup>A</sup>T<sub>E</sub>X can be split up into smaller parts, which can then be inserted into the correct place with the minimum of effort. This also allows the user the flexibility to work on individual chapters, rather than the whole document at one go. Finally, L<sup>A</sup>T<sub>E</sub>X is adept at producing PostScript (PS) or Portable document File (PDF) — which can be printed on any printer without any loss of formatting.

Perhaps the paean of L<sup>A</sup>T<sub>E</sub>X may jar on some ear's, specially of the students used to word processors, but the jackpot at the end of the day is really huge. This article assumes that the reader has rudimentary knowledge of L<sup>A</sup>T<sub>E</sub>X and understands the basics. In the next section, we take a look at the parts of the thesis and subsequently we take a look at how to format a basic thesis which should meet the requirement of most universities.

In what follows, we assume the reader is already familiar with the basics of L<sup>A</sup>T<sub>E</sub>X and we shall use freely the L<sup>A</sup>T<sub>E</sub>X jargon.

## 2 A review of current solutions

Let us now take a look at how to write a thesis using L<sup>A</sup>T<sub>E</sub>X. A simple search of the Comprehensive T<sub>E</sub>X archive Network (CTAN) produces a fairly large number of thesis packages which can be used by the beginner in L<sup>A</sup>T<sub>E</sub>X. For example, muthesis [Gou06] aimed at University of Manchester, Department of Computer

Science, thesis style; ut-thesis [Pit99] aimed at University of Toronto thesis style; utthesis [Das95] for University of Texas (Austin), uwthesis [Fox03] for University of Washington thesis style; uaclasses [Oli96] for University of Arizona thesis style. The above classes can be found at [CTAN:/Formats/LaTeX/Contrib/](http://CTAN:/Formats/LaTeX/Contrib/). Searching for other thesis classes, some more were found at the [CTAN:/Uncategorized](http://CTAN:/Uncategorized) section, namely thutthesis (Tsinghua University), stellenbosch (University of Stellenbosch), nddiss (University of Notre Dame), fbithesis (University of Dortmund) toptesi (Polytechnique of Turin) etc. As can be seen, almost all of the thesis classes are geared to meet the requirements of a particular university. Any of these can be used as a starting point and then customised for writing the thesis. However, that may not be feasible for a new person who has just started using L<sup>A</sup>T<sub>E</sub>X.

Some other packages which are more flexible and generic in nature are reviewed here: (i) hepthesis [Buc06] a special thesis class aimed at writing thesis in the field of high energy particle physics. The package is flexible enough to be used as a general thesis package, but is dependent on various other packages which are available on CTAN. The package provides significant advantages without being too complex in nature. The problem is that if some non-standard specifications are required then the student may not have an easy way of making the changes. For example, the package provides for predefined margins and any changes are not easily made. (ii) classicthesis [Mie06] is another package which provides the first time users with an easy way of writing the thesis. However, the typographical formatting is done in homage to Robert Bringhurst book "The Elements of Typographic Style" and is overtly classical in nature. Another point of dispute is that it presumes that the thesis is a book and uses a wide outer margin on the right and the left hand pages. Customisation seems to be a problem, as the author himself requests the user not to change the style [Mie06, pp. 2]. (iii) jkthesis [Kup02] seems to be another generic thesis class. However as the documentation was in German, I could not do justice to the class. Prima Facie it seems to be reasonably flexible class for preparation of thesis.

Besides the above, some other classes were also found, but the documentation was not enough to form a definite opinion. Almost all the solutions given above seems to be hardwired to a particular university or a style and were not flexible enough, from the point of view of a layman. In search of something more flexible, I made two assumptions that the thesis is not a book but a report and that there

should be flexibility in adopting the thesis to ones needs.

### 3 Using L<sup>A</sup>T<sub>E</sub>X for Thesis Writing

The thesis can be looked upon as consisting of three basic parts which are discussed below.

The first part is the **Front Matter** In the front matter comes various parts which can be listed as follows : (i) Title page - which is in most of the cases also the cover page of the thesis (ii) Table of Contents (iii) List of tables and (iv) List of Figures. A dedication page or a quotation page can also be included.

The second and the longer part is the **main matter** The main matter would consist of the chapters of the thesis such as (i) Introduction (ii) Problem statement (iii) review of literature (iv) methodology (v) data analysis (vi) findings and (vii) conclusion. From the viewpoint of using L<sup>A</sup>T<sub>E</sub>X, appendicies can also be included in the main matter. This is where the student would develop the rationale for undergoing the research work and defend his or her findings. It is in this section, the student would include the mathematical equations, charts and graphs and other illustrations.

Finally at the end comes the **Back Matter**. This is the tail of the thesis and consist of some things which are extremely difficult to produce using a normal word processor. This normally consist of (i) Bibliography or References (ii) Glossary and (iii) Index. L<sup>A</sup>T<sub>E</sub>X, which was designed for typesetting takes care of the various aspects of the back matter in a more efficient way than any word processor and saves a lot of time and energy for the researcher.

#### 3.1 Packages and Assumptions

The first assumption that I made is that the thesis is a report and not a book. This is because, almost universally, the thesis is printed on only the right hand side of a page. Secondly, thesis requires that one-half or double spacing be followed while typing the matter. And thirdly, it should conform to the margin requirements of the page setup. Most universities require that the left margin include a gutter or space for binding.

Based on these assumptions, I have selected the following packages which are needed for our task—`url`, `setspace` and `geometry`. The `url` package is a much

needed package which helps in formatting the long web url's, email id's etc. properly both in the document and in the bibliography. The usage is extremely simple and any url which needs to be typeset just needs to be enclosed in a `\url{...}` command. The `setspace` package provides a much easier method of controlling spacing in the document. Where ever we need a single spacing the command `\singlespacing` does the job. Similarly `\onehalfspacing` and `\doublespacing` provides easy switch based mechanism to turn on or off the style of spacing desired. I made acquaintance with the `geometry` package much later in my thesis work but I wished I had done it sooner. It is an extremely powerful package which provides numerous options to control the page layout.

## 4 Laying out the Front Matter

### 4.1 Preamble

Given the above assumptions, and the objective to provide the user with control over the flexibility, the preamble looked as follows:

---

```
1 \documentclass[12pt, a4paper]{report}
2 \usepackage{graphicx}
3 \usepackage{url}
4 \usepackage{setspace}
5 \usepackage[left=1.2in, right=1in, top=1in, bottom=1in]{geometry}
6 \begin{document}
7 \pagenumbering{roman}
```

---

The standard 12 point type is used on a4paper. Two additional package seen — namely the `graphicx` — is the well know package for inclusion of graphics in to the final document. The use of `\pagenumbering{roman}` changes the default page numbering to small roman numerals in the front matter of the thesis.

### 4.2 Title Page

The title page normally requires five elements — the title of the thesis, the degree for which the thesis has been submitted, the name of the author, the department

in which the work was undertaken and the year of submission. To achieve this, we have provided a flexible alternative which is easy to understand and can be customized by anyone to meet his own requirement.

---

```
8 \begin{titlepage}
9 \vspace*{\stretch{1}}
10 \begin{center}
11 \Huge{\textsc{Title of the Thesis}} \\
12 \vspace{4em}
13 \large{Thesis Submitted To} \\
14 \vspace{2em}
15 \Large{\textsc{Name of the University}} \\
16 \vspace{1em}
17 \large{in partial fulfilment of the requirements} \\
18 \large{of the award of the degree} \\
19 \vspace{2em}
20 \Large{\textsc{Name of the Degree}} \\
21 \vspace{2em}
22 by \\
23 \vspace{1em}
24 \textbf{\textsc{Name of Candidate}} \\
25 \vspace{4em}
26 \Large{\textsc{Name of the Department}} \\
27 \Large{\textsc{Name of the University}} \\
28 \Large{Year}
29 \end{center}
30 \vspace*{\stretch{1}}
31 \end{titlepage}
```

---

This approach to title page design provides flexibility into the hands on new-bie. The new user can also customize the cover page to meet the requirement of his university by inserting logo's, or incorporating relevant information. The generous use of spaces (`\vspace{}`) allows the user to customize the placements of the various elements on the title page.

### 4.3 Other Elements of Front Matter

The other elements that would require to appear in the front matter are the table of contents, tables and figures. This process is fairly straightforward and uses the standard  $\text{\LaTeX}$  commands.

---

```
32 \tableofcontents
33 \listoftables
34 \listoffigures
35 \newpage
```

---

This brings us to the end of setting up the front matter of the thesis.

## 5 Laying out the Main Matter

Next, we turn our attention to designing the main matter. The main body of the thesis consists of the chapters and annexes, which are generally typeset in one-half or double spacing. The page numbering used is the Arabic numeral system and this continues till the end of the thesis.

Laying out the main matter, is perhaps, the easiest task in  $\text{\LaTeX}$  and is accomplished by dividing the various chapters into individual files. I have assumed that each chapter is broken into a file. Each of these chapter files being with the command `\chapter{...}` and then has the necessary material which needs to be typeset; except for the “acknowledgement” which starts with the starred version of the chapter command viz `\chapter*{...}`. This is because, we don’t want the acknowledgement to have a chapter number.

Under the assumption that there are five chapters and three annexes, we can set up the main body as follows:

---

```
36 \doublespacing
37 \include{CHAP_00}           % 0. Acknowledgement
38 \pagenumbering{arabic}
39 \part*{T H E S I S}
40 \include{CHAP_01}           % 1. Introduction
```

```

41 \include{CHAP_02}           % 2. Literature Review
42 \include{CHAP_03}           % 3. Research Methodology
43 \include{CHAP_04}           % 4. Findings and Outputs
44 \include{CHAP_05}           % 5. Conclusions
45 \part*{A P P E N D I X}
46 \appendix
47 \include{APD_01}            % Appendix I
48 \include{APD_02}            % Appendix II
49 \include{APD_03}            % Appendix III

```

---

This is all there is to set up the main body of the thesis. All a newbie has to take care is that he should remember to change the page numbering back into arabic. The `\part{}` command, in my opinion are purely decorative and may be dropped without much loss of formatting. However, keeping them in place produces a separator page with “T H E S I S” and “A P P E N D I X” written in the center, which help in demarcating the appendix from the main set of chapters.

## 6 Laying out the Back Matter

We are almost at the end of our thesis layout. In the back matter, I have made a simplifying assumption that the student has only to submit the bibliography. Bibliography can either be set up within the document or it can be done as a separate file. To produce the bibliography within the document we normally use the `\thebibliography` environment.

As this method is cumbersome and does not lead to easy use with the various bibliographical packages, this method is not recommended. It is always much better to go in for a separate bibliography file and the best way to create a bibliography file would be to use a graphical bibliography manager such as Jabref (<http://jabref.sourceforge.net/>). Once the user has created the bibliography file, it needs to be inserted in the document.

---

```

50 \newpage
51 \footnotesize
52 \singlespacing

```



```
53 \bibliographystyle{plain}
54 \bibliography{mybib}
55 \end{document}
```

---

The `\newpage` command forces L<sup>A</sup>T<sub>E</sub>X to insert a new page. The `\footnotesize` changes the default font size to a smaller font size and the `\singlespacing` turns on the single spacing for the bibliography. The `\bibliographystyle{plain}` tells L<sup>A</sup>T<sub>E</sub>X to use the `plain` bibliographical style.

L<sup>A</sup>T<sub>E</sub>X, by default provides the following four styles—`alpha` for producing a bibliography which is sorted alphabetically, the labels being formed from the name of the author and the year of publication, `unsrt` for producing bibliography similar to the `plain` style, but the entries are in the order of citation, `abbrev` for producing the abbreviated bibliography and `plain` for producing the alphabetically sorted with numerical label styles. The command `\bibliography{mybib}` tells L<sup>A</sup>T<sub>E</sub>X to use the bibliographical file named `mybib.bib`. More than one bibliography file can be used by passing on the names as arguments as shown: `\bibliography{file1,file2,...,fileN}`.

For getting the author-date citation style, more common in social sciences, it requires additional packages. Some packages that can be used to provide “author-date” citation style are `apacite` and `natbib`. All it requires is that one additional command be used in the preamble like—`\usepackage{apacite}`. As each of the packages have different ways of usage and modify the default `\cite{}` command, it is suggested that the student familiarize himself with the package before using it.

## 7 In Sum

This bring us to an end of trying to write a thesis in L<sup>A</sup>T<sub>E</sub>X. The above format is generic enough to meet many requirements and is flexible enough to meet the need’s of the advanced user and specific subjects. Packages desired for a specific discipline can be included in the preamble. Another major advantage of such an approach is that the students can work on any chapter of their choice and compile only the desired chapter. Say, for example, we are working on the chapter 3 of our hypothetical thesis. We can only compile this chapter by issuing the command `\includeonly{CHAP_03}` in the preamble.

The included zip file contains the skeleton structure of the thesis, along with the chapters. The bibliography of this article has been included. It is hoped that this article will provide encouragement to the students writing their thesis and encourage them to use L<sup>A</sup>T<sub>E</sub>X for the same.

## References

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