

# Writing a Thesis with L<sup>A</sup>T<sub>E</sub>X

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## 1 Class Examples (Command by Command)

This handout goes over using TeXWorks (Win/Mac) to create a thesis using the `isuthesis` documentclass but you can do the same thing with TeXnicCenter (Windows) or TeXShop (Macintosh) or any other L<sup>A</sup>T<sub>E</sub>X front end with only a few minor changes. The examples are done here on a step-by-step basis. So you if get lost, check this sheet. The L<sup>A</sup>T<sub>E</sub>X system, TeXnicCenter, TeXWorks or TeXShop can be downloaded from [www.tug.org](http://www.tug.org) and more information on their installation can be found at:

<http://css.ait.iastate.edu/Tex/installation.html>.

The `isuthesis` documentclass itself and installation notes for that package can be found at: <http://css.ait.iastate.edu/Tex/isuthesis.html>. Links to an online video on installing the `isuthesis` documentclass can be found at: <http://css.ait.iastate.edu/>. A full online class involving “Writing a Thesis with L<sup>A</sup>T<sub>E</sub>X” which covers most of this document’s material can be found at: [www.it.iastate.edu/training/videos/thesis/](http://www.it.iastate.edu/training/videos/thesis/).

### 1.1 Basic Thesis Setup

1. *Copy in the thesis template.* Open a Web browser and go to the following location: <http://css.ait.iastate.edu/Tex/isuthesis.html>. Right-click (Windows) or Ctrl-click (Macintosh) the **isuthesis Documentclass** link and download the zip file to your desktop.
2. *Extract the files and move your isuthesiscomplete folder to your desktop.* On a Windows system, you will need to extract the files from the archive to reveal the `isuthesiscomplete` folder. On a Macintosh system, the files should download to your Downloads folder and extract themselves, so you should just be able to move the `isuthesiscomplete` folder from your Downloads folder to your desktop.

3. *Start your L<sup>A</sup>T<sub>E</sub>X system.* On a Windows system, start TeXWorks by going under **Start** → **All Programs** → **MikTeX** → **TeXWorks**. On a Macintosh, simply click on the **TeXShop** or **TeXWorks** icons which are either on the **Dock** or in the **Applications folder**.
4. *Open the isuthesiscomplete folder and have a look around.* The main file is called thesis.tex and as long as you keep it at the same folder level as the isuthesis.cls and isutraditional.sty files then everything should work properly. The title page, abstract, acknowledgements and dedication information is contained in the **Preface** folder. The chapters of your thesis are contained in the **Body** folder. While the references area of your thesis are contained in the **Reference** folder. This template by default uses BibTeX for your bibliography.
5. *Open the file- thesis.tex.* Within TexWorks, pull down under **File** → **Open** and select the file **thesis.tex**. Take a look and see how this file is organized. The parts of your thesis are brought into the main thesis.tex file with `\include` commands from the various folders in your installation.
6. *Open the file- titlepage.tex.* Pull down under **File** → **Open** and within the Preface folder select the file **titlepage.tex**. This file contains information regarding your thesis title, your full name and additional area/departmental information. Alter this file so that it contains your correct information. Then **save and close** the *titletoc.tex* file.
7. *Compile your thesis using PDFLaTeX.* Go back to the thesis.tex document. Within TeXWorks, make sure your compiler is set to PDFL<sup>A</sup>T<sub>E</sub>X then click the **Typeset** button at the top on the far left. **Note** that you always compile your thesis.tex file. The thesis template uses a Master file system. The thesis.tex file actually brings in all the other files when it is compiled. If all goes well, a PDF file will have been created. If an error message pops up, edit the file which contains the error and then re-compile thesis.tex again with PDFLaTeX.
8. *Take a look at the result.* A PDF file named thesis.pdf should have been automatically created for you and then displayed within TeXWorks. If this didn't happen, simply double-click the thesis.pdf file on your desktop within the isuthesiscomplete folder. **Notice** that your Table of Contents, List of Tables and List of Figures are currently blank. All of these type of items in L<sup>A</sup>T<sub>E</sub>X are always one compilation behind. So

if you make a change that effects one of these thesis areas then you need to compile your thesis a second time with PDFLaTeX.

9. *Compile your thesis.tex file again with PDFLaTeX.* **Typeset** your thesis.tex document again within TeXWorks. A new thesis.pdf file should appear.
10. *Take a look at the new results.* Your Table of Contents, List of Tables and List of Figures should now have something in them. For the rest of this class, we will make changes to one chapter or part of the thesis-close that part then return to the *thesis.tex* file to re-compile the thesis and then after that take a look at the result.

## 2 Spell Checking

Within TeXWorks on a Windows system, pull down under **Edit** → **Spelling** → **en\_US** to have your spelling checked as you type. To check your spelling within TeXWorks on a Macintosh system, pull down under **Edit** → **Spelling** but by default no standard dictionary is installed. To install a standard dictionary for the Macintosh version of TeXWorks go to: <http://code.google.com/p/texworks/wiki/SpellingDictionaries> and follow the installation directions there.

## 3 A Typical Thesis Done in L<sup>A</sup>T<sub>E</sub>X

Here are some of the important parts from the standard isuthesis document-class template. Included here are the front and back portions of the thesis as well as a few select portions of some of the other chapters.

### 3.1 Thesis.tex

This is the main **thesis.tex** file. A line that starts with a % is a comment line. Comment lines which are commands can be uncommented to add or alter thesis options.

```
\documentclass[11pt]{isuthesis}
\usepackage[pdftex]{graphicx}
\usepackage{isutraditional} \chaptertitle
% Old-style, thesis numbering down to subsection
\alternate
\usepackage{rotating}
```

```

% Bibliography without numbers or labels
\usepackage{natbib}
\bibliographystyle{apa}
%\includeonly{titletoc,chapter1}
%Optional Package to add PDF bookmarks and hypertext links
\usepackage[pdftex,hypertextnames=false,linktocpage=true]{hyperref}
\hypersetup{colorlinks=true,linkcolor=blue,anchorcolor=blue,citecolor=blue,filecolor=
\begin{document}
\DeclareGraphicsExtensions{.jpg,.pdf,.mps,.png}
\include{Preface/titlepage}
% Optional thesis dedication
\include{Preface/dedication}
% Table of Contents, List of Tables and List of Figures
\pdfbookmark[1]{TABLE OF CONTENTS}{table}
\tableofcontents
\addtocontents{toc}{\def\protect\@chapapp{}} \cleardoublepage \phantomsection
\addcontentsline{toc}{chapter}{LIST OF TABLES}
\listoftables
\cleardoublepage \phantomsection \addcontentsline{toc}{chapter}{LIST OF FIGURES}
\listoffigures
% Comment out the next line if NOT using chaptertitle
\addtocontents{toc}{\def\protect\@chapapp{CHAPTER\ }}
%Optional Acknowledgements
\cleardoublepage \phantomsection
\include{Preface/acknowl}
%Optional thesis abstract
\cleardoublepage \phantomsection
\include{Preface/abstract}
\newpage
\pagenumbering{arabic}
\include{Body/chapter1}
\include{Body/chapter2}
\include{Body/chapter3}
\include{Body/chapter4}
\include{Body/chapter5}
\include{Appendix/appendix1}
\include{Appendix/appendix2}
\include{Reference/bibtex}
%\include{Reference/biblio}
\end{document}

```

## 3.2 Titlepage.tex

The `titlepage.tex` file contains title page and related information. You should update this to contain your thesis title and departmental information. Again a line that starts with a `%` is a comment line. Comment lines which are commands can be uncommented to add or alter thesis options.

```
% Template Titlepage File
\title{This is the title of a thesis
submitted to Iowa State University\\
Note that only the first letter of
the first word and proper names
are capitalized}
\author{Wilbur Terrance Johnson}
\degree{MASTER OF SCIENCE}
\major{Human Development and Family Studies (Marriage and Family Therapy)}
\level{master's}
\mprof{Susan D. Ross}
\members{Mary Jones \\ Bjork Petersen}
\notice
% Add these additional lines for a Doctoral Dissertation
%\degree{DOCTOR OF PHILOSOPHY}
%\level{doctoral}
%\format{dissertation}
%\committee{4}
%\members{Mary Jones \\ Bjork Petersen \\ Sam Anders \\ Harold Jones}
% Add these additional lines for a Creative Component
% - also comment out the \maketitle command
%\format{Creative Component}
%\submit{the graduate faculty}
\maketitle
```

## 3.3 Chapter1.tex

The `chapter1.tex` file is the first real chapter of your thesis. It normally contains an overview of how your thesis fits into the full spectrum of academic work. All the example shows is how a chapter can be divided into sections, subsections, subsubsections and beyond. Remember that like a topic outline, you should always have at least two of a subdivision for that subdivision to occur.

```
% Chapter 1 of the Thesis Template File
\chapter{OVERVIEW}
```

This is the opening paragraph to my thesis which explains in general terms the concepts and hypothesis which will be used in my thesis.

With more general information given here than really necessary.

```
\section{Introduction}
```

Here initial concepts and conditions are explained and several hypothesis are mentioned in brief.

```
\subsection{Hypothesis}
```

Here one particular hypothesis is explained in depth and is examined in the light of current literature.

```
\subsubsection{Parts of the hypothesis}
```

Here one particular part of the hypothesis that is currently being explained is examined and particular elements of that part are given careful scrutiny.

### 3.4 Chapter2.tex

The **chapter2.tex** file is normally a “Review of Literature”. The only thing really interesting in this sample chapter is that the `\cite` command is used to cite information that is contained in the bibliography. Just like the Table of Contents, List of Tables and List of Figures- cited references take something extra to correctly connect with the bibliography which we discuss later on in the Bibliographic area.

By the way, if you change a chapter title— try and make sure that it remains all in caps. So if you decide to use “Research Review” as your second chapter title then the command would be `\chapter{RESEARCH REVIEW}`. The `isthesis` documentclass does not do this automatically for you.

`\chapter{REVIEW OF LITERATURE}`

This is the opening paragraph to my thesis which explains in general terms the concepts and hypothesis which will be used in my thesis.

With more general information given here than really necessary.

`\section{Introduction}`

Here initial concepts and conditions are explained and several hypothesis are mentioned in brief.

`\cite{allen}`, `\cite{bruner}` and `\cite{cox}` did the initial work in this area. But in Struss' work~`[\cite{struss}]` the definitive model is seen.

### 3.5 Chapter3.tex

The `chapter3.tex` file contains a simple table and a simple figure without any contents in the table or figure. Table and figures are floating objects in  $\text{\LaTeX}$  which means they can float from page to page until they find enough room for placement. The standard placement options are **tbp** for **t - top**, **b - bottom** and **p - page**. In a thesis, the placement options that you normally want are **h!tb** for **h - here**, **t - top** and **b - bottom**. Generally speaking in a thesis, you want a table or figure to occur right away. The **!** option behind the **h** means that  $\text{\LaTeX}$  can cheat the page a little bit to get the table or figure onto the current page.

The `\label` command that follows the `\isucaption` commands allows you to use the `\ref` command in your text in order to reference a table or figure without knowing the table or figure number.

`\chapter{METHODS AND PROCEDURES}`

This is the opening paragraph to my thesis which explains in general terms the concepts and hypothesis which will be used in my thesis.

With more general information given here than really necessary.

```
\section{Introduction}
```

Here initial concepts and conditions are explained and several hypothesis are mentioned in brief.

As can be seen in Table~\ref{nothing} it is truly obvious what I am saying is true.

```
\begin{table}[h!tb] \centering
\isucaption{This table shows a standard empty table}
\label{nothing}
```

```
\vspace{ 2 in}
\end{table}
```

```
\subsection{Hypothesis}
```

Here one particular hypothesis is explained in depth and is examined in the light of current literature.

This can also be seen in Figure~\ref{moon} that the rest is obvious.

```
\begin{figure}[h!tb] \centering

\vspace{ 2 in}
\isucaption{This table shows a standard empty figure}
\label{moon}
\end{figure}
```

### 3.6 Chapter4.tex

The **chapter4.tex** file contains a normal table and figure. Normally a *tabular* environments occurs within a table and the `\includegraphics` command occurs within a figure.

The tabular environment makes columns of items in L<sup>A</sup>T<sub>E</sub>X. At the start of a tabular environment, you need to specify in braces the number of columns to create by using the following characters where each character will hold a space for one column: **l** - **left justified column**, **c** - **centered column**, **r** - **right justified column**. So for instance {llc} would create three columns where the first two are left-justified and the last one is centered. Then within the tabular environment, use a & to go from one column to the next and then a \\ to specify the end of a row. You can also use the \hline command to make a horizontal line at the end of a row and add | to the column identifiers to create vertical lines going down around your table.

The \includegraphics command will take any normal web graphic like a .jpg, .pdf or .png file. The PDFLaTeX compiler cannot handle .ps or .eps files so you need to convert those or use the **epstopdf** package to use .ps and .eps files in a PDFLaTeX thesis.

```
\chapter{RESULTS}
```

This is the opening paragraph to my thesis which explains in general terms the concepts and hypothesis which will be used in my thesis.

With more general information given here than really necessary.

```
\section{Introduction}
```

Here initial concepts and conditions are explained and several hypothesis are mentioned in brief.

Of course, data on this as seen in Table~\ref{data} is few and far between.

```
\begin{table}[h!tb] \centering
\isucaption{Moon Data}
\label{data}
% Use: \begin{tabular}{|lcc|} to put table in a box
\begin{tabular}{lcc} \hline
\textbf{Element} & \textbf{Control} & \textbf{Experimental} \\ \hline
Moon Rings & 1.23 & 3.38 \\ \hline\hline\end{tabular}
```

```
Moon Tides & 2.26 & 3.12 \\
Moon Walk & 3.33 & 9.29 \\ \hline
\end{tabular}
\end{table}
```

```
\subsection{Hypothesis}
```

Here one particular hypothesis is explained in depth and is examined in the light of current literature.

Or graphically as seen in Figure~\ref{mgraph} it is certain that my hypothesis is true.

```
\begin{figure}[h!tb] \centering
```

```
\includegraphics{Images/dc5}
```

```
\isucaption{Durham Centre}
```

```
\label{mgraph}
```

```
\end{figure}
```

### 3.7 Chapter5.tex

The **chapter5.tex** file contains two more unusual tables / figures that you might never actually use but that also might be very valuable if you actually need them. This includes a fullpage table which uses the **p!** placement option and a sideways table which produces a sideways page for extra wide tables and figures.

```
\chapter{SUMMARY AND DISCUSSION}
```

This is the opening paragraph to my thesis which explains in general terms the concepts and hypothesis which will be used in my thesis.

With more general information given here than really necessary.

```
\section{Introduction}
```

Here initial concepts and conditions are explained and several hypothesis are mentioned in brief.

Or graphically as seen in Figure~\ref{mgraph2} it is certain that my hypothesis is true.

```
\begin{figure}[p!] \centering
```

```
\includegraphics{Images/dc5}
```

```
\isucaption{Durham Centre--- Another View}
```

```
\label{mgraph2}
```

```
\end{figure}
```

```
\subsection{Hypothesis}
```

Here one particular hypothesis is explained in depth and is examined in the light of current literature.

As can be seen in Table~\ref{nothingelse} it is truly obvious what I am saying is true.

```
\begin{sidewaystable} \centering
```

```
\isucaption{This table shows almost nothing but is a sideways table and takes up a whole page by itself}
```

```
\label{nothingelse}
```

```
% Use: \begin{tabular}{|lcc|} to put table in a box
```

```
\begin{tabular}{lcc} \hline
```

```
\textbf{Element} & \textbf{Control} & \textbf{Experimental} \\ \hline
```

```
Moon Rings & 1.23 & 3.38 \\
```

```
Moon Tides & 2.26 & 3.12 \\
```

```
Moon Walk & 3.33 & 9.29 \\ \hline
```

```
\end{tabular}
```

```
\end{sidewaystable}
```

## 3.8 Bibliography

### 3.8.1 Bibtex.tex

The standard isuthesis template uses a Bibtex bibliography. The file is named **bibtex.tex** but the contents of the files are very simple:

```
\renewcommand{\bibname}{\centerline{BIBLIOGRAPHY}}
\unappendixtitle
\newpage
\phantomsection
\addcontentsline{toc}{chapter}{BIBLIOGRAPHY}
\bibliography{Reference/mybib}
```

The `\bibliography{Reference/mybib}` refers to the file `mybib.bib` which is your Bibtex bibliography. An earlier line in the `thesis.tex` file `\thebibliography{apa}` informs Bibtex as to what sort of bibliography to produce. Bibtex looks at all the `\cite` commands in your thesis and produces the type of bibliography specified using the citations that were cited.

To produce a bibliography with Bibtex, one must use the Bibtex compiler on your main `thesis.tex` file (which may initially produce an error message) then Bibtex your reference file **mybib.bib**. After all that simply go back and PDF $\LaTeX$  your main `thesis.tex` file twice. You have to do this procedure any time that you update your references. It sounds like a lot of work but Bibtex also does a lot of work for you in creating a well-formatted bibliography.

The **mybib.bib** file needs to contains references for all cited material. People who use  $\LaTeX$  tend to create one `mybib.bib` file that they use all the time as Bibtex only uses the cited material within any paper or dissertation to create the Bibliography.

Here is what the **mybib.bib** file actually looks like:

```
@mastersthesis{struss,
  AUTHOR = "Joseph A. Struss",
  TITLE = "An investigation of the sequence of utilizing a
          simulation in an introductory programming course",
  SCHOOL = "Iowa State University",
  YEAR = 1996}
@book{bruner,
  AUTHOR = "J. Bruner",
  Title = "The process of education",
  PUBLISHER = {Random House},
```

```
ADDRESS = {New York},
YEAR = 1960}
```

More information on the format of the .bib file can be found on Wikipedia: <http://en.wikipedia.org/wiki/BibTeX>. But it is not an overly difficult format to figure out.

You can find many .bib entires for Bibtex bibliographic citations on Google. For more information on this, go to: <http://amath.colorado.edu/documentation/LaTeX/reference/faq/bibstyles.html>

Many people also use *Endnote* bibliographic software package to create their bibliography. For information on using Endnote with L<sup>A</sup>T<sub>E</sub>X go to: <http://www.rhizobia.co.nz/latex/convert.html>

### 3.8.2 Biblio.tex

If you wish to use thebibliography environment instead on Bibtex, just changed the last include of your thesis to `\include{Reference/biblio}`. The **biblio.tex** file contains a standard old-style L<sup>A</sup>T<sub>E</sub>X Bibliography. The item in brackets after the `\bibitem` is what is returned when an item is cited by a cite call with the label in braces that follows the bracketed item. For instance, if you use the command `\cite{allen}` then L<sup>A</sup>T<sub>E</sub>X would reference the bibitem with the *allen* label and return **Allen, B. S. (1984)**.

```
\renewcommand{\bibname}{\centerline{BIBLIOGRAPHY}}
\unappendixtitle
\interlinepenalty=300
% For no page break use thebibnopcode environment
\begin{thebibliography}{99}
\addcontentsline{toc}{chapter}{BIBLIOGRAPHY}

\bibitem[Allen, B.~S.~(1984)]{allen}
Allen, B.~S. (1984). System-assigned learning strategies and CBI.
\emph{Journal of Instructional Computing Research},
\emph{1}(1), 3--18.
\filbreak
\end{thebibliography}
```

## 4 More Information

The complete isuthesis documentclass manual is available at:  
<http://css.ait.iastate.edu/Tex/Tex/isuthesis.pdf>  
for more specific thesis information.

An online instructional video for the isuthesis documentclass is also available from: <http://css.ait.iastate.edu/>.