

EXAMPLE OF A THESIS
FORMATTED WITH L^AT_EX
USING THE GEORGETOWN UNIVERSITY
STYLE MACRO PACKAGE, VERSION 3.4

A Thesis
submitted to the Faculty of the
Graduate School of Arts and Sciences
of Georgetown University
in partial fulfillment of the requirements for the
degree of
Master of Science
in Computer Science

By

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Washington, DC
December 15, 2010

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Thesis Advisor: Abraham Baldwin

ABSTRACT

This is the abstract, a brief summary of the contents of the entire thesis. It is limited to 350 words.

The abstract page(s) are not numbered and are not necessarily included in the bound copies. Likewise, the signature page is not counted in page numbering because not all copies contain it.

Throughout this sample thesis, **please note that the layout obtained with L^AT_EX is not meant to be a perfect duplicate of the Microsoft Word examples in the *Graduate School Style Manual*.** L^AT_EX has additional typographic tools at its disposal, such as SMALL CAPITALS and various subtle adjustments of spacing, which are used by the Georgetown L^AT_EX style sheet in accordance with the standard practices of the book-printing industry.

The index words at the bottom of the abstract should be chosen carefully, preferably with the help of one or two of your colleagues. They are the words by which people will find your thesis when searching the scientific literature. If you want to get credit for your ideas, be sure to choose a good set of index words so that people doing related work will know about yours.

INDEX WORDS: Word processing, Computer typesetting, Computer graphics,
 Style sheets, Typography, Dissertations, Theses (academic)

DEDICATION

The Dedication is optional, but if it is included, it should have a roman numeral page number but not be included in the table of contents. To achieve that, we declare it as a `\chapter*` in L^AT_EX.

ACKNOWLEDGMENTS

In a real thesis, this section would contain acknowledgments such as, “This work was funded by National Science Foundation Grant Number AAA-00-00000 (Benjamin Franklin, Principal Investigator),” and “I would like to thank John Doe for helping me proofread my thesis and Mary Roe for drawing my graphs.”

The acknowledgments are included in the table of contents but do not have a chapter number. To achieve that, we declare them to be a `\pseudochapter` (which is defined only in `guthesis.sty`).

I (Mark Maloof) would like to thank Michael Covington for developing this L^AT_EX style sheet for the University of Georgia. Zachary Hunter deserves special thanks for revising the UGA style file to work with the new version of L^AT_EX (2e) as well as the previous version (2.09). The revisions in Version 3.0 of `guthesis.sty` are largely the work of Isidor Ruderfer. Other credits appear in the style sheet itself.

PREFACE

If your thesis has a preface, this is where it goes. A preface is not an introduction, and most theses do not need them.

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CHAPTER 1

WHAT L^AT_EX IS ALL ABOUT

This document is an example of how to format a thesis or dissertation using L^AT_EX and get results acceptable at Georgetown University.

L^AT_EX (with its parent T_EX) has two major advantages for academic use. First, to a remarkable degree it makes design decisions automatically. The author supplies only the words of a text, and L^AT_EX places them on the page in an aesthetic manner, avoiding rivers and awkward breaks. In this respect L^AT_EX is like a very intelligent typist or typesetter.

Second, L^AT_EX can typeset complex mathematical formulas such as

$$\sum_{i=1}^{\infty} x^{y+z} = \frac{p+q+r}{s+t+u+v}$$

both displayed (as shown above) and in the text, as in $\sum_{i=1}^{\infty} x^{y+z} = \frac{p+q+r}{s+t+u+v}$. This makes T_EX and L^AT_EX indispensable for mathematicians, physicists, and the like.

L^AT_EX also has built-in formats for other kinds of displayed material such as verse,

Freude, schöne Götterfunken
Tochter aus Elysium,
Wir betreten, feuertrunken,
Himmlische, dein Heiligum!
Deine Zauber binden wieder
Was der Mode streng geteilt...

and direct quotations:

The society that scorns excellence in plumbing, because plumbing is a humble activity, and tolerates shoddiness in philosophy, because philosophy is an exalted activity, will have neither good plumbing nor good philosophy. Neither its pipes nor its theories will hold water.

— John Gardner, *Excellence*

If you wish, quotes and other displayed material can be single-spaced; here is an example of how that is achieved:

Yes, I wrote “The Purple Cow.”
I’m sorry now I wrote it.
But I can tell you anyhow
I’ll kill you if you quote it!

— Anonymous?

Well, maybe it’s not as anonymous as it looks.

Computer scientists use LaTeX’s “verbatim” format to display portions of computer programs in text, like this:

```
1  GO TO 2
2  GO TO 1
3  PRINT "THIS STATEMENT WILL NEVER EXECUTE"
4  END
```

There you have it.¹

Whenever you quote parts of a computer program in English text, they should be set off by using typewriter type. The `PRINT` statement in the program above will never execute because the `GO TO` statement above it keeps execution from reaching it.

¹This is a footnote. Notice that footnotes are single-spaced even though the text is double-spaced. Long footnotes are discouraged; either make important points in the text or leave them out.

CHAPTER 2

FIVE IMPORTANT NOTES

2.1 L^AT_EX IS NOT A TYPEWRITER — NOR AN ORDINARY WORD PROCESSOR

The format that you get with L^AT_EX is more elegant than the simpler format in the Graduate School style manual and is not intended to match it perfectly.

L^AT_EX makes available to you *all* of the tools of fine book printing. For example, L^AT_EX has more degrees of vertical spacing available than other word processors do, and it uses them effectively. Likewise, L^AT_EX provides SMALL CAPITALS for situations where other software would only provide ALL CAPITALS.

The format produced by `guthesis.sty` has been reviewed by the Graduate School. If your thesis fails the format check, make sure you have followed the instructions for `guthesis.sty` (contained in the file `gusample.tex`) and the instructions for L^AT_EX.

2.2 YOU CAN'T DO WITHOUT THE BOOK!

You are not expected to be able to use L^AT_EX without a manual. Don't even try — you'll waste a lot of time. The definitive manual for L^AT_EX is:

Lamport, Leslie (1994) *L^AT_EX: A Document Preparation System*. 2nd ed.
Reading, MA: Addison-Wesley.

Alternatively, there is a good manual available on line whose author is named Oetiker. There are several versions. Use a search engine to search for “LaTeX Oetiker” and you'll find it.

2.3 THE `guthesis.sty` STYLE SHEET ADDS TO L^AT_EX BUT DOES NOT REPLACE IT

“How do I do so-and-so in `guthesis.sty`?” Almost always the same way as in plain L^AT_EX. The Georgetown University style sheet, called `guthesis.sty`, adds features to L^AT_EX; it does not take away what is already there.

2.4 RAGGED RIGHT MARGINS ARE OPTIONAL

This section is typeset in “ragged right” format, in which L^AT_EX has been told not to force a straight right margin.

“Ragged right” is preferable if your thesis contains a large number of words likely to be hyphenated incorrectly, formulas, web addresses, or the like. To get it, put the two lines

```
\raggedright
\parindent 0.25pt
```

anywhere after the `documentclass` command and before `\begin{document}`.

You can also reduce the amount of hyphenation, without eliminating it totally, by following the instructions in the L^AT_EX manual.

2.5 PLEASE LET L^AT_EX DO THE LAYOUT...

Please do not use `\vspace`, `\hspace`, and other T_EX commands that specify the precise location or spacing of items on the page. Leave the layout to L^AT_EX and `guthesis.sty`. Otherwise, very ugly things can happen.

Your thesis is like a volume in a series. It should look like the other theses and dissertations that were typeset using the same technology. Just as different volumes

of the *Encyclopaedia Britannica* have exactly the same margins and typography, so should different theses from the same university, as far as technology permits.

2.6 PLEASE USE FLOATING FIGURES AND TABLES...

Please use the `figure` and `table` environments for your figures and tables. A picture or table should not interrupt the text the way a mathematical formula does. Instead, it should “float” to the nearest convenient location—which L^AT_EX will take care of automatically—and should be identified by number.

CHAPTER 3

FREQUENTLY ASKED QUESTIONS ABOUT TYPING GEORGETOWN THESES WITH \LaTeX AND `guthesis.sty`

3.1 \LaTeX ITSELF

3.1.1 WHAT IS \LaTeX ?

\LaTeX , by Leslie Lamport, is an extension of \TeX , the computer typesetting system designed by Donald Knuth. This software system is used to typeset books, journals, papers, and theses in the mathematical sciences. Knuth and Lamport had two goals in designing it:

- To use the computer to equal the quality of the best conventional typesetting. No longer does “word processing” mean “a poor substitute for real printing.”
- To separate the jobs of the *author* and the *typesetter*.

Other word processors turn the screen into a blank piece of paper and let you type on it. \LaTeX is not your *typewriter*, it’s your *typist*. For example, to mark the beginning of a chapter, you type something like this:

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

and \LaTeX automatically determines what a chapter heading should look like. It does this by consulting a *style sheet*. You do not have to worry about whether you’ve hit Enter the same number of times at the beginning of each chapter, or whether all the

chapter headings are centered and the margins are correct. That’s the (automated) typist’s job.

3.1.2 HOW IS “L^AT_EX” PRONOUNCED?

The X in T_EX is actually a Greek chi, with the sound of *ch* in Scottish *loch* or German *ach*. Thus, T_EX is pronounced “tekh.” It is short for Greek *tekhnē* “art, craft.”

L^AT_EX is pronounced “lah-tekh” in the Northeast, “lay-tekh” in England and the South, and several different ways in the West.

3.1.3 WHAT’S IT LIKE TO RUN L^AT_EX?

L^AT_EX is *not* a single integrated piece of software. It has several parts. The normal process for typing and printing a paper is as follows. On finding an error or discovering that a change is needed, you can go back to any earlier step at any time.

1. Use a text editor (Windows Notepad or whatever text editor you like) to type your document on a file whose name ends in `tex`.
2. Go to a command prompt and run `latex` to create a `.dvi` file.
3. Optionally, preview the `.dvi` file on-screen. Some of us skip this step.
4. Run `dvipdf` to convert the `.dvi` file to PDF.
5. Use Adobe Reader to view the PDF file and print it, if desired.

3.1.4 WHO BENEFITS THE MOST FROM USING L^AT_EX?

Those who need to typeset mathematical formulas or computer programs; those whose theses are likely to be published by a book publisher; and those who plan to submit their theses electronically.

3.1.5 WHO SHOULD *not* USE L^AT_EX?

If you consider yourself a “computer dummy” and can use only the simplest software, or if you do not have the time or patience to learn a new set of technical skills, you won’t like L^AT_EX. On the other hand, you probably will not type your thesis correctly with a conventional word processor either. (Let’s face it, typing a thesis correctly is a technical challenge, no matter what software you do it with!) You should hire a typist.

3.2 L^AT_EX VERSIONS

3.2.1 WHAT ARE MIK_TE_X, EM_TE_X, TE_TE_X, ETC.?

These are implementations of L^AT_EX for particular computers, incorporating Knuth and Lamport’s original computer programs plus various tools to make them easier to use or more versatile. All of them are 100% compatible with the original L^AT_EX.

3.2.2 IS THERE L^AT_EX FOR MACINTOSH, LINUX, AMIGA, SUN, BEBOX...?

Yes. L^AT_EX has been ported to a huge variety of computers and produces *identical* output on all of them, using *identical* file formats. If you have Linux, you almost certainly already have L^AT_EX.

3.2.3 WHAT IS L^AT_EX 2_ε?

The version of L^AT_EX that has been in use for the last several years. It was preceded by L^AT_EX 2.09. Those are the only two version of L^AT_EX that have been distributed widely. There will eventually be a L^AT_EX 3, but not very soon.

3.2.4 WHERE DO I GET L^AT_EX?

You can download it free of charge from various sites; Be careful about Googling L^AT_EX. It's best to go to the T_EX Users Group web site: <http://www.tug.org>.

3.2.5 WHERE IS THE DOCUMENTATION FOR L^AT_EX?

In the book *LaTeX: A Document Preparation System*, by Leslie Lamport, 2nd edition, published by Addison-Wesley. **You must buy this book.** Other books about L^AT_EX are useful but are not the official guide.

3.2.6 WHERE CAN I GET HELP WITH L^AT_EX?

First, read Lamport's book. *You cannot get along without it.*

Second, you can ask questions on the newsgroups `comp.text.tex` (international).

Third, if you have problems that are specific to `guthesis.sty`, and particularly if `guthesis.sty` does not appear to be meeting Georgetown's thesis format requirements, please contact me (Mark Maloof, maloof@cs.georgetown.edu).

3.3 THE GEORGETOWN UNIVERSITY STYLE SHEET

3.3.1 WHAT IS `guthesis.sty`?

A style sheet for L^AT_EX that makes it follow the format for Georgetown University theses and dissertations.

3.3.2 WHERE DO I GET `guthesis.sty` AND HOW DO I INSTALL IT?

Download it from <http://www.cs.georgetown.edu/academics/guthesis.zip>.

Install it by putting it in the same directory as your thesis, or in directory `texmf/tex/latex` of your T_EX system.

3.3.3 HOW DO I USE `guthesis.sty`?

For a quick summary, see Fig. 3.1. For details, see the file `gusample.tex`. For a skeleton document, see the file `template.tex`.

3.3.4 DO I HAVE TO GET `guthesis.sty` BEFORE TYPING MY THESIS?

No. You can type your thesis using the L^AT_EX `report` documentclass (described in Lamport's book); this will enable you to produce neat, single-spaced copies of the work in progress. When it's finished, get `guthesis.sty` and make the small additions to your thesis that are described there.

3.3.5 WHAT ARE THE REQUIRED PARTS OF A THESIS TYPED WITH `guthesis.sty`?

They are described in `guthesis.sty` itself, which you can read with your text editor. Alternatively, you can use `gusample.tex` as sample to imitate.

3.4 TROUBLESHOOTING

3.4.1 WHY IS THE TEXT TOO HIGH OR LOW ON THE PAGE?

See Appendix A, p. 30.

3.4.2 WHY IS THERE A SPACE BEFORE A FOOTNOTE NUMBER?

If your footnote numbers come out positioned like this ⁸ rather than this⁸, it's because you're leaving a space before the `\footnote` command.

Type like this. `\footnote{Here's the note.}`
Not like this. `\footnote{Here's the note.}`

A useful trick is to put `%` at the end of one line (to comment out all the remaining blank space) and then `\footnote` at the beginning of the next line.

```

\documentclass[12pt]{report}
\usepackage{guthesis}

% The following 2 lines are OPTIONAL to turn off all hyphenation
% and print with "ragged" right margins
\raggedright
\parindent 0.25in

\title{Title of Thesis \\\
      Broken into Lines \\\
      As Appropriate}

\fulltitle{Title of Thesis Not Broken Into Lines}

\author{Your Name Here}

\previousdegree{B.A., Name of University, 1977 \\\
               M.S., Some Other University, 1978}

\thisdegree{Master of Science} % or Doctor of Philosophy, etc.
\thesistype{Thesis}           % or Dissertation
\thisday{5}                   % put the day of defense or approval here...
\thismonth{May}               % put the month of defense or approval here...
\thisyear{2005}               % put the year of defense or approval here...

\indexwords{keywords for indexing your thesis in library catalogs}

\professor{Abraham Baldwin}   % Major Professor
\secondprofessor{Alonzo Church} % Co-Major Professor if you have one
\memberi{Benjamin Franklin}   % Committee member
\memberii{Isaac Newton}       % Committee member
% Use \memberiii, \memberiv, \memberv for up to 3 more members if needed.

\dean{Timothy A.\ Barbari}    % Dean of the Graduate School

\begin{document}
\pagenumbering{roman} % Use Roman numerals until chapters start.

\begin{abstract}
Text of abstract goes here.
\end{abstract}

\maketitle % Creates title page, copyright page if any, and approval page.

\chapter*{Dedication}
Dedication, if any, goes here.
It is a "\chapter*" so it is not in the table of contents.

\pseudochapter{Acknowledgments}
Text of acknowledgments goes here.
It is a "\pseudochapter" so it goes in the table of contents but has no chapter number.

\tableofcontents
\listoffigures % Optional - Omit this line if you don't want a list of figures.
\listoftables % Optional - Omit this line if you don't want a list of tables.

\newpage
\pagenumbering{arabic} % Ordinary pages have Arabic numerals.

\chapter{Title of Chapter Goes Here}
Text of first chapter goes here.

\chapter{Title of Chapter Goes Here}
Text of second chapter goes here.

\appendices % Indicates that appendices follow. If there's only one, use \appendix instead.

\chapter{Title of First Appendix}
Text of first appendix goes here.

\chapter{Title of Second Appendix}
Text of second appendix goes here.

\bibliographystyle{plainnat}
\bibliography{thesis} % Pulls entries from thesis.bib

\end{document}

```

Figure 3.1: Template for formatting a thesis with `guthesis.sty`.

3.4.3 WHY IS MY TABLE OF CONTENTS BLANK OR INCORRECT?

You must run \LaTeX twice in order to get a correct table of contents. The first time, it keeps records of where things are; the second time, it actually generates the table of contents. If the table of contents is long, you may need to run \LaTeX three times to ensure that adequate space is left for it.

3.4.4 WHY IS THERE TOO MUCH SPACE AFTER SOME OF THE PERIODS?

\LaTeX normally assumes that every period marks the end of a sentence, so it leaves extra space after it. You should normally use a required space (`~`) after every period that does not mark the end of a sentence. Type “`T.~S.~Eliot`” to print “T. S. Eliot” or the like.

Beginning with `guthesis.sty` version 2.0 (December 2001), this is no longer a problem because `guthesis.sty` tells \LaTeX not to treat periods specially; the same amount of space follows each word whether or not it ends with a period. This is known as “French spacing” and is an accepted practice in the printing industry.

3.4.5 WHY DO SOME WORDS HANG OUT PAST THE RIGHT MARGIN?

When \LaTeX cannot break a line satisfactorily, it leaves a word sticking out into the margin and gives you an “Overfull hbox” error message. It is up to you to rearrange the text so that it fits.

3.4.6 WHAT IS AN OVERFULL HBOX?

See previous question.

3.4.7 WHAT IS A “PACKAGE HYPERREF WARNING”?

Most people now use the `hyperref` package to generate hyperlinks to their chapters and sections in the eventual PDF output.

This is good, but `hyperref` complains violently if there is anything other than plain text in a section title. It also complains if you use `\pseudochapter`. Just ignore the warnings.

3.5 CHARACTER SET AND TYPOGRAPHY

3.5.1 HOW DO I TYPE A PERCENT SIGN?

See Lamport’s book. A quick answer: Type “`\%`”.

3.5.2 HOW DO I TYPE A TILDE (\sim)?

This character often occurs in web addresses. In \LaTeX , when you type “`~`” you get a blank. (Specifically, you get a “required space,” a space that cannot be broken across a line break.) To get “ \sim ” type “`\sim`”. Also see the `url` package, which lets you write `\url{http://www.cs.georgetown.edu/~maloof}`, typeset as `http://www.cs.georgetown.edu/~maloof`.

3.5.3 WHAT ARE *italics* USED FOR?

All of the things that would be underlined in a handwritten document, including titles of books, foreign words, and the like.

In linguistics, it is normal to put foreign words in italics and their definitions in single quotes. For example, Agatha Christie’s famous detective is named after the French word *poireau* ‘leek’.

3.5.4 WHAT IS UNDERLINING USED FOR?

Almost nothing. Roman type is not normally underlined; use italics instead.

3.5.5 WHAT IS **typewriter type** USED FOR?

Computer program languages, whether displayed or quoted in text. For example, here is part of a program written in C:

```
for ( i = 100; i > 0; i-- ) {  
    printf("%d bottles of beer on the wall...\n", i);  
}
```

It demonstrates how to use the **for** statement to count down from 100 to 1.

3.5.6 WHAT IS THE **verbatim** ENVIRONMENT USED FOR?

Computer programs, as just demonstrated.

3.5.7 WHAT IS **sans-serif type** USED FOR?

Almost nothing except labels within illustrations.

3.6 BIBLIOGRAPHIES

3.6.1 HOW DO I TYPE THE BIBLIOGRAPHY?

See Lamport's book [4] and the examples in `gusample.tex`. \LaTeX lets you refer to bibliography items in your text with markers such as `\cite{lamport.94}`. then have \LaTeX automatically turn these into bracketed numbers in the bibliography.

With `guthesis.sty`, simply use the `thebibliography` environment exactly as Lamport describes it. This will produce a bibliography in the form of an unnumbered chapter at the end of your thesis.

3.6.2 WHAT IF EACH CHAPTER HAS ITS OWN BIBLIOGRAPHY?

If you have bibliographies at the ends of the individual chapters, use the environment `chapterbibliography` instead of `thebibliography`. It works *exactly* the same way except that the bibliography becomes a normally numbered section, not an unnumbered chapter. There is an example of this in `gusample.tex`.

The `chapterbibliography` environment is provided by `guthesis.sty`.

3.6.3 WHAT IF I DON'T LIKE BRACKETED NUMBERS?

Here is an example of a trick to get \LaTeX to print a bibliography without bracketed numbers. Basically, you are telling \LaTeX to put the author's name in place of the bracketed number. Note that this involves using `\item` rather than `\bibitem`.

```
\begin{thebibliography}{}

\item[Covington, Michael A.]
\emph{Natural Language Processing for Prolog Programmers.}
Englewood Cliffs, N.J.: Prentice Hall, 1994.

\item[O'Keefe, Richard A.]
\emph{The Craft of Prolog.}
Cambridge, MA: MIT Press, 1991.

\end{thebibliography}
```

When doing this, don't use the `\cite` command; instead, handle your references manually. You can do *exactly* the same thing with `chapterbibliography`.

3.7 LAYOUT AND ILLUSTRATIONS

3.7.1 HOW DO I TURN OFF JUSTIFICATION?

Justification means printing with a straight right margins. It is not required for Georgetown University theses, and if your text contains many formulas, web addresses, or other unbreakable items, you may get considerably neater results by turning it off. To do this, issue the command

`\raggedright`

immediately after `\begin{document}`.

You may need to turn off justification only within a bibliography. In that case, you should put the `\raggedright` command right after `\begin{thebibliography}` or right after `\begin{chapterbibliography}` as the case may be. It will then affect only the bibliography.

3.7.2 HOW DO I PUT A PICTURE INTO MY THESIS?

See Lamport's book. Here's the basic process...

1. Learn the difference between a vector ("draw") program and a bitmap ("paint") program. Vector programs, such as xfig, OpenOffice Draw, Corel Draw, and Micrografx Windows Draw, tell the computer to draw lines at particular positions; they are the right tool for generating diagrams of all types. Bitmap programs are *only* for working with digitized photographs and the like; their output has an unpleasant stairstep appearance when enlarged or resized.
2. Produce professional-quality artwork. (You may want to hire a professional illustrator.) Artwork in your thesis should look as good as the artwork in published books.

3. Save your artwork as an encapsulated PostScript (EPS) file *with no TIFF header*. (The drawing software may ask you whether you want a TIFF header; say no.)
4. Use the **graphics** package (described in Lamport's book) or the **epsf** package to incorporate your art into your L^AT_EX document. One way to do this is as follows:
 - (a) Add the command `\usepackage{graphicx}` right after `\documentclass`.
 - (b) Use the command `\centerline{\includegraphics{xxxxxxx.eps}}` (with the appropriate filename substituted) to put the picture in your document. Normally this will be within a **figure** environment as described in Lamport's book.

3.7.3 HOW DO I PUT A WINDOWS SCREEN SHOT INTO MY THESIS?

When writing about software, you may need a picture of the computer screen with a program running. Under Windows 95 and up, you can “take a picture” of the screen, by pressing Print Screen (or Alt-Print Screen if you only need the current window). This puts a copy of the screen into the Windows clipboard. Then open up your favorite paint program (bitmap program) and choose Paste. Edit the picture to your satisfaction, save it, and export it as encapsulated PostScript. For the rest of the process, see the previous question.

CHAPTER 4

THE CRAFT OF SCHOLARLY TYPING

4.1 AN EXHORTATION

If you have come to the University for a graduate degree, scholarly writing is one of the crafts in which you are being trained. This includes scholarly typing and word processing. We assume that you will be writing about your subject for the rest of your life. This is more likely to be true than you realize.

L^AT_EX provides you with all the tools of fine book printing. This includes quite a few things that were not available on typewriters. Accordingly, when using L^AT_EX, you must learn some new things about printed language.

4.2 SOME COMMON PUNCTUATION ERRORS

4.2.1 HYPHENS AND DASHES

L^AT_EX distinguishes four kinds of horizontal lines between characters.

- The minus sign, $-$ (typed `$-$`), is used only in math mode. Always go into math mode when you want to mark a number as negative.
- The hyphen, `-` (typed `-`), is used between parts of a word, as in “so-called” or “heavy-handed.”
- The short dash (en dash), $-$ (typed `--`), goes between numbers in sequences, as in “1861–65.”

- The long dash (em dash), — (typed ---), goes between parts of sentences and may be set off by spaces — like this. In good writing, it is uncommon; as alternatives, consider using a semicolon or starting a new sentence.

4.2.2 QUOTATION MARKS

In L^AT_EX you must type your quotation marks ‘‘like this’’ in order to get them to print correctly “like this.” It is not correct to type "like this."

Periods and commas “slide under” quotation marks so that they adhere to the words within them. Correct usage looks “like this.” Incorrect usage looks “like this”.

In computer science and linguistics, this rule sometimes does not apply, because it may be important to show that the period or comma is not part of the quoted material. If you cannot get around this by rearranging the sentence, it is acceptable to put the period or comma outside the quotes.

Single quotation marks (‘like this’) are used in linguistics to give the meanings of words. Thus, French *chateau* ‘castle’ comes from Latin *castellum* ‘fortress.’

4.2.3 PUNCTUATION AROUND MATHEMATICAL FORMULAE

Do not let the punctuation of your sentence intrude into a displayed mathematical formula. When a sentence ends with a displayed formula, end the sentence with a colon. Thus we conclude:

$$a = \sum_{x=1}^{\infty} p(x) = q(x)$$

The formula does not end with a period.

A picture could go here.

Figure 4.1: This is an example of a figure.

4.3 KNOWING THE CHARACTER SET

Part of knowing your subject is knowing its notation. If you are vague on the difference between \emptyset and ϕ , or ω and w , consult some well-produced reference books (not scruffily typed conference papers).

Remember that in good printing, *underlining is almost never used*. Underlining is the handwritten way of indicating italics. Now that you have italics, use them. Instead of wavy underlining (for vectors, etc.), use boldface.

4.4 FIGURES AND TABLES

In a well-produced book, figures and tables do not interrupt the text like mathematical formulae. Instead, they “float” to the nearest convenient location and are identified by number. If there is no convenient place at the top or bottom of a page, they are placed on a separate page.

See Lamport’s book to learn how to control the placement of figures and tables. Nothing is added or changed by `guthesis.sty` — L^AT_EX still works exactly the way Lamport says.

Near here, you will see Figures 4.1 and 4.2. Note that each picture’s caption comes below it. That is achieved by putting the `\caption` command *after* the figure.

Near here, you will also see Table 4.1. Its caption comes above it. This is achieved by putting the `\caption` command *before* the table.

A picture could go here.

Figure 4.2: This is another example of a figure.

Table 4.1: Some institutions and their mascots.

Institution	Location	Mascot
University of Georgia	Athens	Bulldawg
Georgetown University	Washington	Bulldog
Georgia Tech	Atlanta	Insect
UCSC	Santa Cruz	Banana Slug

CHAPTER 5

MORE NONSENSE ABOUT L^AT_EX

In this chapter, we talk about more L^AT_EX things. Suspendisse potenti. Proin justo lorem, rutrum ac, facilisis in, malesuada sed, ligula. Mauris lobortis lacus at nibh. Aenean vitae odio vel odio placerat hendrerit. Suspendisse lacus lacus, tempor id, pharetra eget, ornare sit amet, pede. Sed aliquet, justo ac elementum pretium, arcu leo placerat est, a luctus purus diam eget arcu. Nam augue diam, mollis a, scelerisque eget, aliquet condimentum, pede. Vestibulum tristique lectus sed augue.

5.1 INTRODUCTION

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posuere tortor. Sed tristique, odio at luctus facilisis, nulla quam rhoncus tortor, at congue lacus elit nec metus. Sed tempor sapien ut elit. Donec ac turpis feugiat nisi porta vehicula.

5.2 PROBLEM STATEMENT

This is a test. Blah, blah, blah. $\Pr(A) = \Pr(A) + \Pr(B|A)$. We discuss this issue in Section 5.5.1. Indeed, we have

$$\sum_{k=1}^n f(k) ,$$

where $f(k)$ is my favorite function.

5.3 RELATED WORK

Lorem ipsum dolor sit amet, consectetur adipiscing elit [1]. Phasellus non erat eu dui dignissim dictum. Integer iaculis nulla at nisl [2]. Proin ut enim non ipsum varius laoreet [5, 7]. Integer feugiat, ante fringilla blandit convallis, leo sapien egestas velit, non condimentum nulla sem vitae risus. Mauris aliquam auctor quam. Sed ac enim. Donec mattis dui id ligula. Integer vel sem eget ante cursus tristique. Nullam vel orci vitae sem interdum placerat. In eget lectus. Donec blandit. Quisque lacus urna, malesuada vel, mollis sit amet, rutrum nec, est. Proin blandit ornare nibh. Duis et felis [6].

5.4 APPROACH

Here is an example of code:

```
int main()
{
    cout << "testing" << endl;
```

```
    return 0;
} // main
```

Text. Plain text. *Emphasized text.* *Italicized text.* **Boldfaced text.** `typewriter text.` Large text. Our results appear in Table 5.1. In their paper [5], they discuss a lot of interesting things.

Em dash — which is followed by an en dash – and then we have eloquently-hyphenated words, which are not to be confused with the minus sign: −. All are different [8].

Here is a quote:

Ask not what your country can do for you. Ask what you can do for your country.

In Figure 5.1, we present an algorithm for finding the minimum component of a vector. But there are other ways to present algorithms. Some have started using the `algorithm` and `algorithmic` packages. See Algorithm 5.4 as an example. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Nam iaculis, felis nec semper malesuada, quam metus placerat ligula, id euismod purus eros eget justo. Pellentesque ipsum. In hac habitasse platea dictumst. Ut pede pede, sagittis sit amet, dapibus eu, tristique in, ipsum [3].

Paragraph. Something you may never use, kind of like Latin.¹ Aliquam fermentum velit tristique turpis. Mauris mollis dapibus purus. Quisque vulputate ullamcorper purus. Quisque aliquam rhoncus felis. Aenean fringilla mattis mi. Ut ut massa a sem fermentum venenatis. Fusce ut risus. Maecenas ut nisl. Praesent felis erat, tincidunt ac, placerat vel, sodales vel, justo. Vivamus semper sollicitudin est. Morbi id eros eu tellus dignissim viverra [1].

¹And footnotes.

Algorithm (\vec{x})

\vec{x} : vector of numbers
 i : index of minimum value
 min : minimum value

```

1.   $m \leftarrow \infty$ 
2.  for  $j \leftarrow 1, \dots, n$                                 // Loop over components
3.      if ( $\vec{x}_j < min$ )
4.           $min \leftarrow \vec{x}_j$ 
5.           $i \leftarrow j$ 
6.      end;
7.  end;
8.  return  $i$ 
end.

```

Figure 5.1: Algorithm for finding the minimum component of a vector.

[tb] [1] **Input:** $\{\vec{x}_t, y_t\}_{t=1}^T, w, \theta$

$\{\vec{x}_t, y_t\}_{t=1}^T$: training data w : window size for the reactive learner θ : threshold for creating a new stable learner

Let S be a stable learner Let R_w be a w -reactive learner Let C be a circular list of w bits, each initially 0 $t \leftarrow 1$ **to** T $\hat{y}_S \leftarrow S.\text{Classify}(\vec{x}_t)$ **output** \hat{y}_S $\hat{y}_R \leftarrow R_w.\text{Classify}(\vec{x}_t)$ $\hat{y}_S \neq y_t \wedge \hat{y}_R = y_t$ $C.\text{set}(t)$ $C.\text{unset}(t)$ $\theta < C.\text{proportionOfSetBits}()$ $S \leftarrow \text{new StableLearner}()$ $S \leftarrow R_w.\text{getConceptDescription}()$ $C.\text{unsetAll}()$ $S.\text{Train}(\vec{x}_t, y_t)$ $R_w.\text{Train}(\vec{x}_t, y_t)$

Text. See Figure 5.2. Nullam massa est, facilisis at, egestas non, lobortis at, felis. Vestibulum eu velit ut justo commodo pretium. Quisque commodo velit vel sem. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Donec nec magna. Aliquam erat volutpat.

Theorem 5.4.1 (Kolter and Maloof [3]) *For any time steps $t_1 < t_2$, if we stipulate that $\beta + 2\gamma < 1$, then the number of mistakes that **AddExp.D** will make between time steps t_1 and t_2 can be bounded by*

$$M_{t_2} - M_{t_1} \leq \frac{\log(W_{t_1}/W_{t_2})}{\log(2/(1 + \beta + 2\gamma))} .$$

Proof. **AddExp.D** operates by multiplying the weights of the experts that predicted incorrectly by β . If we assume that a mistake is made at time step t then we know that at least $1/2$ of the weight in the ensemble predicted incorrectly. In addition, a new expert will be added with weight γW_t . So we can bound the weight with

$$W_{t+1} \leq \frac{1}{2}W_t + \frac{\beta}{2}W_t + \gamma W_t = \frac{1 + \beta + 2\gamma}{2}W_t .$$

Applying this function recursively leads to:

$$W_{t_2} \leq \frac{1 + \beta + 2\gamma}{2}^{M_{t_2} - M_{t_1}} W_{t_1} .$$

Taking the logarithm and rearranging terms gives the desired bound, which will hold since the requirement that $\beta + 2\gamma < 1$ ensures that $(1 + \beta + 2\gamma)/2 < 1$. \square

5.5 EXPERIMENTAL STUDY

Always put something here, even if it just informs the reader of what comes next. Integer odio lorem, aliquam id, dignissim in, varius at, neque. Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos himenaeos. Maecenas vitae massa ultrices lorem aliquam pharetra. In hac habitasse platea dictumst. Nunc consectetur sapien. Maecenas ut felis. Sed blandit congue mauris. Donec ornare laoreet tortor. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Fusce id neque ac enim lobortis aliquet. Sed a purus ac nunc feugiat interdum. Suspendisse risus. Donec pulvinar, turpis at rutrum porta, justo

Figure 5.2: A pretty picture.

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5.5.1 METHOD

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Table 5.1: This is my table.

naive Bayes	95.6 ± 0.15
ID3	82.6 ± 1.2

Figure 5.3: Results.

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5.5.2 RESULTS

In Table 5.1, we present the results of our study. In Figure 5.3, we present the results of our study. Aliquam fermentum velit tristique turpis. Mauris mollis dapibus purus. Quisque vulputate ullamcorper purus. Quisque aliquam rhoncus felis. Aenean fringilla mattis mi. Ut ut massa a sem fermentum venenatis. Fusce ut risus. Maecenas ut nisl.

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5.5.3 ANALYSIS

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5.6 CONCLUSION

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APPENDIX A

IMPORTANT NOTE ABOUT MARGINS

A.1 GENERAL TACTICS

No two printers are alike. Please print a few pages and *measure* them. L^AT_EX can send commands to your printer, but it can't see whether they are being obeyed!

Check the `dvips` problem described below. If, after tackling that, you still need to make adjustments to get correct margins on paper (1.5 inches on the left and 1 inch on the right), add commands such as:

```
\hoffset = 0.5in    % shift 0.5 inch to the right
\voffset = -0.1in   % shift 0.1 inch up
```

in your `.tex` file right after after `\usepackage{gu}`.

A.2 THE A4 PROBLEM

If your printouts are consistently too high or too low on the page, and you are generating PostScript files using the `dvips` command, you are probably generating output for A4 (11.7-inch) paper.

That is the size of paper used in Europe. American (“letter”) paper is only 11 inches long and is the size specified for Georgetown theses and dissertations (and their electronic images).

As a quick check, try typing the `dvips` command with the argument `-tletter`, like this:


```
dvips -tletter filename
```

If that cures the problem, you can fix it permanently by editing the file `config.ps` to make letter size (11-inch) paper the default. See the `dvips` documentation for details.

APPENDIX B

CUSTOMIZING THE TABLE OF CONTENTS

On rare occasions the table of contents will not come out formatted the way you'd like. Here's how to control it. *Most people will not need to do this* and can ignore these notes.

Every time you run L^AT_EX, it writes the table of contents on a file whose name ends in `.toc`, and reads and prints the `.toc` file from the *previous* run. That's why you have to run L^AT_EX twice to get a correct table of contents.

If you need to alter your table of contents (e.g., by inserting a page break), you can edit the `.toc` file in between two runs of L^AT_EX. For example, you can insert `\newpage` to generate a page break. Note that this change will not last because L^AT_EX will write a new `.toc` file every time it runs.

Alternatively, you can add a command to your `.tex` file that will add something to the contents. For example, just before beginning a particular chapter, you can execute the command:

```
\addtocontents{toc}{\newpage}
```

to cause a page break at the corresponding place in the table of contents.

APPENDIX C

COMMON PDF PROBLEMS

When you convert your thesis from PostScript to PDF (with Adobe Acrobat Distiller or other suitable software), you may discover two problems.

C.1 TEXT SHRINKS WHEN CONVERTED TO PDF

This may mean that your PostScript file was formatted for A4 (11.7-inch) paper, and PDF is shrinking it to fit on American 11-inch paper. See p. 30.

C.2 TYPE LOOKS BLURRED OR PIXELLATED

This generally means you are using the old bitmap versions of the \TeX fonts rather than the PostScript versions. As a quick check, try adding the command `\usepackage{times}` right after `\documentclass`. This will change the typeface. If the new typeface looks a lot smoother, you've identified the problem but not cured it.

To get the PostScript \TeX fonts, get your system support people to reconfigure `dvips`, or download and install a newer version, or simply run \LaTeX on a computer that has more up-to-date software.

Please note that PDF conversion is not affected by `guthesis.sty` and the author of `guthesis.sty` cannot undertake to solve other problems with it.

APPENDIX D

HOW TO CITE WEB PAGES

Your bibliography entries should follow whatever format is standard in your field. If completely stymied, see the *Chicago Manual of Style* (which gives *two* formats, one for humanities and one for sciences; don't mix them up) or the *Publication Manual* of the American Psychological Association.

Even so, you will probably still be in doubt about how to cite web pages. The way I see it, the Web is not a publisher. Thus, a web address is not a sufficient citation for a web page. Instead, you must cite the document itself (indicating where and when it originated) and then add information about the web address.

If the paper has been published, and you got a copy from the author's web site, your job is easy. Just do something like this:

Newton, Isaac (1672) On the refraction of coloured light. *Journal of Irreproducible Results* 23:456-789. Web: <http://www.trinity.cam.ac.uk/newton/colour.pdf>.

That is, add the web information at the end of a normal citation.

If the paper is available only on the author's web site (at an institution or corporation), cite the institution or corporation as the publisher, something like this:

Newton, Isaac (1672) On the refraction of coloured light. Trinity College, Cambridge. Web: <http://www.trinity.cam.ac.uk/newton/colour.pdf>.

The idea is to cite it just like a privately distributed paper except that you add the web address.

If the web site *is* a publisher (e.g., an online journal), then it will probably give instructions for citation. Do not copy numbers into a bibliography entry if you don't know what they mean.

Consult your major professor for more advice, since the details will depend on other aspects of your bibliography format.

Note that the character \sim in web addresses is typed `\sim`, unless you use the `url` package.

Note also that by itself, L^AT_EX will not hyphenate a URL. It is up to you to indicate with the symbol `\-` the places where hyphens are permitted. Always hyphenate within words, not between compound words, so that the reader will know that the hyphen was not present in the original.

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