GUIDELINES FOR DISSERTATIONS, THESES, AND PROJECT REPORTS IN THE DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING: TYPESETTING USING LATEX

By

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Candidate for Degree of Master of Science

This thesis guideline explains how to produce a thesis using LaTeX. Abstracts for technical publications should have the following characteristics.

Limit the length of the abstract: (1) less than 150 words for a master's thesis, (2) less than 350 words for a dissertation, (3) 100–150 words for IEEE journals, and (4) less than 250 words for conference papers.

Write a "report in miniature", which means it has a self-contained message that does not expect the reader to look at the paper. Answer the questions, "What?", "How?", and "Why?" Use no citations, footnotes, or equations. Use no superlatives; you are not selling anything. Do not use acronyms and mathematical symbols unless absolutely necessary.

Key words: thesis, dissertation, LaTeX, book design, format, template

DEDICATION

To Angie.

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At a minimum, you should acknowledge financial support, permission to use copyrighted materials, trademarks and service marks, and personal assistance. The following is a hypothetical example; edit it with your information, and add your personal feelings.

This work was supported in part by grant CCR-999999 from the National Science Foundation. The findings and opinions in this thesis guideline belong solely to the author, and are not necessarily those of the sponsor.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF SYMBOLS, ABBREVIATIONS, AND NOMENCLATURE

This section is optional, and may be formatted in an appropriate manner. The title `\listofsymbolsname` may be redefined as needed.

g A variable representing gnats

G A variable representing gnus

NASA National Aeronautics and Space Administration

gnat A small animal, found in the North Woods, that causes no end of trouble.

gnu A large animal, found in crossword puzzles, that causes no end of trouble.

CHAPTER 1

INTRODUCTION

The goal of this thesis guideline is to facilitate producing dissertations, theses, proposals, and project reports in an acceptable form using the LaTeX typesetting system.

1.1 University Requirements

The Office of Graduate Studies publishes the *Standards for Preparing Theses and Dissertations* [**?**], which we refer to as the *Standards*. In the following, we uses the word "document" to mean a dissertation, thesis, project, proposal, or project report in the Department of Computer Science and Engineering.

The University requires that all dissertations and theses comply with the *Standards*, latest edition.

1.2 Departmental Requirements

In addition to the university requirements above, the Department of Computer Science and Engineering requires that all Master's project reports, thesis proposals, and dissertation proposals also comply. Even though the department may provide tools or templates to facilitate preparing a document, the student is fully responsible for assuring that the fi-

nal document complies with the *Standards* and the departmental requirements reproduced below.

The *Standards* leave certain issues to be decided by the "degree-granting unit," which in our case is the Department of Computer Science and Engineering. Acceptable styles are selected by the candidate's degree-granting unit, with the approval of the Office of Graduate Studies [**?**]. The following specifies departmental style requirements for dissertations, theses, and project reports, as published on the department Web site.[1]

1. The baseline type size shall be 12 points [**?**]. Exceptions are explained in the *Standards*.
2. The font style shall be one of the following [**?**]:

   - Times
   - New Century Schoolbook
   - Palatino
   - Bookman

   Exceptions are explained in the *Standards*.
3. The abstract may include a list of key words [**?**].
4. The Table of Contents, List of Tables, and List of Figures shall have the style shown in the *Standards* [**?**].
5. Section headings and subheadings within a chapter shall be bold and left-justified [**?**].
6. Chapter numbers may be roman or arabic numerals.
7. Sections and subsections shall be numbered consecutively within the next higher-level section/subsection. A section number shall be formed by an arabic chapter numeral, a period, higher-level section numbers separated by periods, and finally the current subsection number. For example 2.3.4 denotes Chapter 2, the third section within Chapter 2, and the fourth subsection within section 2.3.
8. Text shall be full-justified [**?**].

[1] See `http://www.cse.msstate.edu`.

9. Italics is required, rather than underline, for non-English, titles of books and journals, and similar uses [**?**].

10. Important equations shall be numbered consecutively within chapters, enclosed by parentheses, and formed by an arabic chapter numeral, a period, and the equation number [**?**]. For example, Equation (2.1) indicates the first equation in Chapter 2.

11. Table and figure captions shall be centered with title-style capitalization [**?**].

12. Table and figure numbers shall be consecutive within chapters and formed by an arabic chapter numeral, a period, and the table/figure number [**?**]. For example, Figure 2.1 indicates the first figure in Chapter 2 [**?**].

13. Reference entries shall be consecutively numbered enclosed by brackets, as is common in IEEE Computer Society transactions and conference proceedings [**?**]. Citations shall have corresponding form. For example [1] cites the first entry in the references.

14. Multiple citations in one place shall be enclosed in one set of brackets, in ascending numerical order, delimited by commas, for example [1,7,22,43].

15. References shall follow the last chapter of text, rather than at the end of each chapter [**?**]. If used, any appendices shall follow thereafter [**?**]. The heading shall be REFERENCES [**?**].

16. Reference entries shall be sorted alphabetically by authors' names, and book title [**?**].

17. The style of reference entries shall conform to examples at the Dept. of Computer Science and Engineering Web site, which follows IEEE Computer Society practices [**?**].

18. Multiple appendices shall be labeled with capital letters, per the *Standards* [**?**]. If there is only one appendix it will not be designated by a letter. However, labels of sections, figures, tables and equations in the appendix shall use A as the chapter prefix. This will facilitate unambiguous labeling.

The references in this document conform to departmental requirements and match IEEE Computer Society examples,[2] except for the following details.

- Full journal and conference names are used instead of abbreviations.

[2]See `http://computer.org/author/style/refer.htm`. Click Special Sections; click References. (We prefer the Computer Society style rather than the IEEE Transactions Dept. style.)

- Full state names are used instead of abbreviations.
- Conference paper entries show the sponsoring organization and city of the conference, instead of the publisher of the proceedings and publisher's city.

1.3 What is LaTeX?

LaTeX is a typesetting system that is used primarily in academia. LaTeX files are compatible with many academic publishers' typesetting systems. For example, LaTeX files are one of the preferred forms for final submission of articles to the various *IEEE Transactions*.

LaTeX has very strong capabilities for typesetting mathematics beautifully and for managing bibliographies. Even though, its user interface is not "friendly" compared to commercial word processors, suitable style files obviate concern for detailed formatting issues. Consequently, some students will find it attractive for typesetting dissertations, theses, proposals, and project reports.

This guideline describes how to typeset a document that is compatible with the above requirements using LaTeX and associated specialized style files. This document is itself an example of a master's thesis, so its source files can be used as the starting point for your document.

1.4 Limitations of this Template

This example-thesis template has the following limitations.

- Chapter titles and section titles cannot be longer than one line in the Table of Contents, even though the University's *Standards* allow multiple lines.

  The template formats long titles improperly in the Table of Contents in some cases. The solution is to reword the titles.

- Table captions and Figure captions cannot be longer than one line in the List of Tables or List of Figures, even though the University's *Standards* allow multiple lines.

  Therefore, block-style captions are not supported.

  The template formats long captions improperly in the List of Tables or List of Figures in some cases. The solution is to reword long captions to be less than one line.

  The information that might have been in a block-style caption can be within the table or figure, or can be in an ordinary paragraph that describes the table or figure.

- When a subsection title immediately follows a section title, a special section command is required to get the proper spacing between the titles.

  See sections 3.2 and 6.3 for details.

- Long tables are not handled cleanly by the template.

  If a table continues on successive pages, entries for the continuation pages must be manually removed from the List of Tables by editing the `*.lot` file, which is awkward. See section 3.12 for details.

- All artwork for figures must be in encapsulated postscript files `(*.eps)`.

  Some drawing tools do not produce encapsulated postscript format in a simple way. However, a combination of tools may provide a solution.

- The artwork for every figure must be in a distinct file `(*.eps)`. Artwork that appears in more than one figure must be copied to files with different names.

- Side-by-side figures are not supported by this template.

  The template assumes that each figure takes the full width of a page (or has white space on either side).

- Subfigures are not directly supported by the template.

  We have not tested LaTeX packages for subfigures available on the Web.

- Subsubsubsections are not supported by this template (e.g. section 1.2.3.4.5).

  See section 6.4 for details.

CHAPTER 2

GETTING STARTED

This thesis guideline explains features of various thesis template files (`*.tex`) and the document class file (`msuthesis.cls`) that make preparing your document much easier. The overall process has the following steps.

1. Create a separate directory for your document.
2. Download the thesis template files to your directory from the Computer Science and Engineering Department Web site.
3. Test whether you can correctly typeset this thesis guideline to verify that your LaTeX installation is ready.
4. Prepare your bibliography files (`*.bib`).
5. Edit your main thesis file, based on a copy of `examplethesis.tex`.
6. Write the body of your document, making a separate file for each chapter. Similarly, write any appendices in separate files.
7. Write the abstract in a separate file.
8. Edit the acknowledgments in a separate file.
9. Typeset your document, resulting in a postscript file or `*.pdf` file
10. Convert your postscript file (`*.ps`) to a `*.pdf` file if necessary.

2.1 Compiling the Example Thesis

Note that LaTeX and the style files `msuthesis.cls` and `msucs.bst` are installed on the Computer Science and Engineering Department's Unix system, so you do not need

a personal copy to run LaTeX there. If you are running LaTeX on your own computer, copy `msuthesis.cls` and `msucs.bst` to your directory also. Use the following commands to typeset this document.

```
latex examplethesis
bibtex examplethesis
latex examplethesis
latex examplethesis
latex examplethesis
dvips examplethesis
```

`dvipdf examplethesis` will output a `*.pdf` file instead of a postscript file.

The repeated `latex` commands are necessary to resolve cross-references. Each `latex` command outputs a log file (`examplethesis.log`) which may have error messages. You must check for error messages at each step by examining `examplethesis.log`. Some warnings about unresolved references are expected on the earlier runs of `latex`. `bibtex` also outputs a log file (`examplethesis.blg`) which may have error messages. Error messages from `dvips` will be on your screen. You should carefully examine a printed copy of the final output file, `examplethesis.ps`.

2.2 Compiling Your Thesis

A bibliography file (`*.bib`) is a structured ASCII file that is a data base shared by all your papers and your thesis. LaTeX automatically creates a References list for your document, selecting only those entries in the `*.bib` file that are cited. This is a major advantage of LaTeX.

On the Computer Science and Engineering Department's Unix system, your BibTeX files (`*.bib`) should be in the same directory as your document. On your own machine, they can be in an appropriate LaTeX directory.

Copy `examplethesis.tex` to your own file name, for example, `thesis.tex`. Edit your information into this file.

- Edit the name of your `*.bib` files in the definition of `\biblist`.
- Edit the front matter information.
- Edit the signature blocks of the approval page. Prepare as many blocks as you need. Spacing may need to be adjusted if more than six blocks are needed.
- Edit the name of your abstract file.
- Edit the dedication.
- Edit the name of your acknowledgments file.
- Edit the name of your list of symbols file. Remove the commands if not needed.
- Edit the title of each chapter and its file name, and similarly, each appendix.

Your main thesis file (e.g.`thesis.tex`) uses all the other components of your paper. Use LaTeX, BibTeX, and `dvips` to produce a postscript version of your paper. Use the following commands.

```
latex thesis
bibtex thesis
latex thesis
latex thesis
latex thesis
dvips thesis
```

The result is a postscript file, `thesis.ps`.

Various viewers for postscript files are available. For example, `ghostview` is available under Unix and Windows to view postscript files on-screen. Under Windows,

`ghostview` enables one to print postscript files. Under Unix, you can send a postscript file to a postscript printer using the `lpr` command.

Various programs are available for converting postscript (`*.ps`) to `*.pdf` format, such as Adobe Acrobat's Distiller program.

When you print your `*.pdf` file, be sure to set the scaling parameter to "None", so that measurements of margins etc. will match what the library expects.

CHAPTER 3

TYPESETTING USING LATEX

LaTeX is a markup language which resembles a programming language. Consequently, learning to use LaTeX is similar to learning a programming language. LaTeX is open-source software, which is available for free over Internet.[1] LaTeX2e is the current version. Donald Knuth wrote the foundational typesetting software, TeX, and Leslie Lamport wrote the initial version of LaTeX. TeX is usually pronounced "tek", similar to the "tech" in "technology", and so LaTeX is often pronounced lah-tek or lay-tek.

Because LaTeX input files are ASCII, any text editor may be used to edit text files.

Purchase a book on LaTeX! You will need it. There are several good books available; purchasing one is a good investment. There is also a wealth of information resources on the Web. This guideline assumes you are familiar with LaTeX basics. Try some simple short documents as you study your LaTeX book before studying the details in this guideline.

This guideline is not a tutorial on LaTeX. However, it is an example. You can look at the `*.tex` files that are components of this document and see how to implement various features. Unless otherwise noted, the following introduces standard LaTeX features.[2]

---

[1] See `http://tex.loria.fr/` for information.

[2] Much of the material in this chapter was supplied verbatim as documentation with the software.

3.1 Chapter Titles

Use the `\chapter` command to define chapter titles. This command has been redefined by `msuthesis.cls` to produce proper tables of contents.

Do not make chapter titles or section titles longer than one line. Long titles are not supported by `msuthesis.cls`.

This template provides arabic chapter numbers.

3.2 Section Titles

3.2.1 Subsecton Title without Paragraph

3.2.1.1 When There is No Paragraph

If there is no paragraph following a section title, because a subsection immediately follows, use the appropriate `msuthesis.cls` command so that the spacing between titles conforms to the *Standards*. Note the capital letters in the command names.

```
\SectionNoParagraph{This is a Title}
\SubSectionNoParagraph{This is a Title}
\SubSubSectionNoParagraph{This is a Title}
```

3.2.1.2 Another Subsubsection

Each level of the outline should have at least two items.

3.2.2 When There is a Paragraph

If there is a paragraph following the section title, use the following `msuthesis.cls` section commands; note the capital letters S.

```
\Section{This is a Title}%
This is a paragraph.
\SubSection{This is a Title}%
This is a paragraph.
\SubSubSection{This is a Title}%
This is a paragraph.
```

These commands are required by `msuthesis.cls` to indent the first paragraph of each section as required by the *Standards*. The first paragraph of a section must immediately follow the Section command without a space or line break, so that `msuthesis.cls` can indent the first paragraph of the section. The LaTeX comment symbol % can be used for formatting. For example, all of the following produce an indented first paragraph.

```
\Section{This is a Title}This is a paragraph.
```

```
\Section{This is a Title}%
This is a paragraph.
```

```
\Section{This is a Title}%
%
This is a paragraph.
```

Titled paragraphs. Because the University's *Standards* restrict the use of bold, do not use the LaTeX feature (`\paragraph`) for defining titled paragraphs. The text of the paragraph begins on the same line as the title. These titled paragraphs are are not included in the table of contents.

3.3 Paragraphs

One or more blank lines denote the end of a paragraph.

You can change to and from the default spacing between lines to single spacing by using the following commands between paragraphs.

```
\newspacing{\singlespacing}\vspace{\baselineskip}
This is a single-spaced paragraph.
\newspacing{\defaultspacing}
```

The `vspace` and `baselineskip` commands are standard LaTeX commands. The other commands are defined by `msuthesis.cls`.

3.4 Justification

The ends of words and sentences are marked by spaces. It doesn't matter how many spaces you type; one is as good as 100. The end of a line counts as a space.

Since any number of consecutive spaces are treated like a single one, the formatting of the input file makes no difference to LaTeX, but it makes a difference to you. When you use LaTeX, making your input file (`*.tex`) as easy to read as possible will be a great help as you write your document and when you change it.

3.5 Special Considerations

Because printing is different from typewriting, there are a number of things that you have to do differently when preparing an input file than if you were just typing the document directly. See your LaTeX book for details on all of the following.

3.5.1 Quotation Marks

Quotation marks like “this” have to be handled specially, as do quotes within quotes: “ ‘this’ is what I just wrote, not ‘that’ ”. Don’t use the double quote key (") for quotation marks. Use the grave accent key (`) twice for beginning quotation marks, and use the apostrophe key (') twice for end quotation marks.

3.5.2 Dashes

Dashes come in three sizes: an intra-word dash (-), a medium dash (--) for number ranges like 1–2, and a punctuation dash (---) — like this.

3.5.3 Spaces

LaTeX automatically makes a sentence-ending space larger than the space between words within a sentence.

3.5.3.1 Space After a Period

You sometimes have to type special commands in conjunction with punctuation characters to get this right, as in the following sentence.

Gnats, gnus, etc. all begin with G. Note that the space after etc. is smaller than the space after the end of the sentence. You should check the spaces after periods when reading your output to make sure you haven’t forgotten any special cases. See your LaTeX book regarding the '\ ' and '\@' commands.

3.5.3.2 Ellipsis

Generating an ellipsis ... with the right spacing around the periods requires a special command, `\ldots`.

3.5.4 Special Characters

TEX interprets some common characters as commands, so you must type special commands to generate them. These characters include the following: $ & % # { and }.

3.5.5 Emphasized Type

In printing, text may be emphasized by using an *italic* type style, denoted by the `\em` command.

A long segment of text can also be emphasized in this way. Text within such a segment given additional emphasis with Roman *type. Italic type loses its ability to emphasize and become simply distracting when used excessively.*

The University's *Standards* discourage the use of italics [**?**].

3.5.6 Line Breaks

There are standard commands to prevent LATEX from breaking a line where it might otherwise do so. This may be at a space, as between the "Mr." and "Jones" in "Mr. Jones", or within a word—especially when the word is a symbol like *itemnum* that makes little sense when hyphenated across lines.

3.6 Footnotes

Footnotes[3] pose no problem.

3.7 Embedded Mathematics

LaTeX is good at typesetting mathematical formulas embedded in ordinary text, like $x - 3y = 7\alpha$ or $\alpha_1 > x^{2n}/y^{2n} > x'$. Remember that a letter like x is a formula when it denotes a mathematical symbol, and should be treated as one.

3.8 Quotations

Text is displayed by indenting it from the left margin. Quotations are commonly displayed. There are short quotations

> This is a short a quotation. It consists of a single paragraph of text. There is no paragraph indentation.

and longer ones.

> This is a longer quotation. It consists of two paragraphs of text. The beginning of each paragraph is indicated by an extra indentation.
>
> This is the second paragraph of the quotation. It is just as dull as the first paragraph.

3.9 Lists

Another frequently-displayed structure is a list. The following is an example of an itemized list.

- This is the first item of an itemized list. Each item in the list is marked with a "tick". The document style determines what kind of tick mark is used.

[3] This is an example of a footnote.

- This is the second item of the list. It contains another list nested inside it. The inner list is an enumerated list.

    1. This is the first item of an enumerated list that is nested within the itemized list.
    2. This is the second item of the inner list. LaTeX allows you to nest lists deeper than you really should.

    This is the rest of the second item of the outer list. It is no more interesting than any other part of the item.

- This is the third item of the list.

3.10 Poetry

You can even display poetry.

There is an environment for verse
Whose features some poets will curse.

For instead of making
Them do all line breaking,
It allows them to put too many words on a line when they'd rather be forced to be terse.

3.11 Mathematics

Mathematical formulas may also be displayed. A displayed formula is one-line long; multiline formulas require special formatting instructions.

$$x' + y^2 = z_i^2$$

The above formula is not numbered. If equations are to be numbered then use the `equation` environment, and `\label` command.

$$x' + y^2 = z_i^2 \tag{3.1}$$

Reference an equation like this: Equation (3.1).

3.12 Tables

`msuthesis.cls` takes care of formatting tables, captions, and the associated List of Tables entries.

The following are two examples. Table 3.1 lists meat prices for gnats, gnus, and other animals, and Table 3.2 is in landscape orientation; it also has a footnote as an example.

Table 3.1

Meat prices (portrait)

Item		Price ($)
gnats	gram	13.65
gnats	each	.01
gnu	stuffed	92.50
emur	stuffed	33.33
armadillo	frozen	8.99

For ordinary tables use `\Table{filename}{This is a caption}` where the file `filename.tex` contains the content of the table, for example,

```
\begin{tabular}{...}
\hline
headings \\
\hline
... tabular data
\hline
\end{tabular}
```

Do not make captions longer than one line. Multiline captions are not supported by `msuthesis.cls`. Do not put footnotes or citations in captions, because they will be repeated in the List of Tables.

Table 3.2

Meat prices (landscape)

Item[a]		Price ($)	more columns
gnats	gram	13.65	a very wide column
gnats	each	.01	
gnu	stuffed	92.50	
emur	stuffed	33.33	
armadillo	frozen	8.99	

msuthesis.cls constructs a label by making tab: a prefix to your file name, so if needed, you can use \ref{tab:filename}.

Sometimes a table needs to be displayed in landscape orientation. Put the content of the table (i.e., the tabular environment) in a file (filename.tex). The following shows how to set up and define such a table.

```
\setlength{\tabwidth}{\textheight}
\addtolength{\tabwidth}{-0.5in}
\rotatedtable{filename}{This is a caption}
```

This makes the rotated table 0.25 inch narrower on each side than one page height (about 8.5 inches).

Sometimes a table is in an encapsulated postscript file. Each of the following commands have similar arguments as the corresponding Figure commands below.

```
\Tablewithfigure{epsfilename}{\tabwidth}{Caption goes here}
\Tabledblwithfigure{epsfilename}{\tabwidth}{A Caption}
\rotatedtablewithfigure{epsfilename}{\tabwidth}{A Caption}
```

This template does not handle long tables cleanly. The following is a workaround.

If your table is longer than one page, you must segment the content into multiple files. Use an ordinary \Table command for the first page, and then use a \Tablecontinued command for each following page. For example, the following commands create a table with two pages. Note that the table number does not change.

```
\Table{pricesfirst}{Meat prices} %first page
\Tablecontinued{pricesnext}{Meat prices (continued)}
%next page
```

However, each page of the table is in the List of Tables. Unfortunately, this must be cleaned up by manually editing the *.lot file. The existing version of this file is inserted

Table 3.3

Meat prices

Item		Price ($)
gnats	gram	13.65
gnats	each	.01
gnu	stuffed	92.50
emur	stuffed	33.33
armadillo	frozen	8.99
gnats	gram	13.65
gnats	each	.01
gnu	stuffed	92.50
emur	stuffed	33.33
armadillo	frozen	8.99
gnats	gram	13.65
gnats	each	.01
gnu	stuffed	92.50
emur	stuffed	33.33
armadillo	frozen	8.99
gnats	gram	13.65
gnats	each	.01
gnu	stuffed	92.50
emur	stuffed	33.33
armadillo	frozen	8.99
gnats	gram	13.65
gnats	each	.01
gnu	stuffed	92.50
emur	stuffed	33.33
armadillo	frozen	8.99
gnats	gram	13.65
gnats	each	.01
gnu	stuffed	92.50
emur	stuffed	33.33
armadillo	frozen	8.99
gnats	gram	13.65
gnats	each	.01
gnu	stuffed	92.50
emur	stuffed	33.33

Table 3.3

Meat prices (continued)

Item		Price ($)
gnats	gram	13.65
gnats	each	.01
gnu	stuffed	92.50
emur	stuffed	33.33
armadillo	frozen	8.99
gnats	gram	13.65
gnats	each	.01
gnu	stuffed	92.50
emur	stuffed	33.33
armadillo	frozen	8.99
gnats	gram	13.65
gnats	each	.01
gnu	stuffed	92.50
emur	stuffed	33.33
armadillo	frozen	8.99
gnats	gram	13.65
gnats	each	.01
gnu	stuffed	92.50
emur	stuffed	33.33
armadillo	frozen	8.99
gnats	gram	13.65
gnats	each	.01
gnu	stuffed	92.50
emur	stuffed	33.33
armadillo	frozen	8.99
gnats	gram	13.65
gnats	each	.01
gnu	stuffed	92.50
emur	stuffed	33.33
armadillo	frozen	8.99
gnats	gram	13.65
gnats	each	.01
gnu	stuffed	92.50
emur	stuffed	33.33

into the document each time you run LaTeX, and then it is replaced by a new version. If you edit this file, then you should run LaTeX only once on your last edit cycle, and then run `dvips`. In summary, try to avoid multipage tables to avoid this complex manual process.

3.13 Figures

The following is an example. A lion, as shown in Figure 3.1, eats gnus. Gnats eat lions.

Figure 3.1

Lion

`msuthesis.cls` expects all art work to be encapsulated postscript files (`*.eps`) with no embedded captions.

If you do not yet have your art work in an `*.eps` file, then you may copy the file `temporary.eps` to the proper filename for temporary use. For example, we do not yet have a drawing of a gnat, so Figure 3.2 is a temporary placeholder.

You can create art work with a Microsoft Office tool. Clear backgrounds, rather than white, are recommended. Make your artwork a one-page document with no caption and no page number. Print to a postscript file (`*.ps`).

- Install a postscript printer driver on your PC with FILE selected as the port. The printer driver may be PSDRIVER or the oldest "Apple laserwriter" printer driver available on your system (v.23 on my PC).
- Using your artwork tool, print to a postscript file.
    1. Select the printer driver that prints postscript to the FILE port. (Do not check the "print to a file" box.)
    2. Modify the printer options/postscript options if necessary:
        - Paper source should be "cassette", not "automatic". (If the paper source is "automatic", the figure appears to be blank when printed and flashes when viewed using `ghostview`.)
        - "Generate job control code" should be "No".
        - "Send control-D after each job" should be "No".
    3. Click Ok when printing is properly set up.
- Use `ghostview` or other tool to convert the resulting postscript (`*.ps`) to encapsulated postscript (`*.eps`).

Every figure must be in a different `filename.eps` file. (Make duplicate files with different filenames if the same art work is in multiple figures.)

Text in your thesis is in a single column that is about 6 inches wide. However, text in conference proceedings is in two columns. The LaTeX length `\textwidth` is the width of all columns on a page. The LaTeX length `\linewidth` is the width of the current column.

Figure 3.2

Gnat

The length `\figwidth` is defined by `msuthesis.cls`. In general, redefine the width of each figure relative to `\linewidth`, just prior to defining a figure. For example, for a one-column figure that is almost the full width of the column, you should put the following. (Note that `Figure` is capitalized.)

```
\setlength{\figwidth}{\linewidth}
\addtolength{\figwidth}{-0.5in}
\Figure{filename}{\figwidth}{This is a Caption}
```

You can also specify fractions of a line width, for example, for a figure width of half a line,

```
\setlength{\figwidth}{0.5\linewidth}
```

Sometimes a figure needs to be displayed in landscape orientation. The following shows how to set up and define such a figure using `msuthesis.cls`.

```
\setlength{\figwidth}{\textheight}
\addtolength{\figwidth}{-0.5in}
\rotatedfigure{filename}{\figwidth}{This is a caption}
```

Do not make captions longer than one line. Multiline captions are not supported by `msuthesis.cls`. Do not put footnotes or citations in captions, because they will be repeated in the List of Figures.

CHAPTER 4

FEATURES FOR COMPATIBILITY WITH JOURNAL ARTICLES

This chapter explains a variety of commands defined by `msuthesis.cls` that you can redefine when your are preparing an article for a journal. Thus, your writing (`*.tex`) will need few modifications to conform to the journal's style requirements. Some journals provide LaTeX style files, as well.

4.1 Organize Your Files for Journal Articles

You may be able to publish the content of individual chapters of your thesis or dissertation as journal articles. Note that journal articles do not have chapters. To allow for possible publication, put all `\chapter` commands in your main thesis file (e.g.`thesis.tex`), and let `\Section` be the highest level in any chapter file.

4.2 Citations

`msuthesis.cls` provides commands that combine punctuation and citation. For example, this citation [**?**] is in the middle of a sentence. This citation [**?**], is combined with a comma, and this citation is combined with a period [**?**]. Journals have various styles of citations which differ in where spaces and punctuation should go. Your thesis

may be one style and the final submission of a journal article may be a different style. Use the following commands so that changes are easy to make.

```
\spacecite{biblabels} %in the middle of a sentence
\commacite{biblabels} %includes a comma
\periodcite{biblabels}%includes a period
```

4.3 References

The following are examples in the References and guidance from the IEEE Computer Society.

- Article in a collection [**?**]
- Article in a conference proceedings [**?**]
- Article in a journal or magazine [**?**]
- Book [**?**, **?**]
- CD-ROM [**?**]
- Dissertation or thesis [**?**, **?**]
- Electronic publication [**?**]
- Newsletter [**?**]
- Non-English source, when original title is included [**?**], and when original title is unprintable [**?**]
- Personal communication and unpublished materials are usually not referenced because they are not available to the reader. However, footnotes can be used to give credit to such sources. General thanks can be given in an acknowledgments section.
- Standard [**?**, **?**]
- Technical memo [**?**]
- Technical report with report number [**?**] and without report number [**?**]
- Technical or user manual without authors [**?**]

In references to electronic publications, be sure to include all punctuation exactly as supplied (hyphens and tildes (∼), in particular, are very common in Web addresses). Tilde is produced by `$\sim$` in LaTeX. Verify addresses you tag as URLs by copying and pasting them into your browser and seeing if the string of text that is in your document actually goes where it should. If the address must run across more than one line, follow these guidelines:

- Break only after a forward slash or a dot (period).
- Do not split the double slash.
- Do not split at hyphens, tildes, and so on, that are part of the address.
- Do not introduce hyphens to break words.
- Separating the extension (for example, the html at the end) is discouraged.

Some examples using

`http://www.web-pac.com/mall/pacific/start.html`:

Acceptable:

```
http://
www.web-pac.com/mall/pacific/start.html
```

```
http://www.web-pac.
com/mall/pacific/start.html
```

```
http://www.web-pac.com/mall/
pacific/start.html
```

Not acceptable:

```
http:/
/www.web-pac.com/mall/pacific/start.html
```

```
http://www.web-
pac.com/mall/pacific/start.html
```

```
http://www.web-pac
.com/mall/pacific/start.html
```

```
http://www.web-pac.com/mall/paci-
fic/start.html
```

Discouraged:

```
http://www.web-pac.com/mall/pacific/start.
html
```

In titles and captions, capitalize the first and last words, and all nouns, pronouns, adjectives, verbs, adverbs, and subordinating conjunctions. Lowercase articles, coordinating conjunctions, and prepositions, regardless of length. Example: Toward Better Real-Time Programming through Dataflow.

To make a source easy for researchers to find, use the title as it originally appears. Do not add or remove hyphens, change words to preferred spellings, or lowercase internal capitals.

Do not include the editor's name for a conference proceedings unless it is a carefully edited volume published as a regular book.

The IEEE Computer Society's Web page also has detailed advice regarding references to electronic publications and other matters.[1]

4.4 Common Abbreviations

`msuthesis.cls` provides commands to produce abbreviations of common Latin expressions for compatibility with various journals. Some journals require italics and some require Roman fonts. The abbreviations are: etc., e.g., i.e., et al., and *vs.* Various publishers prefer different fonts for certain abbreviations. The following commands are available to provide flexibility when a thesis chapter is published as a journal article.

```
\etc
\ie
\eg
\etal
\vs
```

Note that periods after abbreviations are included inside each command.

4.5 Equations

Don't start a paragraph with a displayed equation, nor make one a paragraph by itself.

[1] See `http://computer.org/author/style/refer.htm`. Click Special Sections; click References.

You should use `\begin{equation}` and `\end{equation}` to define one equation so that equation numbers are generated, instead of `\[` and `\]`. It is convenient to use `\begin{eqnarray}` and `\end{eqnarray}` to define all equations just in case a long equation needs to be broken into multiple lines later.

Each major equation should have a `\label{eq:label}` command at the end of the equation. Journals have various standards for referring to equation numbers in paragraphs. The following commands are provided by `msuthesis.cls` as an alternative to the standard LaTeX command `Equation~(\ref{eq:label})`.

```
\eqnref{lable}          %in middle of sentence
\eqnsref{firstlabel}    %in middle of sentence
\andeqnref{lastlabel}   %at end of list
\Eqnref{label}          %at start of sentence
\Eqnsref{firstlabel}    %at start of sentence
```

If you are referring to one equation, use `\eqnref{label}`, or as the first word in a sentence, `\Eqnref{label}`. If you are referring to a list of equation numbers, use

```
\eqnsref{firstlabel}, \ref{eq:secondlabel},
\andeqnref{thirdlabel}
```

or similarly, at the beginning of a sentence, `\Eqnsref{firstlabel}` etc. Equation (4.1) is an example of a multiline equation.

$$\begin{aligned} y &= ax + b \\ &+ cx + d \end{aligned} \tag{4.1}$$

4.6 Theorems

The following theorem environments are defined by `msuthesis.cls` for compatibility with journals published by Elsevier and Kluwer.

```
\begin{thm} \end{thm} %Theorem
\begin{lem} \end{lem} %Lemma
\begin{cor} \end{cor} %Corollary
\begin{defn}\end{defn}%Definition
\begin{case}\end{case}%Case
\begin{pf}  \end{pf}  %Proof
```

The command `\qed` is defined by `msuthesis.cls` to produce a black box; it is used by the `pf` environment at the end of proofs.

Unfortunately, the University's *Standards* prohibits using bold and italics for things like theorem headings and text.

The following are examples of these.

Theorem 1

This is an example theorem.

Proof: This is a proof. ■

Lemma 1

This is an example lemma.

Proof: This is another proof. ■

Corollary 1

This is an example corollary.

Definition 1

This is an example definition.

Case 1 This is an example case.

Case 2 This is another case.

4.7 Tables

If a table needs to span the full page in a double-column publication, use the `\Tabledbl` command. In a single-column thesis, it looks the same as the `\Table` command.

Journals have various standards for referring to table numbers in paragraphs. The following commands are defined by `msuthesis.cls` as alternatives to the standard LaTeX command `Table \ref{tab:filename}`.

```
\tableref{filename}  %in middle of sentence
\Tableref{filename}  %as first word of sentence
```

where `filename` is the identifier for your table data.

4.8 Figures

Some journals and conference proceedings are published in two column format. Some figures fit within one column, but others must span both columns (usually at the top of a page. The following command is used when you want the figure to span two columns if the document is in two-column format. If this command is used in a one column document, such as a thesis, then the figure is typeset the same as the ordinary `\Figure` command.

```
\Figuredbl{filename}{\figwidth}{This is a Caption}
```

This command lets your thesis chapter's `*.tex` file be practically the same as your conference paper's with respect to figures.

Journals have various standards for referring to figure numbers in paragraphs. The following commands are defined by `msuthesis.cls` as alternatives to the standard LaTeX command `Figure~\ref{fig:filename}`.

```
\figureref{filename} %in middle of sentence
\Figureref{filename} %as first word of sentence
```

where `filename` is the identifier for your artwork.

CHAPTER 5

SUGGESTIONS

This chapter has suggestions to make preparing your document easier. The IEEE Computer Society's advice to authors will also be generally helpful to you.[1]

5.1 Organize Your Files

You may organize additional source files hierarchically and use the LaTeX command `\input{filename}` to insert portions of a chapter into its chapter file. Put all your files in the same directory.

5.2 Local Definitions

You can put your own local LaTeX command definitions in the front of your main file (`thesis.tex`). Create commands for abbreviations for lengthy mathematical expressions, or to print a word in a special font, for example, NASA in the middle of a sentence or NASA at the beginning of a sentence. I prefer the small caps font style (`\textsc`) for acronyms. Definitions, like the following should be prior to the `\begin{document}` command.

```
\newcommand{\NASA}{\textsc{nasa}\xspace}
\newcommand{\Nasa}{\textsc{Nasa}\xspace}
```

[1] See `http://computer.org/author/style`.

As in the above example, most acronyms look better in the small capitals font (`\textsc`), so creating similar pairs of new commands for each acronym will save you work and avoid inconsistencies.

5.3 Bibliography

You may spread you bibliography among multiple `*.bib` files, e.g., by subject and/or author. If so, the definition of `\biblist` in `msuthesis.tex` would look like this.

```
\renewcommand{\biblist}{bibfile1,bibfile2}.
```

Spaces are not allowed inside the braces ({...}).

The `*.bib` file for this document is an example. See chapters on BibTeX in your LaTeX book.

The file `empty.bib` has templates for various kinds of entries. Use your editor to cut and paste entry templates as you need them. According to your LaTeX book, some fields are required, some are optional, and some are not used in bibliographies; the unused fields can to hold information for other purposes. For example, I like to list keywords in each bibliographic entry, so I can find all references on a topic by using a text editor's find feature.

Compare `empty.bib` to `ieeecsexamples.bib`. The most common bibliographic entries are `@BOOK` [**?**], `@ARTICLE` [**?**], and `@INPROCEEDINGS` [**?**].

The first field in an entry is the `citekey`. You need to devise an easy-to-remember system of citekey codes that is very likely to give a unique citekey for each bibliography entry. In general, the citekeys in the `*.bib` files are case-sensitive.

For example, my coding system is based on the initials of the authors' last names, the year of publication, and an abbreviation for the magazine or conference [**?**, **?**]. I distinguish ambiguous situations by an appended page number. The labels for books are based on initials and year [**?**]. Single authors are represented by last name (e.g., `Allen`) instead of initials. Other people use different coding schemes. The important point is that each citekey must be unique.

Empty fields are represented by empty braces, `{}`. Text goes inside braces, and numbers do not need braces. BibTeX has three-letter abbreviations for the months of the year which do not go in braces, `jan`, `feb`, etc. See the BibTeX section of your LaTeX book for details.

5.4 Tables

The content of tables is formatted with the LaTeX environment

```
\begin{tabular}{...}
\hline
headings \\
\hline
... tabular data
\hline
\end{tabular}
```

See your LaTeX book for details. `\hline` creates a horizonal line. Most journals discourage using vertical lines in tables, and prefer few horizonal lines. If at all possible, use only a top horizonal line, a bottom horizonal line, and a line under the headings.

The length `\tabwidth` is already defined by `msuthesis.cls`. In general, the `tabular` environment takes care of table widths. However, if you need to specify the

width of a column in a table, redefine `\tabwidth` relative to `\linewidth`, just prior to defining the table, and then use it as needed within your tabular environment. For example, for one half of the line width, use this command,

```
\setlength{\tabwidth}{0.5\linewidth}
```

CHAPTER 6

FREQUENTLY ASKED QUESTIONS

6.1 How can I remove DRAFT on the title page?

The third line of `examplethesis.tex` is

```
\usepackage[light,first]{draftcopy}
%remove for final version
```

Putting a % at the beginning of this line will make this line a comment, disabling DRAFT.

6.2 Why can't LaTeX find my files?

You must put all files for your document in the same directory, including all the figures (encapsulated postscript `*.eps`). A warning in the `*.log` file may indicates that you had a command like `\Figure{./Drawings/tiles_fuel}{...` The template cannot handle paths. Remove paths in all `\Figure`, `\Table`, and `\input` commands.

6.3 How can I fix the top margin of my title page?

If your title is 1 or 2 lines, then the top margin of the title page should be satisfactory, 3.5–4.0 inches.

If your title is 3 lines, the the top margin will be a bit more than 3 inches which does not conform with the University's standard. The library has agreed to waive the 3.5 inch rule for theses and dissertations formatted with this template (per James Nail, 6/12/09).

If you use this template, you should inform the library staff of this fact when you turn it in for review.

6.4 Why is there extra white space after a section title?

In most cases, you should use `\Section`, not `\section`. Also note that there must be no blank lines between a `\Section{}` command and the the paragraph text, e.g. `\Section{bla bla}This begins a paragraph...` This rule was necessary to assure that the first paragraph of a section is indented, as required by the university.

6.5 How do I create subsubsubsection 3.5.3.1.1?

The template does not support subsubsubsections.

They are usually short and can often be included in the higher-level subsubsection. A sentence or two could make the transition for the reader in lieu of a subsubsubsection title.

An alternative workaround is to use an `enumerate` environment to create a numbered list. See your LaTeX book for details.

6.6 Why are figure titles double spaced instead of single?

This template does not support figure captions, table captions, or section titles that are more than one line in the table of contents, list of figures, or list of tables. The solution is to shorten the titles to less than one line. The extra information removed from a caption

can be annotated inside the figure or table, or can be in an ordinary paragraph that explains the figure or table.

Some journals use a block-caption style, where the caption explains the figure or table. This template does not support block-caption style, because the University's requirements for the List of Figures and List of Tables are incompatible with this style.

6.7 How do I fix not enough memory for figures and tables?

A large number of figure/tables on consecutive pages causes LaTeX to become confused due to limited memory. When you have numerous consecutive "floats" (i.e. figures or tables), you should have a `\clearpage` command between groups of three to five floats. `Clearpage` forces a page break and typesets all known floats beginning on the new page. So you should position the `clearpage` commands at points you want a page break to occur, such as between consecutive figures.

6.8 How can I refer to a list of equations, tables, or figures?

See Sections 4.5, 4.7, and 4.8. Here are three examples of lists of references.

```
\eqnsref{aaa}, \ref{eq:bbb}, \andeqnref{ccc}
Tables~\ref{tab:aaa}, \ref{tab:bbb}, and~\ref{tab:ccc}
Figures~\ref{fig:aaa}, \ref{fig:bbb}, and~\ref{fig:ccc}
```

6.9 How can I make a table heading span more than one column?

See your LaTeX book for commands associated with the tabular environment, such as `\multicolumn`.

6.10 Why is a missing $ inserted?

When your `*.log` file has this warning, `! Missing $ inserted.`, this is most often caused by the use of underline characters in nonmath mode. If you have a filename, URL, etc. that has an underline in the middle of a paragraph, you must substitute `\_` for the plain underline.

Plain underline is interpreted as a subscript command in math mode. LaTeX assumes you want to begin math mode.

6.11 How can I typeset "John Wiley & Sons" in a reference?

BibTeX fields can have LaTeX commands like paragraphs. Ampersand is a special character. See your LaTeX book for escape sequences for special characters, such as `\&`.

6.12 How can I typeset a tilda in a URL?

Tilda is a special character in LaTeX. A "similar" symbol ($\sim$) looks good in URLs. It is created by `$\sim$`. See Section 4.3.

6.13 How can I change to single spacing?

See Section 3.3.

6.14 How can I change to bold and then back to normal print?

See your LaTeX book for commands associated with fonts, such as `\bfseries`, `\mdseries`, and `\textbf`.

6.15 How can I create a superscript or subscript?

See your LaTeX book for math mode formatting symbols, such as `^` and `_`.

6.16 How can I make a fraction in an equation?

See your LaTeX book for math mode commands, such as `\frac` in displayed equations. Stacked fractions are ugly inline in paragraphs; use **/** instead to represent division in paragraphs.

6.17 How can I typeset all my references?

Even though LaTeX provides a `\nocite` command, which causes all references in the `*.bib` file to be in the References section, I recommend that you just put a `\cite` command for each reference in any convenient place in your draft document. Later you can add the sentences to go with each citation. Because the university requires that all references be cited, your final thesis should not use `\nocite` at all.

CHAPTER 7

CONCLUSIONS

The concluding chapter synthesizes the chapters in the body of the thesis, explaining how the research problem has been answered.

7.1 Contributions

This example thesis made no contribution to knowledge of science and technology.

7.2 For Further Research

Gnats and gnus is a facinating subject with many possible topics for further research.

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APPENDIX

AN EXAMPLE

Appendices are written like the body of the paper using `\chapter`. LaTeX numbers them with capital letters. If there is only one appendix, then use `\oneappendix` instead of `\chapter` so that the table of contents is properly formatted.

The MSU library requires that each appendix have a separator page. The following lines in `examplethesis.tex` achieve this.

```
%MSU library requires title page for each appendix
\renewcommand{\appendixname}{\vspace*{2.5in}Appendix}
%for appendix title page
\oneappendix{An Example} %for a single appendix
%\chapter{An Appendix Title}
%alternative for each of multiple appendices
\newpage %end of appendix title page
\input{exappendix} %content of appendix
```

The `\vspace*` command provides the proper layout of the title page. This example has only one appendix. Therefore, the `\oneappendix` command is used. The `\newpage` command forces a page break after the title page. If you have multiple appendices, then use the `\chapter` command for each appendix instead of `\oneappendix`, and put `\newpage` after each `\chapter` command.