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NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

THE NEW NPS LaTeX REPORT AND THESIS FORMAT

by

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November 29, 2011

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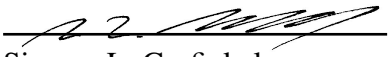

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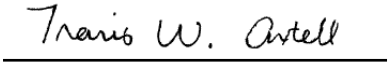

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14. ABSTRACT

This report introduces the NPS LaTeX templates that can be used to produce a master's thesis, a Ph.D. dissertation, or a technical report. The template can produce documents that are unclassified, For Official Use Only (FOUO), or classified. Additional information on using LaTeX is also provided.

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Abstract

This report introduces the NPS LaTeX templates that can be used to produce a master's thesis, a Ph.D. dissertation, or a technical report. The template can produce documents that are unclassified, For Official Use Only (FOUO), or classified. Additional information on using LaTeX is also provided.

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CHAPTER 1:
Introduction to LaTeX

LaTeX is a text formatting system created by Leslie Lamport in the early 1980s [5]. The program is based on the TeX text formatting system created by Donald Knuth in 1978 [4]. With LaTeX you author your document by editing a text input file using a program such as EMACS, `vim`, or another editor. You then give this input file to LaTeX (or, more accurately, to a program such as `pdflatex` or `xelatex`). LaTeX then transforms your input file(s) into an Adobe Portable Document Format (PDF) file.

Although most documents at NPS are prepared with Microsoft® Word, LaTeX is widely used outside of NPS in the sciences to create conference papers, journal articles, and even full-length books. LaTeX is especially popular in computer science. With the NPS template you can use LaTeX to produce an NPS thesis that is consistent with NPS formatting requirements. Because LaTeX provides for automated formatting, automatic updating of references, and the ability to directly embed experimental results, many students who write technical documents at NPS that use LaTeX find that they save time—even when they take into account the time that they spend learning to use LaTeX in the first place!

1.1 Reasons to use LaTeX

There are many reasons to use LaTeX for preparing a technical document:

- Formatting for paragraphs, quotations, lists, tables, and other elements is performed automatically. You can easily make changes to formatting and have them reflected throughout your document. The numbers used for numbered sections are automatically updated when new material is added or removed. As a result, formatting is more consistent with LaTeX than with Microsoft Word.
- References within your document to numbered chapters, appendices, sections, figures, tables, equations and references are updated automatically each time a `.pdf` file is produced, assuring that they are correct.
- The BibTeX system produces consistent citations and bibliography. References are pulled from a bibliographic database that is separately maintained and can be shared between many documents. Records for the bibliographic database can be downloaded from many online services, helping to assure that they are consistent. The citation format is maintained separately from the citation contents, making it easy to change citation styles when submitting to different conferences or journals.
- LaTeX allows you to directly include other files at the time that the `.pdf` file is created. This makes it easy to automatically incorporate the results of experiments in tabular or graphical form, without having to manually copy results. Source code for programs can be included with pretty syntax from the original files, and line numbers can be automatically displayed as desired.

- `pdflatex`, the version of LaTeX we recommend at NPS, also allows you to embed other files as attachments within your `.pdf` file. This makes it easy to preserve experimental data, spreadsheets, or other information in the final file that is distributed to sponsors and archived.
- Because the LaTeX input file is plain ASCII, you can store your document using a revision control system such as Subversion (SVN) [1]. This allows multiple people to work on the same document at the same time; Subversion automatically merges the changes together. If you save your thesis work daily, it is possible retrieve previous revisions of your thesis and undo changes or mistakes—even many months after the fact.
- LaTeX is free software and runs on PCs, Macs, and Unix systems. This means that you can produce your documents on practically every computer you have, without having to purchase anything else.

NPS has developed this template for preparing NPS reports and theses. If you are using LaTeX at NPS, there are many reasons for using the template:

- The template has been in use since 2007. Numerous NPS faculty members have worked with the NPS Thesis Processor to assure that the documents produced are acceptable for student and faculty use.
- The template supports the creation of unclassified, For Official Use Only (FOUO), and classified documents. In particular, the template supports classification labels for paragraphs, captions, and references.
- The cover page, signature page, and Standard Form 298 are automatically generated.
- Combined with the Subversion, the template makes it possible for students and their advisors to collaborate on a document without the need to pass files back and forth.

1.2 The Purpose of this Document

This document does not duplicate the depth of information available elsehwere on LaTeX, but does provide you with the minimum amount of information required to use LaTeX to produce a master's thesis or technical report at NPS.

If you wish to learn more about LaTeX, there are many good reference books and online tutorials for LaTeX.

We recommend these online resources:

1. `http://en.wikibooks.org/wiki/LaTeX`, a wikibook that discusses many aspects of LaTeX.
2. `http://www.ctan.org/`, the Comprehensive TeX Archive Network, a collection of modules and documentation for extending LaTeX.
3. `http://en.wikipedia.org/wiki/Comparison_of_TeX_editors`, a web page on Wikipedia that discusses different programs available for editing LaTeX input files.

4. http://tex.stackexchange.com/, a question-and-answer website for TEX and LATEX problems.

We also recommend these books. They are expensive, but worth if it if you wish to become a LATEX master.

1. Guide to LATEX (4th Edition), by Patrick W. Daly. This is the comprehensive LATEX reference which will provide you with an astounding amount of LATEX-related information. Do not read Lamport's original book, as it is quite out of date.
2. The LATEX Companion (Tools and Techniques for Computer Typsetting), by Frank Mittelbach, Michel Gossens, Johannes Braams, David Carlisle and Chris Rowley.
3. The LATEX Graphics Companion, by Michael Gossens, Frank Mittelbach, Sebastian Rahtz, and Denis Roegel.

1.3 Installation

Before you can use LATEX, you will need to install two critical pieces of software:

1. The LATEX system itself.
2. A program for editing the .tex input files.

Here once again there are many options. For both LATEX and text editors there are both free and commercial distributions. This document makes specific recommendations that were known to work as of the document's date of publication. You are free to explore on your own as well.

1.3.1 Installation on MacOS 10.5 and above

The easiest way to get LATEX operational on a Mac is to download an installer for the most recent distribution from the TEXUsers's Group (TUG) at http://www.tug.org/mactex.

TUG's MacTEX distribution will install LATEX in the /usr/texbin/pdflatex directory and will update your startup files to include this directory in your path. If you chose this strategy, be sure to click "Customize" in the installer and select all of the optional packages for installation.

You can also install the program from sources using the MacPorts or Fink installer system, but this is not recommended.

If you are using LATEX on a Mac, you should consider downloading and using *LaTeXiT*, an open-source program that allows you to type LATEX math and create PDFs for embedding in other applications. The created PDFs have the source LATEX code embedded, so you can re-edit them in LaTeXiT using the Mac "Services" feature. You may also consider the commercial program *Latexian*, which allows you to type a LATEX document in one window and see the PDF update in another window as you type.

1.3.2 Installing on Linux

For most Linux systems a complete LaTeX distribution can be downloaded as part of the `texlive-latex3` package. This package can be downloaded in source from the `http://tug.org/` website and compiled locally, or installed directly using a package management command. In either case you will need to the installation as the superuser; this is typically done with the `sudo` command.

For Debian and Ubuntu Linux, use the `apt-get` command:

```
% sudo apt-get install texlive-latex3
```

For Fedora, RedHat, and Centos, use the `yum` command:

```
% sudo yum install texlive-latex3
```

We have noticed that the install command occasionally fails. If it fails for you, try it again two or three more times. If that still does not work, you will need to download and install from source.

1.3.3 Installation on Microsoft Windows

One of the most popular distributions for Microsoft Windows machines is called MiKTeX, which can be downloaded from `http://www.miktex.org/`. In most cases, this distribution of LaTeX will automatically download additional packages if needed.

1.3.4 Creating classified documents

If you are producing a classified thesis, you should ask a system administrator at the STBL or SCIF to provide you with a LaTeX installation on a computer authorized to handle classified information. With appropriate approvals you can alternatively set up an installation on a standalone machine. In the event that you are missing a package to create your thesis, the `.sty` files can be copied from the package on the CTAN website into your thesis directory. A system administrator should be consulted on the file transfer process.

1.4 Additional Applications for LaTeX

In addition to downloading and installing LaTeX, you will need an editor for editing the `.tex` input files. These programs are sometimes called *front ends*, although the term is imprecise and probably incorrect. You can use *any* editor for editing a `.tex` file, even Microsoft Word. Indeed, most of the front ends for LaTeX are really just text editors with syntax highlighting, although some will automatically compile your document and even jump to errors in the input file when they are encountered.

1.4.1 Selection of an Editor

Text editors offer a variety of features. Some are easier for beginners, such as Notepad++, LEd, and TeXnicCenter. Advanced editors for skilled users include emacs, vim, and Texlipse. A thorough comparison of editors is available at `http://en.wikipedia.org/wiki/Comparison_of_TeX_editors`. Learning about the various features of the text editors can help you to dramatically improve your writing efficiency.

If you are running LaTeX on MacOS, you already have a powerful editor installed on your computer: EMACS, which can be run from within the Macintosh Terminal application. You can run the tutorial for EMACS by starting Terminal, typing `emacs` and enter at the command prompt, and then typing control-h followed by a "`t`" to start the tutorial.

1.4.2 LyX: An alternative LaTeX system

LyX is a program that provides a WYSIWYG (What You See Is What You Get) graphical user interface for LaTeX. Instead of editing the `.tex` file directly, however, you edit an intermediate form which is a restricted set of LaTeX. LyX then runs LaTeX for you and produces the results.

While LyX is easier to use than LaTeX, it does not have the power or the flexibility.

LyX is free and open source and actively supported. LyX provides a GUI interface for floating figures and tables, formatting, fonts, labels, chapters, sections, subsections, math equations, tables, and much more. It also has built-in features for supporting BibTeX bibliographies, citations, and cross-references, and generally supports anything that can be done with LaTeX.

LyX can be downloaded from `http://www.lyx.org/` and is available for Linux, MacOS and Windows. If you want spell-checking, you will also need to install the *aspell* package.

An NPS thesis and dissertation template developed by CDR Michael Bilzor is available for use with LyX. It can be be obtained from `http://simson.net/npsthesis/lyxthesis.zip`.

Further information about the LyX template can be found in the Appendix.

1.5 Running LaTeX

The LaTeX system is actually a set of programs. For creating a thesis at NPS you will use several programs:

`pdflatex` This program reads the input file (e.g., `thesis.tex`) and produces a `.pdf` file (e.g., `thesis.pdf`) as an output. This program also produces a number of intermediate files (`thesis.aux`, `thesis.bbl`, `thesis.toc`, etc.).

`xelatex` is a version of LaTeXdesigned to process Unicode used in non-Roman languages. In some cases packages that are designed to work with LaTeXwill not work with `xelatex`, which is why we do not recommend using it unless you have no other choice.

`latex` This is an older version of the `pdflatex` program that produces `.dvi` files. The `.dvi` file must then be transformed into either a `.ps` or a `.pdf` file. In practice you should not run `latex` unless you need to use a special graphics module called `PStricks`. That module is beyond the scope of this document.

`bibtex` This program reads the `thesis.bbl` file and produces a bibliography in a file called `thesis.bst` which includes the bibliography. The `thesis.bst` then gets read the next time `pdflatex` is run.

`authorindex.pl` This is a program in perl that produces the author index from the `thesis.bbl` file. The authorindex is saved in the file `thesis.ain`.

`fixerrors.py` It turns out that there is a bug in BibTEX which causes URLs longer than 53 characters to be improperly split. This program unsplits them. It also will correct `authorindex` errors. You do not need to use this program if you do not have these errors.

If you are processing a file *thesis.tex* to create a *thesis.pdf* file, you will typically execute these commands in this order:

1. `pdflatex thesis`
2. `bibtex thesis`
3. `python fixerrors.py thesis`
4. `pdflatex thesis`
5. `pdflatex thesis`

The first run of `pdflatex` creates the file `thesis.aux` (and any other `.aux` files that might be needed). A PDF file is also created, but if you have any backwards references in your document the PDF file will contain incorrect references. The subsequent runs read these `.aux` files and generate correct back-references. Some editors, such as TEXlipse, will run these commands as needed on behalf of the user. Each command has a `thesis` argument, which is referring to the file `thesis.tex` without the `.tex` file extension. In rare cases it may be necessary to delete the `.aux` files and re-run the `pdflatex` command from the beginning.

1.6 Basic LATEX formatting

Here is a simple LATEX document:

```
\documentclass{article}
\begin{document}
Hello World!
\end{document}
```

Normally with LATEX, you just type text and leave a blank line between each paragraph. LATEX then formats it into beautiful paragraphs. LATEX will ignore the space at the beginning of each line.

Here is a slightly more complex document:

```
\documentclass{article}
\begin{document}
In December 1951, in a move virtually unparalleled in the history of
academe, the Postgraduate School moved lock, stock and wind tunnel
across the nation, establishing its current campus in Monterey,
Calif.
     The coast-to-coast move involved 500 students, about 100
     faculty and staff and thousands of pounds of books and
     research equipment. Rear Adm.\ Ernest Edward Herrmann
     supervised the move that  pumped new vitality into the
     Navy's efforts to advance naval science and technology.

% This is comment. Nobody will see it.

Today the school, known as the ``Naval Postgraduate School,'' is the
Navy's preeminent institution of graduate education and advanced
research. Approximately 1 in 10 of the students are in the top 10\% of
their classes.
\end{document}
```

LaTeX will format the above text into a document that looks like this:

> In December 1951, in a move virtually unparalleled in the history of academe, the Postgraduate School moved lock, stock and wind tunnel across the nation, establishing its current campus in Monterey, Calif. The coast-to-coast move involved 500 students, about 100 faculty and staff and thousands of pounds of books and research equipment. Rear Adm. Ernest Edward Herrmann supervised the move that pumped new vitality into the Navy's efforts to advance naval science and technology.
>
> Today the school, known as the "Naval Postgraduate School," is the Navy's preeminent institution of graduate education and advanced research. Approximately 1 in 10 of the students are in the top 10% of their classes.

This sample document illustrates a few important points about LaTeX:

- LaTeX will automatically re-wrap your text as necessary to format the paragraphs. Indention is determined by the style of the current document, not by whether or not you actually indent the paragraph.
- LaTeX ignores space at the beginning of lines; breaks between paragraphs are marked with blank lines.

- What you type is not what you get! In particular, opening double quote marks are typed as two backquotes (``) and closing double quote marks are entered as two apostrophes (''). You will also note that the period following Rear Adm. Ernest Edward Herrmann's name is followed by a backslash (\) and a space, rather than just a space. This tells LaTeX that the period does not mark the end of a sentence.
- Commands begin with a backslash (\) and contain only uppercase and lowercase letters.
- A command can have zero or more arguments. The arguments are enclosed within braces ({}). The `\documentclass` command begins the document; its argument is the kind of document you are making.
- The `\begin` command introduces an *environment*. Every document has at last one environment, the `document` environment. Every `\begin` must have a matching `\end` that names the same environment. Environments can be nested.
- Comments can be embedded in your document with a percent sign (%). Anything after the percent sign will not print. To print a percent sign, prefix it with a backslash (\%).

1.7 Typing Special Characters

This section provides information on how to type special characters in LaTeX. In each section we will have a table that shows what to type and how it displays in your final `.pdf` file. If the above text were put into a table, it would look like this:

Typed	Displayed	Typed	Displayed
``	“	''	”

The left entry of the table is the backquotes, which shares the tilde key on the US keyboard. The right entry is the single quotes, which shares the double quote marks key.

1.7.1 Typing Quotes

To type quotes, you should not use the double-quote character. Instead, use the back quote (`) and the forward quote (') to type quotes:

Typed	Displayed	Typed	Displayed
`don't`	don't	`3'2''`	3'2”
``this''	“this”	`` `is' ``	‘is’
``\,`special'\,''	“ ‘special’ ”		

1.7.2 Controlled Special Characters

Unlike Microsoft Word and other programs, LaTeX uses special characters embedded in your text to control formatting. The most common of these characters is the backslash (\). All of special characters are listed below:

Special Character	Why it is special
\	Introduces a command
{	Introduces arguments in commands or the start of a group
}	Closes arguments in commands or the end of a group
%	The comment character; LaTeX ignores the rest of the line
#	Used for parameter substitution inside macros
~	Enters a hard, non-breaking space
&	Used for delimiting columns in a table
$	Turns on/off math mode (see §1.9)
_	Used for subscript in math mode
^	Used for superscript in math mode

To enter the special characters into your document you must use a special sequence that begins with a backslash. Most (but not all) of these special sequences are the character itself. If you are curious, inside LaTeX, each of these sequences is implemented as a command that causes LaTeX to output the character that has been quoted:

Typed	Displayed	Typed	Displayed
\$	$	\&	&
\{	{	\}	}
\%	%	_	_
\#	#	\^{}	^
\~{}	~	$\backslash$	\

1.7.3 Accented, Dotless and Slashed Vowels

With LaTeX most accented vowls are entered with a combining accent character and a vowel, although some (such as the angstrom symbol) are not, as shown below:

Typed	Displayed	Typed	Displayed
\'{o}	ó	\~{o}	õ
\'{o}	ó	\={o}	ō
\^{o}	ô	\.{o}	ȯ
\"{o}	ö	\d{o}	ọ
\c{o}	o̧	\u{o}	ŏ
\b{o}	o̲		
\aa	å	\AA	Å
\i	ı	\j	ȷ
\o	ø	\O	Ø
\ae	æ	\AE	Æ
\oe	œ	\OE	Œ
\v{o}	ǒ	\H{o}	ő
\t{oo}	o͡o		

Note that `\i` displays a dotless i while `\j` displays a dotless j. Some fonts do not have some of these characters, and display a black box instead.

1.7.4 Symbols

LaTeX has literally hundreds of symbols that you can include in your document. These symbols include the copyright symbol, currency symbols, foreign language characters, and many more. The symbols are placed in documents using macros, allowing a plain text document to support a large variety of non-standard text characters. A complete guide to the available symbols in LaTeX is available online at `http://mirror.ctan.org/info/symbols/comprehensive/symbols-letter.pdf`.

Here are some of the most common symbols you are likely to need for an NPS document:

Typed	Displayed	Typed	Displayed
`\l`	ł	`\L`	Ł
`\S`	§	`\ss`	ß
`\P`	¶	`\pounds`	£
`?``	¿	`\copyright`	©
`!``	¡	`\texttrademark`	™
`\euro`	€	`\textregistered`	®
`\dag`	†	`\ddag`	‡

(Note: The `\euro` command requires that the command `\usepackage{eurosym}` be part of the document's *preamble* (the part before the `\begin{document}`). It is included as part of the `npsreport.cls` file.)

1.8 Fonts

Like Microsoft Word, LaTeX makes it easy to alter font, size, face, and weight of text. But unlike Word, these changes are typically done in a structured manner that lends itself to creating documents that have consistent font usage throughout.

1.8.1 Changing Font Size

Although LaTeX allows you to use fonts of any size, the built-in templates provides eleven built-in sizes. These sizes automatically adjust depending on if you are creating a document with 12-point font (NPS standard), 11-point font, or 10-point font.

When you change the font size, that change stays in effect until you change it again. You can confine your font change by placing the text you want resized within braces, sometimes called a *group* or a *block*, as shown in the examples in the following table:

Size	Point Size	Typed	Displayed
`\tiny`	6	`{\tiny This is tiny}`	This is tiny
`\scriptsize`	8	`{\scriptsize scriptsize}`	scriptsize
`\footnotesize`	10	`{\footnotesize footnotesize}`	footnotesize
`\small`	11	`{\small This is small}`	This is small
`\normalsize`	12	`{\normalsize normalsize}`	normalsize
`\large`	14	`{\large This is large}`	This is large
`\Large`	17	`{\Large Large}`	Large
`\LARGE`	20	`{\LARGE LARGE}`	LARGE
`\huge`	25	`{\huge huge}`	huge
`\Huge`	25	`{\Huge Huge}`	Huge

Notice that with the NPS template there is no difference between `\huge` and `\Huge`.

You can also pick an arbitrary size by using the `\fontsize` and `\selectfont` commands. The `\fontsize` command takes two arguments: the size of the font and the size of the leading, or the amount of space between lines. First the size is selected with the `\fontsize{i}{j}` command where `i` and `j` are expressed in points (there are 72.27 points in an inch). Next the font is selected with the `\selectfont` command, as shown below:

Typed	Displayed
`{\fontsize{4}{5}\selectfont very tiny}`	very tiny
`{\fontsize{64}{64}\selectfont Big}`	Big

1.8.2 Changing Font Style

LaTeX provides these macros for selecting font styles:

Typed	Displayed
`\textrm{This is Roman}`	This is Roman
`\textbf{This is bold}`	**This is bold**
`\texttt{This is typewriter}`	`This is typewriter`
`\textsc{This is small capitals}`	THIS IS SMALL CAPITALS
`\textsl{This is slanted}`	*This is slanted*
`\textsf{This is sans serif}`	This is sans serif
`\textit{Italics}`	*Italics*
`\emph{This is emphasized}`	*This is emphasized*
`$\cal CALLIGRAPHICS$`	$\mathcal{CALLIGRAPHICS}$
`{\boldmath $\cal BOLD CALIGRAPHICS$}`	$\boldsymbol{\mathcal{BOLDCALIGRAPHICS}}$

Notice that the last two are surrounded by dollar signs as they require math mode (see §1.9).

If you just want to put something into italics, you should use `\emph{text}`, which will produce *text*. The reason to use `\emph{}` and not `\textit{}` is that `\emph{}` will nest as necessary. For example, this:

```
\emph{You can even \emph{emphasize} a word within a sentence
that is emphasized.}
```

typesets as this:

You can even emphasize *a word within a sentence that is emphasized.*

As you should in general avoid underlining text, we will not show you how to do it in this document.

1.8.3 Choosing an Arbitrary Font

There are many ways that you can request arbitrary fonts for small sections of your document, but they are all beyond the scope of this article. It is also possible to embed arbitrary Unicode within a LaTeX document, either by using the Unicode-aware version of LaTeX called XeTeX (`xelatex`), or by saving your Unicode characters in a `.pdf` file and including that file with the `\includegraphics{}` command (as we did with the XeTeX logo).

If you want to change the font for an entire document, please refer to the LaTeX Font Catalogue at `http://www.tug.dk/FontCatalogue/` which provides documentation and examples. To change the font of the NPS template, refer to §2.2.1.

1.9 Math

Typsetting mathematics is one of the primary design goals of LaTeX. The program has more features for typsetting math than typsetting text. There is also a powerful set of mathematical extensions by the American Mathematical Society called `amsmath`. For more detailed information, please see:

- The LaTeX wikibook, `http://en.wikibooks.org/wiki/LaTeX/Mathematics`.
- The User's guide for the `amsmath` package is available at: `ftp://ftp.ams.org/ams/doc/amsmath/amsldoc.pdf`
- The short math guide, available at `http://tinyurl.com/63w3mnu`.

What follows here is necessarily very brief.

1.9.1 Math Mode

To typset math you must enter math mode. There are two easy ways to enter math mode.

- You can put your math between two dollar signs. For example, entering `$1+1=2$` in your document will produce $1+1=2$.
- You can put the equation on a line by itself in an *equation* environment (e.g., between `\begin{equation}` and `\end{equation}` commands). An equation environment creates a block that is typeset in math mode and includes a numbered equation. For example, this:

  ```
  \begin{equation}
  1+1=2
  \end{equation}
  ```

  produces this:

$$1+1=2 \tag{1.1}$$

Math mode can also be used in paragraphs to add special math characters, such as the π symbol (using `$\pi$` here). In fact, many of the symbols that LaTeX displays can only be displayed while in math mode.

1.9.2 Simple Math in Math Mode

As the examples above show, you can type simple math in math mode and get what you want. In general, variables (the letters a through z), the plus (+), minus (−) and equals (=) all typeset properly when you type them between dollar signs. But there are some caveats:

- If you wish to typeset a multiplication symbol, use `\times` instead of an asterisk (`*`).
- If you wish to typeset division, use `\div` to enter a division symbol or the `\frac` command to create a fraction. Do not use `/` for division.

- Spaces are ignored in math mode. If you want a space, you probably should use multiple equations, with each equation in math mode but with a non-math mode space between them.

The table below shows some examples:

Typed	Displayed	Comments
`$1+2=3$`	$1+2=3$	
`$10 * 10 = 100$`	$10*10=100$	Don't use asterisks for multiplication.
`$10\times10=100$`	$10\times10=100$	Spaces don't matter
`$10 \times 10 = 100$`	$10\times10=100$	
`$a=3$`	$a=3$	
`$a=f/m$`	$a=f/m$	Don't use the slash for division.
`$a=f \div m$`	$a=f\div m$	
`$a=\frac{f}{m}$`	$a=\frac{f}{m}$	
`$f(x)=3x$`	$f(x)=3x$	
`$a=2b$ and $a+2=b+4$`	$a=2b$ and $a+2=b+4$	

Use math mode when you need to enter math—it's worth the effort. For example, consider a function of t. You can certainly type this without math mode—witness f(t)—but doesn't it look much better when dollar signs are placed around the symbol, like this: $f(t)$? Math mode adds clarity.

If you wish to discuss an important equation in your document, use the *equation* environment. This environment sets your equation off from the body text and gives it a number.

Using the equation environment, this:

```
\begin{equation}
a = 1+2
\end{equation}
```

typesets as:

$$a = 1+2 \tag{1.2}$$

1.9.3 Superscripts and subscripts

In math mode the caret (^) is used for superscript and the underbar (_) is used for subscript (this is why the characters are special). The commands only superscript or subscript the following character; if you want to superscript or subscript multiple characters you need to make them a group by enclosing them in braces.

Here are some examples:

Typed	Displayed
`$a^2+b^2=c^2$`	$a^2+b^2=c^2$
`$2^{16}=65,535$`	$2^{16}=65,535$
`$N_A$ is Avogadro's constant`	N_A is Avogadro's constant
`$A^{B^C}$`	A^{B^C}
`$A^{B^{C^D}}$`	$A^{B^{C^D}}$
`$a_k$ and $b_k$`	a_k and b_k
`$a_k$ and $b_k$`	a_k and b_k

1.9.4 Combining Symbols in Groups

Many math symbols use subscripts and superscripts to determine placement of specific equation elements. This includes `\int` which is used to create integrals and `\sum` which is used to create sums. Below are some examples with the Fourier series.

Typed	Displayed
`$a_k=\frac{1}{\pi}` `\int_{-\pi}^{\pi}f(x)cos(kx)dx$`	$a_k=\frac{1}{\pi}\int_{-\pi}^{\pi}f(x)cos(kx)dx$
`$b_k=\frac{1}{\pi}` `\int^{\pi}_{-\pi}f(x)\sin(kx)dx$`	$b_k=\frac{1}{\pi}\int_{-\pi}^{\pi}f(x)\sin(kx)dx$
`$f(x)=\sum_{k=-\infty}^{\infty}` `c_k e^{-jkx}$`	$f(x)=\sum_{k=-\infty}^{\infty}c_k e^{-jkx}$

The `\sum` and `\int` symbols display these elements differently in an *equation* environment:

$$f(x)=\frac{a_0}{2}+\sum_{n=1}^{\infty}\left[a_k\cos(kx)+b_k\sin(kx)\right] \tag{1.3}$$

We used this code to type Equation (1.3):

```
\begin{equation}
f(x)=\frac{a_0}{2} + \sum_{n=1}^{\infty}
    \left[a_k \cos(kx) + b_k \sin(kx)\right]
\label{fourier}
\end{equation}
```

There are several important math mode conclusions to draw from these examples:

- Simple one letter subscripts and superscripts do not need to be enclosed by curly braces, but multiple character ones must.
- Subscripts and superscripts in math mode are to the right of the sum and integral characters; however, in the equation environment they are above and below. In the other uses (exponentials, etc.), the results are the same in either mode.
- The order of appearance of subscript than superscript or vice versa does not change the results.

The `amsmath` package has additional environments, symbols and commands such as provisions for non-numbered, multiple-lined and aligned equations. Its user guide is an excellent reference and provides many examples.

Although math mode may seem cumbersome at first, its syntax does become second nature and very sophisticated equations can be generated, if needed. Consult the user manuals and references provided in §1.9.

1.9.5 Parenthesis and Brackets

You can use regular parentheses in math mode, but they do not stack nicely:

Typed	Displayed
`$((1))$`	$((1))$
`$[((1))]$`	$[((1))]$

You probably want the outer brackets and parenthesis to be bigger than the inner ones. You can do that using the `\left` and `\right` commands. Following these macros is another character, such as a parenthesis or bracket. These macros place the correctly sized specified character into the equation. They will automatically get bigger as necessary, especially in the *equation* environment.

For example, here is what you get with the conventional parenthesis:

```
\begin{equation}
A = ( \sum_{i=1}^{10}i\times\sin(i) )
\end{equation}
```

$$A = (\sum_{i=1}^{10} i \times \sin(i)) \tag{1.4}$$

And here is an example using `\left` and `\right`:

```
\begin{equation}
A = \left( \sum_{i=1}^{10}i\times\sin(i) \right)
\end{equation}
```

$$A = \left(\sum_{i=1}^{10} i \times \sin(i) \right) \tag{1.5}$$

This example seems silly, but shows how powerful `\left` and `\right` are:

```
\begin{equation}
\left(\frac{
    \left(\frac{1}{2}\right)}{
    \left(\frac{3}{4}\right)
}\right)
\end{equation}
```

Produces this:

$$\left(\frac{\left(\frac{1}{2}\right)}{\left(\frac{3}{4}\right)} \right) \tag{1.6}$$

1.10 Spacing, Frameboxes, and Centering

LaTeX has a number of commands for controlling space, creating boxes, and centering text.

1.10.1 Controlling Spaces

You can use these commands for controlling how much space is inserted between words:

Typed	Displayed
`\,` (a slash followed by a comma)	produces a small space.
`\ ` (a slash followed by a space)	produces a standard word space.
`\@` (a slash followed by an at sign)	produces an intersentence space.

The small space and standard word space are used between the words in the right column. An intersentence space is needed to correct the following error where a sentence ends in a capital letter.

1.10.2 Suppressing Orphans and Widows

When typesetting, paragraphs that have their last line on the following page are called *orphans*, and paragraphs that begin at the bottom of a page with a single line are called *widows*. Orphans and widows are considered ugly. Microsoft Word can be programmed to prevent widows and orphans by requiring that all paragraphs have at least 2, 3 or 4 lines on a page. Microsoft Word achieves this desired result by inserting spaces between paragraphs to balance out the page as necessary. LaTeX has no automatic control over orphans and widows. It is one of the major failings of the system.

NPS students working on their Master's thesis are frequently instructed by the Thesis Processor to modify their document so that there are no widows or orphans. One way to achieve such a result is to rewrite the text by inserting sentences or removing them. This may seem excessive to you. Another way you can control widows and orphans is by manually adding or removing space, or by stretching a page to allow additional lines on it.

You can force a blank line using `\\` and have the option to force a specific length using `\\[3pt]`:

Typed	Displayed
`This is\\`	This is
`an example.`	an example.
`This is\\[3pt]`	This is
`an example.`	an example.

You can add or remove space on a page with the `\enlargethispage` command. For example, to squeeze another line onto the current page, insert this command onto the page:

```
\enlargethispage{1pc}
```

This command is useful when you need to manually enlarge a page so that the last line of a paragraph can fit on the present page without being pushed to the next page.

You can shorten a page by a line, forcing a widow onto the next page:

```
\enlargethispage{-1pc}
```

These commands are also useful when writing a conference paper that needs to fit within a certain page length.

1.10.3 Frameboxes and Centering

You can draw a box around text with:

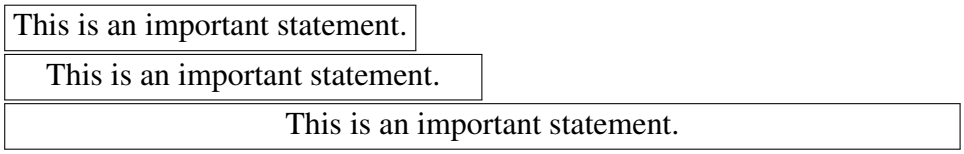
```
\framebox[width]{textstring}
```

The `[width]` parameter is optional. Without it, the box defaults to the minimum size necessary to hold the `textstring`.

Here are is an example to show what we mean. This text:

```
\framebox{This is an important statement.}\\
\framebox[15pc]{This is an important statement.}\\
\framebox[30pc]{This is an important statement.}
```

will typeset as this:



If you provide a space that is too small, the results will be ugly:

```
\framebox[5pc]{This is an important statement.}
```

This is an important statement.

You can center any text, table, figure, etc. with the *center* environment, using the following:

```
\begin{center}
\framebox{$a^2 + b^2 = c^2$}
\end{center}
```

Produces this:

$$\boxed{a^2 + b^2 = c^2}$$

If you are entering a number of equations in your document, you may want to use the `equation` environment, which will provide numbered equations:

```
\begin{equation}
a^2 + b^2 = c^2
\end{equation}
```

$$a^2 + b^2 = c^2 \tag{1.7}$$

Unlike many things in LaTeX, the *framebox* and *equation* environments cannot be readily combined. That's because `\fbox` turns off math mode, so you need to manually turn it back on.

Type this:

```
\begin{equation}
\fbox{$a^2 + b^2 = c^2$}
\end{equation}
```

To produce this:

$$\boxed{a^2 + b^2 = c^2} \tag{1.8}$$

1.11 Lists

There are three kinds of lists that you may wish to make:

description lists are used for definitions, where a short phrase is bolded and the remainder text is the standard font (like this list).

enumerate lists are lists where each item is numbered and the ordering is relevant, like the steps of a recipe.

itemize lists are lists where each item is of equal importance.

Lists are implemented as LaTeX environments, which means that they begin with a `\begin{`*listname*`}` and end with an `\end{`*listname*`}`.

```
\begin{description}
\item[Earth] Third Planet.
\item[Mars] Fourth Planet.
\item[Venus] Second Planet.
\end{description}
```

Earth Third Planet.
Mars Fourth Planet.
Venus Second Planet.

```
\begin{enumerate}
\item Wake up.
\item Go to work.
\item Go home.
\item Go to sleep.
\item Repeat.
\end{enumerate}
```

1. Wake up.
2. Go to work.
3. Go home.
4. Go to sleep.
5. Repeat.

```
\begin{itemize}
\item Hamburgers
\item Hotdogs
\item Chips
\end{itemize}
```

- Hamburgers
- Hotdogs
- Chips

1.12 Labels and Captions

Labels are hidden markers in your `.tex` files created by the `\label{name}` command. These markers are never shown directly in the output files. However, correctly placing these markers in your file allows you to reference chapters, appendices, sections, figures, tables and equations. You may wish to give your marker names prefixes such as `chap:`, `sec:`, `fig:`, `tab:` and `eqn:` to logically identify the labels.

Captions are the text that appears below a figure or table to provide context for the information presented. Captions are indicated by the command `\caption{Sentence.}` Sometimes longer captions can look poorly in the Lists of Figures and Tables, so a caption for the table can also be specified by using `\caption[Short Sentence.]{Longer Sentence.}`

1.13 Tables

Tables provide a valuable means to display data in an organized manner. Using tables in LaTeX is easy once the syntax is understood, although tables can be incredibly complex as well. To see plenty of examples and explanation of options, visit `http://en.wikibooks.org/wiki/LaTeX/Tables`. There are also *many* add-on packages which provide additional functionality.

Here is a very simple table:

```
\begin{center}
\begin{tabular}{cc}
Shape & Sides \\
\hline
Triangle & 3 \\
Square & 4 \\
\end{tabular}
\end{center}
```

Produces this:

Shape	Sides
Triangle	3
Square	4

This table has six things we have not seen before:

1. The `{cc}` is the table format specifier. Each "c" represents a column that is centered.
2. The `&` is used to separate columns of the table.
3. The `\\` is used to separate rows of the table.
4. The `\hline` is used to draw a horizontal line.
5. The table is drawn in a `tabular` environment.
6. The `center` environment is used to center the table.

Here is a slightly more complex table:

```
\begin{center}
\begin{tabular}{lcr}
Left Justified & Center Justified & Right Justified \\
\hline
Each & Column & Entry \\
Spaces      & Do not    & Matter \\
But         & May       & Assist you. \\
\end{tabular}
\end{center}
```

And here is how it formats:

Left Justified	Center Justified	Right Justified
Each	Column	Entry
Spaces	Do not	Matter
But	May	Assist you.

This table has three columns as identified by the format specification `lcr`. The first column is left-justified ("l"), the middle column is center justified ("c") and the third column is right justified ("r"). The left side of the table has a vertical bar due to the pipe character (`|`). The `\hline` macro causes a horizontal line to be drawn across the table. Columns are indicated by the ampersands (`&`) and the amount of spaces used are not important. Thus, the spaces can be used to ensure your columns line up in your `.tex` file the way the table is intended to print.

An empty cell is just ampersands separated by a space. To start a new row of the table, use the double backslash (\\); this can be done at the end of the current row.

Below is a more complex table:

```
\begin{center}
\begin{table}
\begin{tabular}[t]{|l||r|r|r|r|r|r|}
\hline
Pulse  & Pulse  & PRF & Duty  & Coupler & Power & Average & Peak  \\
Width  & Length &     & Cycle & Losses  & Meter & Power   & Power \\
\hline
Long & $1.0 * 10^{-6} s $ & 750 Hz & $7.0 * 10^{-4} $ &
       49.1 dB & 3.4 dBm & 52.5 dBm & 73 dBm \\
& & & 31.075 dB & & & & 43 dBW \\
& & & & & & & 227.7 kW \\
\hline
Medium & $3.0 * 10^{-7} s $ & 1200 Hz & $2.0 * 10^{-4} $ &
         49.1 dB & 0 dBm & 49.1 dBm & 83 dBm \\
& & & 34.29 dB & & & & 53 dBW \\
& & & & & & & 218.27 kW \\
\hline
Short & $1.0 * 10^{-7} s $ & 2400 Hz & $1.9 * 10^{-4} $ &
        49.1 dB & -1 dBm & 48.1 dBm & 83 dBm \\
& & & 35.05 dB & & & & 53 dBW \\
& & & & & & & 206 kW \\
\hline
\end{tabular}
\end{center}
```

And here is the formatted table:

Pulse Width	Pulse Length	PRF	Duty Cycle	Coupler Losses	Power Meter	Average Power	Peak Power
Long	$1.0 * 10^{-6} s$	750 Hz	$7.0 * 10^{-4}$ 31.075 dB	49.1 dB	3.4 dBm	52.5 dBm	73 dBm 43 dBW 227.7 kW
Medium	$3.0 * 10^{-7} s$	1200 Hz	$2.0 * 10^{-4}$ 34.29 dB	49.1 dB	0 dBm	49.1 dBm	83 dBm 53 dBW 218.27 kW
Short	$1.0 * 10^{-7} s$	2400 Hz	$1.9 * 10^{-4}$ 35.05 dB	49.1 dB	-1 dBm	48.1 dBm	83 dBm 53 dBW 206 kW

1.14 Graphics

This section briefly describes how to embed graphics in a LaTeX document. For alternative treatments we recommend Höppner's "Strategies for including graphics in LaTeX documents" [3], and the book *The LaTeX Graphics Companion* [2].

Graphics are embedded using the `\includegraphics` command. It looks like this:

```
\includegraphics[options]{filename}
```

Typical options that you can use are `width=XX` or `height=XX`. For example, to include an image, have it centered, and scale it to 3 inches, use this:

```
\begin{figure}
    \begin{center}
        \includegraphics[width=3in]{imagedirectory/file}
        \caption{Caption of the important figure.}
        \label{fig:importantfigure}
    \end{center}
\end{figure}
```

The `imagedirectory/file` notation indicates the images are in a subdirectory of `imagedirectory` and the file name is `file`. The file extensions (`.jpg`, etc.) are optional.

Note: LaTeX does not properly include graphics that have periods in their filenames in addition to the period that is used to denote the file type!

There are two kinds graphics that you can include in a LaTeX document:

Vector graphics are excellent for printing purposes. These images show up nicely on the computer screen and paper. The computer renders these dynamically. Several tools to generate vector graphics include `Inkscape` and `asymptote`. In general, you should convert vector graphics to a `.pdf` file and embed it in your document using `\includegraphics`.

Raster graphics include `.bmp`, `.jpg`, `.png`, and `.gif` images. Formats without compression, including `.bmp` files generally will make your thesis file much larger. Some of these images show up poorly or pixelated in print copy. You should convert these files to `.jpg` or `.png` and embed them in your document with `\includegraphics`.

Grahpics can also be created with R, gnuplot, matplotlib, or the asymptote package.

Specific macros for including graphics provided by the `npsreport` template are discussed in Section 2.3.3.

1.15 BibTEX and Citations

Bibliography and citation are important in your thesis. Each department has different expectations on citation styles. Even if you select the wrong style initially, changing the format to the correct option is only a one-line change for LATEX—unlike a complete nightmare for Microsoft Word users.

See `http://en.wikibooks.org/wiki/LaTeX/Bibliography_Management` and `http://stefaanlippens.net/bibentry` for more information on BiBTEX.

Many common citation reference organizers and websites output BibTEX formatted citations in `.bib` files. This is a time saver, as rather than retyping information, you can download the `.bib` file and copy its contents into your thesis master `.bib` file. The master `.bib` file contains all of your citations, even ones that you have not yet cited. When you reference these citations in your thesis, BibTEX can generate the references list for you. To cite a specific reference use the `\cite{name}` command. After your first run of `pdflatex`, you follow with the `bibtex` command as in §1.5.

1.16 Going Further

You are now on your way to becoming a LATEX expert and will find that many of the LATEX modules are already installed with your LATEX. You may find the following packages useful:

multirow Allows a single table cell to extend to multiple rows.

ifthen Allows you to put conditions in your thesis. It is a bit easier than using the `if` that's built in to TEX.

acronym A great package for automatically generating acronym lists. It can track the usage of acronyms to correctly use the long name of the acronym on its first use.

makeidx For creating an index of key words and phrases in your document and what page the keywords appear on.

mcode Places a MATLAB .m file contents directly into the output. The package performs syntax highlighting and line numbering if desired. This package is not in the CTAN and documentation may be obtained from the MATLAB Central website at `http://tinyurl.com/3wgcufr`.

In learning about LaTeX, you are likely to do searches on the Internet, learn about a new package, and want to learn more about it. You will probably be surprised to find that many of these packages are already part of your LaTeX distribution. In most cases, the documentation for the packages is already on your hard drive as a `.pdf` file. We recommend reading package documentation; the documentation frequently has better information than the random pages you may find by using Google.

CHAPTER 2:
The NPS LaTeX Template Package

This chapter describes how to get the NPS report template and how to use it.

2.1 Getting the Template

Get a copy of the `npsthesis.zip` distribution from `http://simson.net/npsthesis/npsthesis.zip`. Unpack this into a directory on your computer. This is where we will be working for the remainder of this chapter.

2.1.1 LaTeX Files Included in the Template Package

Below you will find the important files in the package.

These files are used for all document types:

Makefile The Makefile to make the thesis
appendix1.tex The example file for an appendix.
authorindex.* The LaTeX authorindex package, for making the Referenced Authors page.
chapter1.tex The example file for each chapter.
chngcntr.sty The `chngcntr` package, for changing the way that LaTeX displays its counters.
fixerrors.py A python program that removes the breaks in the `.bbl` file inserted by BibTeX and improper authorindex items.
npsreport.cls The style class file for NPS documents.
nps-plain.bst A BibTeX style file that makes references in a style that is acceptable to NPS for which the references appear sorted by author's last name.
nps-plain-unsorted.bst A BibTeX style file that makes references in a style that is acceptable to NPS for which the references appear in the order of appearance.
nps-plain-classified.bst A BibTeX style file that makes references in a style that is acceptable to NPS for a classified thesis. References are sorted by last name.
nps-plain-classified-unsorted.bst A BibTeX style file that makes references in a style that is acceptable to NPS for a classified thesis. References appear in the order of appearance.
nps_logo_3clr_cymk.pdf NPS Logo, 3 color, in format suitable for printing
thesis.tex A skeletal thesis LaTeX template file
thesis.bib A skeletal thesis bibliography file

These files are skeletal files for creating your own documents. Use them as a template by removing our text and inserting your own:

thesis.tex A one-author thesis.
thesis_two.tex A two-author thesis.
thesis_coadvisors.tex A one-author thesis with two co-advisors.
thesis.bib A thesis BiBTeX input file.

You will also find `techreport.tex`, which is the LaTeX source code for this document.

2.1.2 LaTeX Demonstration Files

In addition to the files in the `npsthesis.zip` file, we have made available a set of demonstration documents. These can be downloaded from `http://simson.net/npsthesis/demos.zip` and includes the following files:

demo_classified.tex A demonstration classified master's thesis that shows how to use all of the macros we have created for labeling classified paragraphs, figures and references. To avoid confusion, this document is classified F//MM//SPECIAL//TOM FOOLERY (F is for Fun).

demo_fouo.tex A demonstration For Official Use Only thesis. To avoid confusion this document is classified For Entertainment Use Only (FEUO).

demo_phd.tex A demonstration PhD thesis.

demo_report.tex A demonstration technical report.

demo_thesis.tex A demonstration master's thesis.

demo_traditional.tex A demonstration thesis in the traditional NPS master's thesis style.

demo_twoauthor.tex A demonstration master's thesis with two authors.

2.2 Creating Your Document

The skeletal `thesis.tex` file consists of two main parts: the *prologue* (everything before the `\begin{document}`) and the *body* (everything between the `\begin{document}` and the `\end{document}`). The body is further split into two parts: the main body and the postmatter (the appendices, bibliography, and distribution list). You will typically create your thesis or technical report by editing each. Some students put their entire thesis into the `thesis.tex` file, while others put each chapter into its own `.tex` file and include them using the `\include{filename.tex}` command.

The remainder of this section will show a skeletal thesis template for each of these three parts (the prologue, the main body and the postmatter), and then will explain the purpose of each command.

2.2.1 The Thesis Prologue

Below is the thesis prologue from the `thesis.tex` file, with all of the comments removed:

```
\documentclass[twoside,thesis,authorindex]{npsreport}
\securitybanner{}
\title{[TITLE]}
\author{[AUTHOR]}
\degree{Master of Science in [DEGREE]}
\degreeabbreviation{MS}
\department{Department of [DEPARTMENT]}
\thesisadvisor{[ADVISOR]}
```

```
\secondreader{[SECOND READER]}
\departmentchair{[DEPARTMENT CHAIR]}
\rank{[RANK]}
\prevdegrees{[UNDERGRADUATE DEGREE]}
\degreedate{[DEGREE DATE]}
\distribution{Approved for public release; distribution is unlimited}
\abstract{
  [INSERT ABSTRACT HERE]
}
\ReportType{Master's Thesis}
\DatesCovered{2102-06-01---2104-10-31}
\SponsoringAgency{Department of the Navy}
\RPTpreparedFor{}
\ReportClassification{Unclassified}
\AbstractClassification{Unclassified}
\PageClassification{Unclassified}
\SupplementaryNotes{ The views expressed in this thesis are those of
  the author and do not reflect the official policy or position of the
  Department of Defense or the U.S. Government.
  \footnotesize IRB Protocol Number: XXXX}
\SignatureOne{\includegraphics[width=2in]{signature_picture}}
\makeatletter\@removefromreset{footnote}{chapter}\makeatother
```

The following explains each of these commands and options:

\documentclass

The documentclass specifies that the document uses the `npsreport.cls` file and all settings contained therein. There are several optional parameters, each separated by comma:

article, thesis, or dissertation choose the appropriate one for the case.

12pt, 11pt, or 10pt Font size selection. With no option given, 12pt is the default.

times, arial, or courier Font selection. With no option given, times is the default.

twoauthors, threeauthors, or fourauthors use these options if you have several authors. Single authors need no option.

twoadvisors if you have two advisors rather than a second reader.

twoside prints on both sides of the same sheet of paper; recommended.

classified if you are using an approved computer system to write your thesis on sensitive research.

authorindex if you are including an author index page of your thesis references.

index if you are including a keyword index page of your thesis important terms.

acronym for a more sophisticated handling of acronyms. See `acronyms.tex` for additional information.

traditional prints the thesis in the style of the NPS Microsoft Word thesis template. Although you are free to use this style, the newer style is approved and looks quite

nice when no option is given.

singlespace if you prefer single-spaced paragraphs, though it may be a little harder to read. This is not approved for an NPS Masters Thesis, but is approved for NPS technical reports.

tight Causes the spacing between paragraphs and paragraph indentation to be smaller than standard.

securitybanner

Leave blank unless producing a FOUO or classified theses. Whatever text appears between the braces is placed at the top and bottom of each page of the document.

title

Your title

degree

Your planned NPS degree written out.

degreeabbreviation

MA, MS, MBA, or other shorthand notation

prevdegrees

Written out as "B.S., Degree, School, Year"

degreedate

Written as "Month Year"

distribution

One of the approved Department of Defense distribution statements (A through F or Export Control). These are listed out on the thesis release form that must also be submitted with your thesis.

abstract

Your entire abstract goes here. Do not make it too big, as it must also fit on the SF298 form.

SponsoringAgency

Your appropriate military department, such as Department of the Air Force, Department of the Navy, etc.

RPTpreparedFor

This optional item can be used to specify the sponsor of the research.

SupplementaryNotes

If your thesis does not have an Institutional Review Board (IRB) protocol number, replace the XXXX with N/A, otherwise fill in the appropriate number. This is needed for theses that use human subjects to collect data. Ask your advisor for more information if this applies.

SignatureOne, SignatureTwo, SignatureThree, and SignatureFour

Each author's signature line can show an image of the signature, if desired. Specifying the width as 2 inches is recommended. This is an optional feature.

2.2.2 The Thesis Main Body

Below is a thesis body, with all of the comments that appear on lines by themselves removed:

```
\begin{document}
\NPScover                       % Cover
\NPSsftne                       % SF298
\NPSthesistitle                 % Title page
\NPSabstractpage                % Abstract Page
\NPSfrontmatter                 % NPS front matter follows
\renewcommand{\chaptermark}[1]{
  \markboth{\MakeUppercase{\chaptername}\ \thechapter.\ #1}{}}
\NPStableOfContents
\NPSlistOfFigures
\NPSlistOfTables
\NPSlistOfAcronyms{
 \begin{description}
   \item[NPS] Naval Postgraduate School
   \item[USG] United States Government
 \end{description}
}
\NPSlistOfAcronymsFromFile{acronyms}
\NPSexecsummary{
  [EXECUTIVE SUMMARY CONTENTS]
}
\NPSacknowledgements{
  [ACKNOWLEDGEMENTS CONTENTS]
}
\NPSbody
\chapter{[CHAPTER ONE TITLE]}
[CHAPTER BODY]

This is the beginning of your thesis. Don't be a Micky
Mouse\cite{mm2}: Always have text between every head and subhead.
\section{Your First Section}
[Section One Body]
\section{Your Second Section}
[Section Two Body]
\section{Your Third Section}
[Section Three Body]
\chapter{[CHAPTER TWO TITLE]}
[CHAPTER BODY]
This is the beginning of the second chapter.
Always have text between every head and subhead.
\section{Your First Section}
[Chapter two Section One Body]
\section{Your Second Section}
[Chapter two Section Two Body]
\section{Your Third Section}
```

```
[Chapter two Section Three Body]
```

Now we describe each command:

\NPScover
: Prints the coversheet page.

\NPSsftne
: Prints the Standard Form 298 completely filled out with the provided information.

\NPSthesistitle
: Prints the signature page.

\NPSabstractpage
: Prints the abstract page.

\NPSfrontmatter
: Applies some thesis settings for the remainder of the document.

\NPStableOfContents
: Creates the Table of Contents that lists `chapters` and `subsections`.

\NPSlistOfFigures and NPSlistOfTables
: These lists are automatically created based on the content of the thesis, using the *figure* and *table* environments.

\NPSlistOfAcronyms
: Manual list of acronyms, useful for a very short list of acronyms. Use this or NPSlistOfAcronymsFromFile but not both.

\NPSlistOfAcronymsFromFile
: Specifies the file of where the acronyms are stored, `acronyms.tex` in this instance. Using this separate file can keep your `thesis.tex` easier to read. Use this or NPSlistOfAcronyms but not both.

\NPSexecsummary
: Used by the Electrical Engineering, Systems Engineering, and Operations Research departments.

\NPSacknowledgements
: It is considered good form at NPS to formally thank your advisor as well as others at NPS who have contributed in a positive manner to your time at the Institution. You are also free to thank family members, friends, team members, family pets, or anyone else you deem appropriate.

\NPSbody
: Thesis chapters follow.

2.2.3 The Postmatter

The end of the document optionally has one or more appendices and a distribution list:

```
\def\showURL{}
\bibliographystyle{nps-plain-unsorted}
```

```
\bibliography{thesis}
\NPSappendixTOC{Appendix TITLE}
[APPENDIX BODY]
\NPSend
\chapter*{Initial Distribution List}
\addcontentsline{toc}{chapter}{Initial Distribution List}
\singlespace
\begin{enumerate}
\item Defense Technical Information Center\\
  Ft. Belvoir, Virginia
\item Dudly Knox Library\\Naval Postgraduate School\\
  Monterey, California
\item Marine Corps Representative\\Naval Postgraduate School\\
  Monterey, California
\item Directory, Training and Education, MCCDC, Code C46\\
  Quantico, Virginia
\item Marine Corps Tactical System Support Activity
  (Attn: Operations Officer)\\Camp Pendleton, California
\end{enumerate}
\end{document}
```

Now we describe these commands:

\bibliographystyle
: Can be one of the provided styles (`nps-plain`, `nps-plain-classified`, `nps-plain-classified-unsorted`, `nps-plain-unsorted`) or others commonly used (`acm`, `acmtrans`, `amsalpha`, `amsplain`, `apa-good`, `ieeetr`, `ieeetrans`, etc.)

\bibliography
: Specifies your master `.bib` file, in this case, `thesis.bib`. All cited references should be kept in this file.

\NPSappendix
: Use this for a single appendix thesis with an "Appendix" entry in the Table of Contents. Add a `\chapter{title}` creates a lettered appendix "A."

\NPSappendixTOC{Appen TITLE}
: Use this for a single appendix thesis with a single entry in the Table of Contents of "Appendix: Appen TITLE." The appendix is not given an appendix letter. This is the preferred style for NPS single-appendix theses. Additionally, use `\section*{name}` rather than `\section{name}` to keep entries out of the Table of Contents.

\NPSappendices
: Use this for a multiple appendices thesis. Each appendix will need a `\chapter{title}`.

\NPSend
: Includes the authorindex and index, if the option was specified in the `documentclass`. Concludes the content of the thesis.

2.3 Additional Commands Provided by the Template

In additional to commands above, the NPS template provides additional commands designed to make it easier to have references, tables, figures, and embedded graphics.

2.3.1 Labels

Recall from Section 1.12 that labels are hidden markers in your `.tex` files created by `\label{name}`. The NPS LaTeX template contains a number of commands for referencing labels in your text; they are presented below:

Built in to LaTeX:

`\ref{l}`	General reference of the label that places the label's number in the document.

Provided by `npsreport.cls`:

`\chapref{l}`	Chapter reference that formats as "Chapter 3"
`\chapvref{l}`	Chapter reference that formats as "Chapter 3 on page 4"
`\secref{l}`	Section reference that formats as "Section 3." You can use this for sections, subsections, and so on.
`\secvref{l}`	Section reference that formats as "Section 3 on page 4"
`\figref{l}`	Figure reference that formats as "Figure 3"
`\figvref{l}`	Figure reference that formats as "Figure 3 on page 4"
`\tabref{l}`	Table reference that formats as "Table 3"
`\tabvref{l}`	Table reference that formats as "Table 3 on page 4"
`\eqnref{l}`	Equation reference that formats as "Equation (3.1)"
`\eqnvref{l}`	Equation reference that formats as "Equation (3.1) on page 4"
`\eqnsref{l,m}`	Equation reference that formats as "Equations (3.1) and (3.5)"
`\eqnsvref{l,m}`	Equation reference that formats as "Equations (3.1) and (3.5) on page 4"
`\appref{l}`	Appendix reference that formats as "Appendix 3"
`\appvref{l}`	Appendix reference that formats as "Appendix 3 on page 4"

The `vref` commands can also automatically swap "on page 4" for "on the preceeding page" and other phrases.

2.3.2 Tables and Figures

Tables and figures are floating objects that LaTeX moves around as necessary to make your thesis look better. Tables are inserted with the `\begin{table}` command while figures are inserted with `\begin{figure}`. Here are some rules to consider:

- Every table and figure should have a caption, created with the `\caption{text}` command.
- Every table and figure should have a unique label, created with the `\label{marker}` command.

Figure 2.1: Banner from the top of the NPS web site.

- Every table and figure should be referred to in the main body of your text. LaTeX provides a command called `\ref{marker}`; this template provides additional commands `\tabref{marker}` and `\figref{marker}`. All of the reference commands are shown in Section 2.3.1 on the facing page.
- Do not assume that figures and tables will be on the same text as your page. Always refer to the figures and tables by their numbering.

2.3.3 Including Photos and Figures

The NPS report template uses the LaTeX `graphicx` package to embed photos and other graphics into the resulting document. You can include graphics directly with the `\includegraphics` command or use the commands described in this section.

By using the `\sgraphic{filename}{caption}` command provided by `npsreport.cls`, you can embed a photo from a given filename and give it a label and a caption. The label is set to be the filename. Use the `\figref{tag}` command to get an in-paragraph reference. Figure 2.1 shows an example of an embedded image using `\sgraphic`. The filename is `demos/demo_cart/home_topimg`. It is embedded with the command:

```
\sgraphic{demos/demo_art/home_topimg}{Banner from the top of the NPS web site.}
```

The figure can then be referenced with the command:

```
\figref{demos/demo_art/home_topimg} shows an example
of an embedded image using \verb+\sgraphic+.
```

The variants of sgraphic are `b` for box, `n` for no box, `o` for boxed but not a figure, and `on` for no box and not a figure.

```
\sgraphicb{file}{caption}
```

```
\sgraphicn{file}{caption}
```

Each of the *sgraphic* commands have an optional parameter that you can use to modify the image. The `width` can be used to specify a dimension on the page such as 3 inches or 10

Figure 2.2: Using sgraphicb (box)

Figure 2.3: Using sgraphicn (no box)

centimeters. The `scale` can be used with either a number between 0 and 1 to scale down the image or larger than 1 to magnify the image; magnification of bitmapped images may look pixelated and print poorly if you are not starting with an image that has sufficient resolution. If you need a larger image, you should find a way to make it larger before including it in your thesis. The image can be rotated with `angle`.

```
\sgraphic[width=3in]{imagefile}{caption}
\sgraphicb[scale=0.5]{imagefile}{caption}
\sgraphicn[angle=270]{imagefile}{caption}
\sgraphico[width=2in]{imagefile}{caption}
\sgraphicon[width=10cm]{imagefile}{caption}
```

Figure 2.4: Using twofigures

Figure 2.5: A second caption.

Figure 2.6: Using twoimages

The `twofigures` command allows you to have two figures side-by-side, as shown in Figure 2.4 and Figure 2.5. An example of the `width1` and `width2` entries is 2.5in, 10cm, etc.

```
\twofigures{width1}{imagefile1}{caption1}
           {width2}{imagefile2}{caption2}
```

```
\twoimages{imagefile1}{imagefile2}{caption}
```

There are three additional commands to arrange text or images side by side. These are advanced features. See `npsreport.cls` for additional information.

```
\sidebyside{contents1}{contents2}{caption}{label}|
\tsidebyside{contents1}{contents2}{caption}{label}|
\threesidebyside{contents1}{contents2}{contents3}{caption}{label}
```

2.4 Macros for Creating Classified Documents

The NPS LaTeX template has been designed so that it can be used for creating documents that are For Official Use Only (FOUO) or classified at any classification level. As a general rule, you only create a classified document on a system that has been approved for processing classified data at a particular classification level. You should also arrange for the NPS security office to install LaTeX on the system, rather than installing it yourself. However, once you have a system that is appropriately set up, the template can save a substantial amount of time over the alternative.

In general, preparing a classified document requires a few changes from preparing an unclassified document:

1. The security banner must be set.
2. The SF-298 form must be properly labeled.
3. Each paragraph and caption must be labeled.
4. Citations must be appropriately classified.

2.4.1 Setting the Security Banner

The security banner is the notation that is printed at the top and bottom of each page of your classified or otherwise restricted document. Use the `\securitybanner{}` macro to set the banner. Here is an example from our fictitiously classified document:

```
\securitybanner{F//MM//SPECIAL//TOM FOOLERY}
```

This document is classified F (for FUN) and it contains three additional restrictions: MM (Mickey Mouse), SPECIAL, and TOM FOOLERY.

2.4.2 Labeling the SF-298

The NPS LaTeX template automatically creates a SF-298 form for you. When you create a classified document you need to determine the classification of the document's SF-298 form, its abstract, and the report itself. In order for the SF-298 to be unclassified the document's title and abstract must be unclassified. However it is possible to have a classified document with an unclassified abstract and an unclassified title. In this case the SF-298 may also be unclassified. However, before you make a determination, you may wish to speak with your sponsor or with the Site Security Officer.

The report classification, abstract classification, and classification of the SF-298 are indicated with these three macros:

```
\ReportClassification{Fun}
\AbstractClassification{Jolly}
\PageClassification{Amusing}
```

In this case the report is classified as Fun, the abstract is classified as Jolly, and the SF-298 is classified as Amusing. Of course, actual classified documents should be classified with actual classifications.

2.4.3 Labeling the paragraphs and caption

(U) Each paragraph of your document should be proceeded with an appropriate classification level. For example, this paragraph is explicitly labeled as being unclassified. It appears in the source of this document as this:

```
(U) Each paragraph of your document should be proceeded with an
appropriate classification level. For example, this paragraph is
explicitly labeled as being unclassified. It appears in the source
of this document as this:
```

As you can see from the example above, paragraph classification labeling must be done manually. Captions must also be manually labeled.

2.4.4 Labeling Your References

When citing references in a classified document, use the `\citeafter{}` macro instead of the `\cite{}` macro.

When you use BiBTEXto produce a classified document you should use either the bibliographic style `nps-plain-classified` or `nps-plain-classified-unsorted`. These styles have been modified to support an additional `classification` tag. Below, the `mm2` reference is classified `F` and is further within the MM compartment:

```
@misc{mm2,
  title="Ears, Ears and More Ears",
  publisher="Department of Departments",
  author="Micky Mouse",
  year=2013,
  classification="(F//MM)"
}
```

2.5 Additional Files Included in the Template

There are several files included with the template that may be useful for your writing needs.

Makefile Included with the template is the `Makefile` that Mac and Linux users will readily enjoy. Typing `make` on the command prompt will perform all necessary commands to produce your document.

build.py An alternate build system for Windows users.

authorindex.pl This perl script is used to generate the authorindex. You will need to use this script if you are generating your document with the authorindex option (see §2.2.1). An additional install of a perl interpreter is required for Microsoft® Windows (ActivePerl® is recommended).

fixerrors.py This python script will correct `.bib` file entries for URLs that contain long URLs and also corrects errors in the authorindex `.ain` files.

xls_extract.py This python script extracts all Excel terms from an NPS budget spreadsheet and write LaTeX variables. Although it is unlikely you will need to use the script exactly, it can be a reference of how to do something similar if needed for your document.

xls_covert_to_pdf.py Converts the Excel workbook to PDF file. This program requires additional software to operate properly and can only be used on a Macintosh computer.

2.6 Additional Software

This section discusses additional software that you may find useful when preparing your document.

2.6.1 Citation Management Software

Organizing your thesis citations is critical to a successful thesis. Legacy techniques included using index cards. In modern times, software is available to help you accomplish this task. A complete list of the available options is at `http://en.wikipedia.org/wiki/Comparison_of_reference_management_software` . NPS has a site-license for Refworks. Other highly recommended options are Zotero and Mendeley. See `http://www.zotero.org/` and `http://www.mendeley.com/` for additional details.

2.6.2 Revision Control Systems and Subversion

Revision control software such as subversion (`svn`), mercurial (`hg`), `git`, and others are excellent modern choices. Consult their websites to determine which one best suits your needs.

You will note that LaTeX creates many temporary files. These files should *not* be included in your subversion repository. Because they are generated on a per-machine basis, you can get conflicts if different files are created and then committed on different machines.

If you are using subversion to manage your thesis, you should instruct it to ignore these files. This can be done with the `make ignore` target in the Makefile.

```
ignore:
        svn propget svn:ignore . > /tmp/ignore
        echo thesis.pdf >> /tmp/ignore
        echo '*.ain' >> /tmp/ignore
        echo '*.aux' >> /tmp/ignore
        echo '*.asy' >> /tmp/ignore
```

```
echo '*.bbl' >> /tmp/ignore
echo '*.blg' >> /tmp/ignore
echo '*.lof' >> /tmp/ignore
echo '*.log' >> /tmp/ignore
echo '*.lot' >> /tmp/ignore
echo '*.sow' >> /tmp/ignore
echo '*.toc' >> /tmp/ignore
echo '*.zip' >> /tmp/ignore
sort /tmp/ignore|uniq|grep .|svn propset svn:ignore -F - .
@echo ""
@echo Will ignore:
svn propget svn:ignore .
@/bin/rm -f /tmp/ignore
```

2.7 Going Further

If you are interested, feel free to review the file `npsthesis.cls`. A great deal of effort has gone into making this file both readable and understandable. You will find additional commands in this file and you may even have thoughts on changes to make. Please let us know what you come up with!

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CHAPTER 3:
Helpful Writing Tips for Your Report or Thesis

This chapter discusses elements of writing and style that are helpful when writing a report or thesis at NPS. This chapter is based on a publication that was distributed by the NPS Thesis Processor in 2009.

3.1 English Grammar Tips

1. Punctuation (periods and commas) go inside quotation marks.
2. When using i.e., e.g., or etc. always put a comma before and after, *e.g.*, like this. You can also use the `\ie`, `\eg` and `\etc` macros that the thesis template provides.
3. Master's degree has an apostrophe and Postgraduate is one word.
4. If you use "however," make sure there's a comma before and after, unless you start a sentence with it. However, it's best not to start a sentence with "however." And while we are on the subject, you should try to avoid starting a sentence with "and" or "because."
5. When typing a date, do not use "st" or "th." Instead, just note the date: July 4, 1776, is Independence Day. Commas go after Month/date, year. No comma between month/yr.
6. Spell out numbers 1 through 9 as one to nine. Larger numbers remain as digits.
7. Capitalize C in Chapter, F in Figure and T in Table when referring to chapters, figures or tables in the text and use roman numerals vs numbers or spelling out, etc. for chapters. Even better, use the referencing commands described in Section 2.3.1 on page 36.
8. Footnote numbers go outside the punctuation.
9. Ibid cannot be the first footnote on the page.
10. When typing equations in text and when using "where" or "if," etc. and it's not a new paragraph the word starts at the margin.
11. When inserting symbols, use the proper symbols commands. Avoid trying to include the character directly in the `.tex` file.
12. Avoid writing in the first person!
13. Avoid dangling participles. Wrong: Substituting (12) into (14) gives...; Correct: Substituting (12) into (14), we get...
14. Contractions are not used in formal writing. Cannot is one word.
15. Chapters, figures and tables do not show things. Instead, things are shown or illustrated in figures and tables. Things are discussed in chapters or sections.

3.2 Additional Writing Tips

1. Displayed equations must be numbered, part of a sentence and properly punctuated. This means your equation may have a period as the last character to indicate the sentence has ended.
2. In-line equations in paragraphs must be simple and use "/" to indicate division.
3. All figure captions should be complete sentences with a period at the end of the caption.

4. Figures and tables should display the units associated with quantities being displayed.
5. Axes in figures should be clearly labeled with quantities and units.
6. Discuss all figures and tables in your thesis.
7. Acronyms need to be defined in the acronyms list, in the abstract, in the executive summary, and the first time they are used in the thesis. They do not need to be defined for every chapter.
8. The introduction should provide the background that allows the reader to understand why he or she should be interested in the problem. Provide a discussion of related work with references. State clearly and explicitly the goal(s) or objective(s) of your work. Discuss how your work differs from the previous works.
9. Abstracts briefly summarize the work and help the reader to ascertain the purpose of the thesis. An abstract may include the problem at hand, the technique used to solve the problem, and indicate the conclusion of the results.
10. Some departments require an an additional section called the Executive Summary. It is more comprehensive than the abstract and generally 2-10 pages in length. The Executive Summary must stand alone from the rest of the document. Figures and tables are numbered independently from the thesis content and do not appear in the List of Figures or List of Tables. Additionally, references in the Executive Summary are independent from the thesis and there is a separate list of references at the end of the Executive Summary.
11. Conclusions summarize the results obtained in your research and emphasize your original contributions. Recommended future work should include any new questions arising from your research.

3.3 LaTeX Tips

1. Do not use "*" or "x" to indicate multiplication. $X = YZ$ is sufficient.
2. If you must use multiplication, please do so using `\times` in math mode. That is, type `$X=Y\times Z$` to produce $X = Y \times Z$.
3. Use the LaTeX `\begin{figure}` and `\begin{table}` environment to create floating figures and tables. Use the `\caption` command to create your captions. Label your captions with the `\label{marker}` command inside the caption itself. Captions are shown in the paper as text. Labels are internal LaTeX identifiers that can be referenced with the `\ref{marker}` reference command.
4. Do not split text around a figure or table. Write complete paragraphs, since LaTeX will place figures in your document to efficiently use the paper.
5. When there is more than one reference, put them both into the `\cite` command: `\cite{john1,john2,john3}`. The additional `cite` package can improve the multiple citations result from [6,7,8] to [6-8].
6. Make sure there's at least one and a half lines of text at the top of the page—if LaTeX gives you a hard time, you may need to add or remove text so that everything works out properly.
7. Don't use math mode as a general italics—use `\emph{}`.

8. Do not make tables too wide in columns or they can be drawn off the right-side of the paper.
9. Use automatic numbering and lettering by using the appropriate environments, such as `enumerate`, `itemize` or `list`.
10. There can only be one `label` entry for a section, figure, etc.. Trying to have more than one will cause a problem in the automatic numbering. If you need to troubleshoot numbering, look in the generated `.toc` files.

3.4 NPS Thesis Tips

When writing your thesis, the sections should be in this order:

1. Table of Contents
2. List of Figures*
3. List of Tables*
4. List of Acronyms*
5. Executive Summary*
6. Acknowledgements*
7. Chapters
8. Appendices
9. Author Index*
10. Index*
11. References
12. Initial Distribution List

The starred items do not appear in Table of contents. Not all theses will have an index, but that can be generated automatically with LaTeX. If your thesis only has one appendix, then it is not lettered, but just referred to as the appendix. If you have multiple appendices, then they are lettered. If you do not have any tables, then the list of tables is not included. This also applies to list of figures and acronyms. The Executive Summary is required by the Electrical Engineering, Systems Engineering, and Operations Research departments.

3.5 Initial Distribution List Recipients

Each thesis contains a list at the end of the original recipients of the thesis. You may add additional names to this list for professional or personal reasons. When you submit your thesis, you will provide an email address for the individuals on the list, and they will receive an email when the thesis has been posted.

1. Defense Technical Information Center
   Ft. Belvoir, Virginia
2. Dudly Knox Library
   Naval Postgraduate School
   Monterey, California

3. Your department chair
   Naval Postgraduate School
   Monterey, California
4. Your advisor
   Naval Postgraduate School
   Monterey, California
5. Your 2nd reader/coadvisor
   Naval Postgraduate School
   Monterey, California
6. Each author
   Naval Postgraduate School
   Monterey, California

   Marine officer students are required to show:
7. Marine Corps Representative
   Naval Postgraduate School
   Monterey, California
8. Directory, Training and Education, MCCDC, Code C46
   Quantico, Virginia
9. Marine Corps Tactical System Support Activity (Attn: Operations Officer)
   Camp Pendleton, California

   Officer students in the Operations Research Program are also required to show:
10. Director, Studies and Analysis Division, MCCDC, Code C45
    Quantico, Virginia

    Officer students in the Space Ops/Space Engineering Program or in the Information Warfare/Information Systems and Operations are also required to show:
11. Head, Information Operations and Space Integration Branch,
    PLI/PP&O/HQMC, Washington, DC

3.6 Documentation Submitted with Thesis

The Thesis Processors will require some additional forms to accept your thesis and give you a green card. These forms are available on their website at `http://www.nps.edu/research/research1.html`.

- Thesis release form
- Thesis color page request form
- Special Abstract
- Completed Signature Page

Appendix: The NPS LyX Template

The NPS LyX Dissertation Template was developed by CDR Michael Bilzor is available for use with LyX. The template can be obtained from `http://simson.net/npsthesis/lyxthesis.zip`. The remainder of this section was written by CDR Bilzor and describes using the template.

Using the NPS LyX Dissertation Template

Get LaTeX

Download and install, if necessary, a LaTeX installation package. For Mac, I recommend using MacTeX - it includes some extras like BibDesk and gives you a good basic LaTeX editor. (`http://www.tug.org/mactex/2009/`)

Get LyX

Download it, install it, and tell it about your LaTeX installation. (If the lack of a spell-checker is bugging you, an easy way to add one is via MacPorts (http://www.macports.org/) - once a package like aspell has been ported in, you can point LyX to it and it'll use it).

Editing your SF298

Unfortunately the SF298 files provided by the LaTeX system do not work with LyX without modification. You therefore need to modify the SF298 style file or use the one we have modified for you.

Option 1: modify the standard sf298 file (permanent fix)

There are no Windows-specific directions for this task, but it has been tested on MacOS and Ubuntu.

Find the copy of your LaTeX distro's `sf298.sty` file:

MacOS `/usr/local/texlive/2010/texmf-dist/tex/latex/sf298/sf298.sty`
Ubuntu `/usr/share/texmf-texlive/tex/latex/sf298/sf298.sty`

These files are read-only, and may be hidden. To make the file read-write, do a chmod at the command line (Unix gurus), or use Get Info (Command-I) from the Finder and click the lock icon; you'll be prompted for the admin password and can then make canges to the permissions.

(The template includes a modified copy of the `sf298.sty` file in the `/styles` folder, in case you just want to set permissions, delete the old one, and replace it with this one).

Open `sf298.sty` in a text editor (I recommend TextWrangler for Mac; I've had issues with standard text editor in saving the file, but TextWrangler was obedient).

Locate and comment out the following line (as shown below, now with a % at the beginning):

```
%\ExecuteOptions{config,nofloatlongboxes}
```

Skip the next line, then comment out the following three lines as shown:

```
%\if Y\sf@config
%  \InputIfFileExists{sf298.cfg}{}{}
%\fi
```

Save the file and exit. Lyx will default to using the LaTeX distribution copy of `sf298.sty` unless you explicitly point it to the location of a different copy of `sf298.sty` in your `\usepackage` statement. Unmodified, you will get at least two errors compiling the NPS dissertation file. With `sf298.sty` modified, it will now compile the NPS LaTeX dissertation format without the errors.

Option 2: use the custom-named nps_sf298 style file and keep a copy of it in your dissertation's working directory (easy fix).

Open up the LaTeX Preamble in LyX, using Document/Settings. Once there, change the statement `\usepackage{sf298}` to `\usepackage{nps_sf298}`, and be sure there is always a copy of `nps_sf298.sty` in your dissertation's working directory.

Open up the Template. The file is called `Sample_nps_phd.lyx`. It uses the files in the `/images` directory, as well as the bibliography file `Sample.bib`. Typeset a PDF file to check it out. If everything works, you can use this as a template and edit your dissertation using the LyX editor.

Notes:

- This template takes most of the formatting from the `npsphd.cls` file (from Prof. Simson Garfinkel and MAJ Rob Harder), and adds the necessary parts into a LyX field called "LaTeX Preamble," which is accessible under document settings. The basic class is "report", and the master fonts are set to Times New Roman. To add more style files, add `\usepackage` statements to the ones already in the Preamble.
- Be sure that the fields you use for Title, Name, etc. exactly match where they're entered in the document in multiple places (i.e., in the sf298 fields).
- Sections like the Abstract, Acknowledgments, etc. are implemented as unnumbered chapters (chapter* in the pulldown).
- `hyperref` support is available through the native LyX GUI interface.

- The document class in LyX is just “report,” and all the customization comes from the LaTeX preamble. LyX has a way to create what it calls a “layout” which is LyX-speak for a locally-defined custom LaTeX document class. I haven’t done this, but it’s probably a good “future work” project.

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[5] Leslie Lamport. *Latex: A Document Preparation System*. Addison Wesley, 1986.

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