Meta-thesis for Scientific Word:
How to Use LaTeX to Typeset Your MUN Thesis

by Theodore S. Norvell

© Theodore S. Norvell

A thesis submitted to the

School of Graduate Studies

in partial fulfilment of the

requirements for the degree of

Master of Engineering (Computer Engineering)

Faculty of Engineering and Applied Science

December 2012

St. John's   Newfoundland

Abstract

This document provides information on how to write your thesis using the LaTeX document preparation system. You can use the files used to generate this paper as a template for your own thesis.

You should put your real abstract here, of course.

Acknowledgements

Contents

List of Tables

List of Figures

List of Listings

List of Algorithms

List of Abbreviations

GNU   GNU's not UNIX

LOA   List of Abbreviations

TLA   Three Letter Acronym

List of Notations

$f : a \rightarrow b$ f is an arrow from a to b

$\overrightarrow{f}$ The target of f

$\overleftarrow{f}$ The source of f

$\text{id}(a)$ The identity arrow of f

$f ; g$ The composition of f and g where $\overrightarrow{f} = \overleftarrow{g}$

Chapter 0

Introduction

LaTeX is a system for typesetting documents. Its first widely available version, mysteriously numbered 2.09, appeared in 1985. LaTeX is now extremely popular in the scientific and academic communities, and it is used extensively in industry. It has become a *lingua franca* of the scientific world; scientists send their papers electronically to colleagues around the world in the form of LaTeX input.[Lamport, 1994]

0.0   Getting started

This document serves three purposes.

- It contains some information on how to use LaTeX [Lamport, 1994] and Scientific Word to typeset your thesis.

- It serves as a template that you can use for your thesis. Make a copy.

- It contains many examples and some advice.

By default, all text is double spaced, however, lengthy quotations and footnotes must be singled spaced. The left margin is slightly wider than the right margin. This

is to compensate for binding.

See `http://www.mun.ca/sgs/go/guid_policies/guidelines_intro.php` for the SGS guidelines.

0.1   Some tips, pitfalls, and opinions

0.1.0   Text mode

- Use the View menu to turn on all the following: Invisibles, Helper lines, Helper Boxes, Markers, Status Bar. Use View >> Toolbars to ensure that most tool bars are displayed. (I use all except History and Exam). Rearrange the tool bars with the mouse until you are happy.

- In text mode, type ' twice to get a " and type ' twice to get ".

- In LaTeX a closing single quotation mark and an apostrophe are the same character. Use the ' key.

- When you need three 's or three 's in a row, you can use a "zero space" (see below) to clarify what is what. For example: John said, "I heard her yell 'Stop'". There is a zero space between the ' and the ".

- In text mode, type - twice to get and en-dash –. Type - three times to get an em-dash — . (Use en-dashes only for ranges of numbers or years. Use em-dashes for punctuation.)

- In text mode, the - key gives a hyphen, not a minus sign. Compare $x - y$ to x-y.

Space		Shortcut	Use
Normal	a b	Space bar	Text mode
Required	etc. a	Shift-space	Text mode, after a ., !, or ? that does not end a sentence
Nonbreaking	Table 0.0	Cntl-space	Text mode, where a line break would be confusing.
Em-space	a b		Math or text mode.
2 em-space	a b		Math or text mode.
Thin space	$x\,y$	Cntl-,	In math mode only.
Thick space	$x\ y$	Cntl-Shift-space	In math mode only.
Italic correction	$f;$		If needed, between italic and roman characters.
Zero space	'''		Between ' and '' or ' and ''.
Negative thin	@		Math only. (Best to avoid the need.)
No indent			Before a paragraph that should not be indented.
Custom			When long or stretchy spaces are needed.

Table 0.0: Horizontal spaces

- For various kinds of horizontal spaces Insert >> Spacing >> Horizontal space (or Alt i s h). See table 0.0 for more shortcuts and descriptions.

- You can double click on a space to change its width and nature. I find it easier to select the space and hit Control-F5

- Tip: You can change the properties of spaces, letters, tables, and other objects by selecting the object and hitting Control-F5.

- Pitfall: Speaking of spaces. LaTeX will insert a little an extra-stretchy space between sentences. About 99% of the time LaTeX has no problem correctly identifying the end of a sentence. The rule is this: Any period (.), exclamation point (!), or question mark (?) that does not follow a capital letter and that is

followed by a normal space marks the end of a sentence. So:

- When a period (.), exclamation point (!), or question mark (?) does not end a sentence, follow it with a "nonbreaking space" (Alt i s h b) or a "required space" (Alt i s h r). For example, if I wrote "Dr. N. loves C.", I'd put a nonbreaking space between "Dr." and "N". I could have put a required space between the "N." and "loves", but there is no need, as LaTeX will assume that this period does not end a sentence. I chose a nonbreaking space between "Dr." and "N." because I didn't want a line-break between them. For long surnames, it may be preferable to use a required space after an abbreviated title.

- When a period (.), exclamation point (!), or question mark (?) does end a sentence but also follows a capital letter, put a LaTeX \@ command between the letter and the punctuation mark. For example in "Dr. N. loves C.", I'd put a LaTeX \@ command between the "C" and the ".". Alt i y t can be used to insert a TeX command. Then put \@ in the text box and click OK.

- A common error is to put a normal space rather than a required space after "i.e.", "e.g.", "etc." If they don't end a sentence, follow it by a required, rather than a normal space. For example: "CDC, Univac, etc. are no more, i.e. defunct."

- When a period (.), exclamation point (!), or question mark (?) is followed by a close parenthesis, LaTeX will treat the parenthesis as the end of the sentence and the following space will be extra stretchy.

– When a period (.), exclamation point (!), or question mark (?) is followed by a single or double close quotation mark, LaTeX should treat the quotation mark as the end of a sentence. However, thanks to an SW oddity, this won't work with SW. At present I have no good workaround.

– The following table illustrates how LaTeX deals with various cases:

Default behaviour	"(M M m. M MMMM.
Required space	"(M M m. M MMMM.
Paren after period	"M M m.) M MMMM.
Quote after period.	(M M m." M MMMM.
Period after capital.	"(m M M. M MMMM.
\@ before period	"(m M M. M MMMM.

- The 'Noindent space' (Insert >> Spacing >> Horizontal Space... >> Noindent or Alt i s h n) is not really a space at all. It can be used at the start of a paragraph to suppress its indentation. This is useful when a list is used that is not at the end of a paragraph.

- Usually TeX hyphenates without trouble. If it fails to hyphenate *Entscheidungsproblem*, for example, correctly you can indicate all the places where it can hyphenate such troublesome words, using Insert >> Spacing >> Break >> Discretionany Hyphen.

- To indicate where line breaks are allowed insert an "allow break" command (Insert >> Spacing >> Break >> Allow break or Alt i s b a). For example, if I give a file name as /usr/theo/docs/thesis/Master.tex. I might do well to add an 'allow break' after each / except the first.

- For URLs and URIs use, Insert >> TeX Object >> Tex Field ... and insert `\url{`*your url*`}`. Follow the link `http://en.wikibooks.org/wiki/LaTeX/ Hyperlinks` for more. This has several advantages: It correctly typesets characters such as tildes. It allows breaks at the right places. It sets the URL in typewriter font. It will insert actual hyperlinks into the PDF copy of your thesis, if you compile it with PDFLaTeX.

0.1.1 Math mode

- Control-m will switch to math mode. Control-t will switch to text mode.

- I set up my User Setup (Tools >> User setup) so that the spacebar after a space will switch from text mode to math mode and a spacebar while in math mode will switch to text mode. That way, two taps on the spacebar will switch modes and insert a space.

- To get spaces in math mode, use Control-Shift-Spacebar to get a thick space $f\; x$ and Control-Comma to get a thin space $f\, x$.

- In math mode, the - key gives a minus sign, not a hyphen. Compare $x - y$ to x-y.

- In math-mode ' gives you a superscript prime. Compare x' to x'. If you really need an apostrophe, closing single quote, or double quote, switch to text mode.

- Control-d will insert a new math display as shown in (0.0)

$$\binom{k}{3} + \frac{\binom{k}{2}\binom{k-2}{2}}{2} = \frac{1}{(k-2)!} \sum_{i=0}^{k-3} (-1)^i \binom{k-2}{i} (k-2-i)^k \quad .$$

(0.0)

- When your cursor is at the end of the math display, the tab key will toggle whether the display is numbered.

- Opinion: Displays should be used when a formula might cause a bad line break, when the formula is so tall that it will cause an irregular distance between lines of text, or when it needs a number.

- Opinion: It is good style to only number those displays that need to be referred to in the text. I.e., that will be cross referenced.

- Opinion: Usually it is best to **not** omit punctuation after displayed math. I usually leave an em-space or a quad-space between the math and the punctuation. For example: Now it is time to prove

$$P \sqsubseteq Q \quad .$$

I make an exception for computer code. For example:

```
rm -r -f tmp   .
```

If I put a period at the end of that sentence, it turns a command to delete one directory into a command that also deletes the current directory. The IEEE style guide suggests omitting the period at the end of sentence, but not other punctuation.

- Pitfall: After a display, be careful to only start a new paragraph if you need one.

- Pitfall: Multi-character identifiers should not be set in math mode's default italic font, like this $\sin(first)$. Instead use the *italic* font, like this $\sin(\textit{first})$. The reason is that TeX uses slightly different fonts for "math italic" and "italic". The math italic font is designed so that the spacing between adjacent letters is correct for implicit multiplication or function application $xy + fx$. The italic font is designed so the letter spacing is correct for words. (I have set Shift-F6 to give *italic font.*)

- Opinion: I generally use italic (or math italic, if only one letter is used) for variables and an upright font such as Roman (Shift-F4) or sans-serif (Shift-F5) for constants, e.g. $\sin(x)$, but $f(\mathrm{e})$. However, as Alan Perlis once said, "one man's constant is another man's variable". If a certain sequence of letters is intended to represent exactly the same thing everywhere in your thesis, it's probably a constant. Otherwise, it is probably a variable. (Aside: Strictly speaking, the opinion that constants should be set upright should be applied to e, i, and π. However, it is not easy to make an upright π with Scientific Word, as the required fonts are not included. The best I can do is $\mathrm{e}^{\mathrm{i}\pi} + 1 = 0$.)

- Use Control-(to enter a pair of round brackets (parenthesis) (x), Control-[for square brackets $[x]$, Control-{ for curly brackets (braces) $\{x\}$, Control-< for angle brackets $\langle x \rangle$, Control-\ for absolute values $|x|$, and Control-| for norms $\|x\|$. Use Insert >> Brackets for any other combinations such as $\lceil x \rceil$.

- Opinion: Bracket pairs entered this way will automatically enlarge. Compare

$$\left(\frac{fx}{gx}, hx\right) \text{ to } (\frac{fx}{gx}, hx)$$

The former is preferable.

- However, avoid such "paired brackets" in in-line math (as opposed to displayed math). The reason is that, LaTeX will not insert a line break between paired brackets. If the brackets need to be enlarged, the formula, should likely have been in a display anyway.

- Opinion: Never use [] or {} brackets for simple grouping. E.g., $u \times (v + (w + (xy)))$ is preferable to $u \times \{v + [w + (xy)]\}$; the curly {} bracket should be used for sets and the square [] brackets often have some meaning ascribed to them, for example, sequencing.

- Never use less-than and greater-than signs in place of angle brackets. Not only are they the wrong symbols, but LaTeX puts too much space or too little space around them. Compare $P = < x' = x >$ to $P = \langle x' = x \rangle$.

- Invisible brackets (use Insert $>>$ Brackets) are useful sometimes. For example if I want to define a relation I might use

$$f \equiv g \triangleq f \sqsubseteq g \wedge f \sqsubseteq g$$

$$f^\smile \triangleq \lambda s \lambda s' \cdot f\, s'\, s$$

There are invisible brackets around $f \equiv g$ so that the vertical alignment and

the horizontal spacing is correct. Also use an invisible bracket for cases:

$$f(x) = \begin{cases} g(x) & \text{if } x > 0 \\ h(x) & \text{otherwise} \end{cases}$$

- Use Control-↓ and Control-↑ for sub- and superscripts $x_{i_j}^2$. Use the spacebar or → key to exit the sub- or superscript.

- Opinion: It is generally bad style to over use subscripts. If you ever find you need two levels of sub(or super)scripts, rethink your notation.

- Use markers (labels) and cross-references to refer numbered displays (see (0.0) on page 6), sections (see section 1.0 on page 16), figures and tables. To enter a new marker (label) use the "Marker" button on the "Field" toolbar or Insert >> Marker ... (Alt i e). To enter a cross-reference use "Cross Reference" button on the "Typeset object" toolbar or Insert >> Typeset Object >> Cross Reference ... (Alt i y r). When you insert or edit a cross reference, markers in other chapters won't show up in the list of markers; that's ok; just type in the marker.

- Tip: Abbreviate frequently used symbols in math mode with automatic substitutions (Tools >> Automatic Substitutions). Develop your own system of substitutions that is easy for you to remember. Unfortunately only letters can be used, so you can't start your abbreviations with, say, a \ . I use the letter q to start many of my abbreviations. E.g. qa for ∧, qo for ∨, qrb for ⊑, and so on.

- Table 0.1 summarizes some of useful key combinations for editing math.

9

Key	Meaning
Control-m	Math mode
Control-t	Text mode
Control-d	Displayed math
Tab	Toggle display numbering
Tab	Go to next input box
Control-Shift-spacebar	Thick math space
Control-,	Thin math space
Control-g letter	Greek letter
Control-s letter	Symbol. E.g. Control-s v gives $\vee$
Control-/	Fraction $\frac{x}{y}$
Control-(, Control-9	(x)
Control-[	$[x]$
Control-{	$\{x\}$
Control-\	$|x|$
Control-|	$\|x\|$
Control-<	$\langle x \rangle$
Control-↓	x_y
Control-↑	x^y

Table 0.1: Some useful keys

Function Key	Meaning
F1	Help
F2	Pop the top item tag
F3	Body Text
F4	Clear font
Shift-F4	Roman font
F5	**Bold**
Shift-F5	Sans-serif font
Control-F5	Edit Properties
F6	*Emphasis*
Shift-F6	*Italic font*
F7	Numbered item
Shift-F7	Indent code
F8	Bullet item
Shift-F8	Code
F9	`Typewriter font`
Shift-F9	$\mathcal{CALIGRAPHIC\ FONT}$
F10	Access menu
F11	Section
F12	Subsection
Shift-F11	Subsubsection
Shift-F12	Sub^{3}section

Table 0.2: Some useful function keys

0.1.2 Function keys

Table 0.2 on page 11 summarizes some useful functions keys. You can reprogram most function keys with Tag >> Function Keys... Table 0.1 on page 10 gives some other useful key combinations
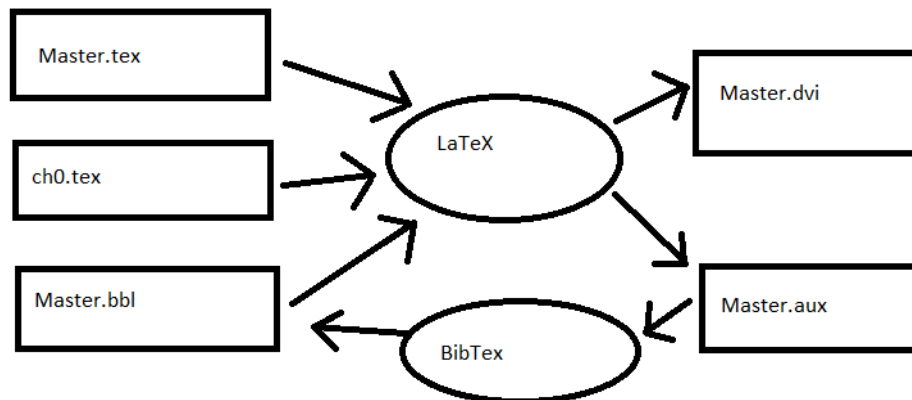
Figure 0.0: A simplified view of LaTeX bibligraphy generation.

0.2   Figures and Tables

0.2.0   Figures from image files

Scientific Workplace has good support for figures if they come from an image file. Use File >> Import Picture... or Alt-f-i For example see Figure 0.0. I suggest sticking to PNG or EPS for image formats.

To make the figure float, pick "floating" from the "layout" tab of its properties. Select "top of page" and "bottom of page".

0.2.1   Other Figures

Any LaTeX can be a figure. The trick is to use "TeX Fields" and use LaTeX's figure environment the way I did to produce Figure 0.1

$$AP \quad \sqsubseteq \quad AS$$

$$\downarrow I \qquad \downarrow I$$

$$CP \quad \sqsubseteq \quad CS$$

Figure 0.1: A commutativity diagram

By the way there are several packages that make really fancy commutativity diagrams. Figure 0.1 simply uses a matrix (Insert >> Matrix — which produces LaTeX's "array" environment) as a quick and dirty way to make simple commutativity diagrams.

To create a figure that is not based on an image file, use the fragment "figure" or, for single spacing, "ssfigure".[0]

0.2.2   Tables

Scientific Word has good support for tables, but not for the floating kind. To make floating tables, you can use "TeX Fields" and LaTeX's "table" environment.

To make his easier, I've created a fragment "sstable" that inserts a single spaced table.

See Table 0.3 for an example.

---

[0] A fragment is a snippet of text that has been saved to a file. To insert a fragment use the fragment "drop down" list or type Alt-4. Then pick the fragment you need.

You can create your own fragments, by selecting some text and then File >> Save Fragment ...

Language	Cusses
C#	20
C++	56
C	28
Java	20
JavaScript	46
Perl	30
PHP	4
Python	10
Ruby	53

Table 0.3: Cuss count by programming language.

0.3 Bibliography and Citations

Use BibTeX to create your bibliography (or references) section. It is well worth reading Oren Patashnik's manual for BibTeX [Patashnik, 1988]. While BibTeX files can be edited with any text editor, I prefer to use JabRef. However using JabRef or a similar tool is no replacement for reading the manual. BibTeX has a number of peculiarities that it pays to be aware of. Be particularly careful of BibTeX entries you obtain from sources such as the ACM; these often exhibit a low standard of care.

Citations are inserted using Insert >> Typeset Object >> Citation.

My favourite citation style is 'Harvard style' or ("named" style) with square brackets. It looks like this

LaTeX was created by Lamport [Lamport, 1994].

If you don't like the way the author's name is sometimes repeated, as it is in the preceding example, you can use the \shortcite, which shows only the year in brackets. You can enter such a command as a "TeX Field" (Menu Insert >> Typeset Object >> TeX Field). Or use the "shortcite" fragment.

LaTeX was created by Lamport [1994].

This removes the temptation to do this sort of thing

LaTeX was created by [Lamport, 1994].

Which you should not do. (It suggests that LaTeX was created by a book, which it was not.) Your sentences should read correctly with all citations removed.

Many electrical and computer engineers use IEEE style, which is shorter, but harder on the reader. It looks like this

LaTeX was created by Lamport [1].

Some supervisors may insist on IEEE style. To get IEEE style citations (and bibliography), double click on the BIBTEX field in the master file and select an IEEE style. Then remove named.cite from the "Package Options" list for the master document (Typeset >> Options and Packages >> Package Options).

Chapter 1

Tags and environments

In order to use tags, the Tag toolbar should be showing (View >> Toolbars). This toolbar has 3 "drop-down" menus.

- Item Tags (Alt-1)

- Section/Body Tags (Alt-2)

- Text Tags (Alt-3)

1.0   Sections and Chapters

Chapters: No function key is assigned to chapter heads. Use the Section/Body Tag drop-down (Alt-2).

F11 gives a new section head

1.0.0   Subsections

F12 gives a new subsection

1.0.0.0 Subsubsections

Shift-F11 gives a new subsubsection

Subsubsubsections Shift-F12 gives a new sub^{3}section (aka a paragraph). These are not numbered and do not appear in the Table of Contents.

1.1 Body tags

The Section/Body tag drop-down (Alt-2) is used for environments that typically do not nest and section headings. We've seen section headings above. Some of the other environments available via Section/Body tags are

F3 Body text. This is the default kind of paragraph

Centred. It was our yesterdayes resolution, and agreement, that we should to day discourse the most distinctly, and particularly we could possible, of the natural reasons, and their efficacy that have been hitherto alledged on the one or other part, by the maintainers of the Positions, Aristotelian, and Ptolomaique; and by the followers of the Copernican Systeme:

Flush left. And because Copernicus placing the Earth among the moveable Bodies of Heaven, comes to constitute a Globe for the same like to a Planet; it would be good that we began our disputation with the examination of what, and how great the energy of the Peripateticks arguments is, when they demonstrate, that this Hypothesis is impossible:

Flush right. Since that it is necessary to introduce in Nature, substances different

betwixt themselves, that is, the Cœlestial, and Elementathat impassible and

immortal, this alterable and corruptible. Which argument Aristotle handleth in his

book De Cœlo, insinuating it first, by some discourses dependent on certain general

assumptions, and afterwards confirming it with experiments and perticular

demonstrations: following the same method, I will propound, and freely speak my

judgement, submitting my self to your censure, and particularly to Simplicius, a

Stout Champion and contender for the Aristotelian Doctrine.

> Long quotation. And the first Step of the Peripatetick arguments is that, where Aristotle proveth the integrity and perfection of the World, telling us, that it is not a simple line, nor a bare superficies, but a body adorned with Longitude, Latitude, and Profundity.

> Short Quote.

Body and section tags should be applied only to top-level paragraphs. Furthermore Item tags can not be used within Body tags. You can try to make a list of quotations or a quotation that contains a list, but the straight-forward approach is not likely to succeed. (These things can be done with LaTeX; the limitation is with Scientific Word and Scientific Workplace.)

1.2   Item tags and environments that nest

The "Item Tag" drop-down (Alt-1) lists all tags that nest. Some of these generate list-like environments in LaTeX.

- Bullet lists F8

0. Numbered lists F7

   Description lists: Use "Description List Item" on the Item Tag drop down.

   Depth: You can nest item tags to a depth of 4, but no more

   – This list item is at depth 4. LaTeX supports deeper nesting, but Scientific Word and WorkPlace do not.

   1. See also the "code" and "indent" tags discussed in the next chapter.

- F2 to step out a level.

- The "singlespaced" environment is not associated with a function key or tag. You can use TeX fields (Insert >> Typeset Object >> TeX Field) to insert the required LaTeX magic. You can also use the "singlespaced" fragment.

1.3 Theorems and proofs

Theorem-like environments and proofs (perhaps surprisingly) nest. Use the Item Tag drop-down (Alt-1) Be sure to use F2 (Remove Item Tag) after the end of each.

Axiom 1.0 (The axiom of equality) *All animals are equal.*

Claim 1.1 *That some animals are more equal than others.*

Conclusion 1.2 *Whatever goes upon two legs is an enemy.*

Condition 1.3 *No animal shall drink alcohol.*

Corollary 1.4 *Whatever goes upon four legs, or has wings, is a friend.*

Conjecture 1.5 *All men are enemies. All animals are comrades.*

Criterion 1.6 *No animal shall kill any other animal.*

Definition 1.7 (Insanity) *Doing the same thing over and over again while expecting different results.*

Example 1.8 *Example is not the main thing in influencing others. It is the only thing.*

Exercise 1.9 *Find all errors in Cantor's diagonal proof that the continuum is larger than $\aleph_0$.*

Lemma 1.10 *What is yellow and equivalent to the axiom of choice. ... Zorn's Lemon.*

Notation 1.11 *We use $\langle E \rangle$ to represent that total function f in $\Sigma \times \Sigma \to \mathbb{B}$ such that $f(\sigma, \sigma')$ is equal to the value of the expression obtained by replacing, in the boolean expression E, each unprimed identifier i with $\sigma.i$ and each primed identifier i' with $\sigma'.i$.*

Problem 1.12 *Show that $P = NP$ or that $P \neq NP$.*

Proposition 1.13 *No animal shall wear clothes.*

Solution 1.14 *That which is not in the problem set is in the solution set.*

Summary 1.15 *No question now, what had happened to the faces of the pigs. The creatures outside looked from pig to man, and from man to pig, and from pig to man again; but already it was impossible to say which was which.*

Theorem 1.16 (The Curry/Löb paradox) *I am Santa Claus.*

Remark 1.17 *Truth is an ill-defined concept.*

Proof. (Theorem 1.16.)

(a) Let S be the statement "If S is true, then I am Santa Claus".

(b) Assume, for the moment that S is true.

- Since S is true and S is the statement "If S is true, then I am Santa Claus",

  the statement "If S is true, then I am Santa Claus" is true.

- Therefore, if S is true, then I am Santa Claus.

- As we are assuming S is true, I am (under that assumption) Santa Claus.

(c) Since in (b), assuming S to be true lead to the conclusion that I am Santa

Claus, we can see that "If S is true, then I am Santa Claus" is true.

(d) By (c) and (a), S is true.

(e) From (c), if S is true, then I am Santa Claus.

(f) From (d) and (e), by modus ponens, I am Santa Claus. ■

In Scientific Word and WorkPlace you can double click the tagged paragraph's

leader (i.e. the word(s) or symbols leading the paragraph) to enter an optional "cus-

tom label", as I did with the Axiom, Definition, and Theorem above. This works for

theorem-like environments and description-list items. It does not work for proofs.

The numbering system that I have chosen is to number theorems sequentially

within each chapter and all other theorem-like entities as if they were also theorems.

You can use another numbering system if you want; to do so, edit the preamble

(Typeset >> Preamble) of the master document.

1.4 Fonts and sizes

The Text Tag drop-down (Alt-3) is used for tags that operate at the character level rather than the paragraph level.

- F4 to return to the default.

- Shift-F4 for roman

- **F5 for bold**

- Shift-F5 for sans-serif

- *F6 for emphasized. Emphasized (by default) alternates between italic and upright as it nests*

- *Shift-F6 for italic. Italic is always italic. Use italic for multi-letter names in math mode.*

- `F9 for typewriter`

- $\mathcal{SHIFT}$-$\mathcal{F}9$ $\mathcal{FOR}$ $\mathcal{CALIGRAPHIC}$ Only capitals and numerals. Best saved for math.

- 𝔉𝔯𝔞𝔠𝔨𝔲𝔯 Best saved for math

- 𝔹𝕃𝔸ℂ𝕂𝔹𝕆𝔸ℝ𝔻 𝔹𝕆𝕃𝔻 Only capitals. Use only for constant sets: $\mathbb{C}$ for the complex numbers, $\mathbb{R}$ for the real numbers, $\mathbb{Z}$ for the integers, $\mathbb{N}$ for the natural numbers, $\mathbb{B}$ for the Booleans.

- Small Capitals.

- Most font size changes needed are done automatically. You should never or only very rarely use $\text{\Large size}$ $\text{\tiny changing}$ $\text{\large text}$ $\text{\tiny tags}$.

- ***Combining text tags is possible, but rather tricky, unless one tag is strictly within the other. Start by typing three letters, say "xyz"; make all three emphasized. Then make the y bold. Select the y and start typing. Finally delete the x and the z.***

$\Gamma\rho\varepsilon\varepsilon\kappa$ $\lambda\varepsilon\tau\tau\varepsilon\rho\sigma$. Greek letters are available on the Symbol Panels toolbar (View >> Toolbars...) and from the keyboard. For example "Control-g p" gives π and Control-g P gives Π. Missing capital greek letters can be replaced by their Roman equivalents: $AB\Gamma\Delta$. Likewise lowercase omicron is not available, but you can use an italic oh, o. Some letters come in more than one variation: ϵ and ε, θ and ϑ, ρ and ϱ, π and ϖ, ϕ and φ, σ and ς. I prefer ε to ϵ, as the latter is often confused with $\in$. (By the way, please do not use ϵ in place of $\in$.) Otherwise, I prefer θ, ρ, π, and σ, these being the more standard variants. Greek is not a text tag, so no tricks are needed to combine Greek letters with text tags to make, for example, bold Greek $\mathbf{AB\Gamma\Delta\alpha\beta\gamma\delta}$ or italic Greek $AB\Gamma\Delta\alpha\beta\gamma\delta$. However most other text tags do not work with Greek letters; in particular, there is no easy way to make upright lower-case greek letters.

Chapter 2

Algorithms and listings

2.0   The code tag/environment

For algorithms I use my own environment called "code" (Shift-F8). Before you use this you have to install my code.sty file somewhere latex can find it. Here is an example

let $x \mid x \in \mathbb{N}$·
while $x > 0$ do
    $x := x - 1$

Indentation is done with the indent tag (Shift-F7). To unindent use F2. Also use F2 to get out of code. Please only use the indentation tag (Shift-F7) inside of the code tag (Shift-F8). Unfortunately SWP limits the number of indentations levels to 4 — counting not indented at all. To get more indentation, I start putting in 2-Em spaces (Insert >> Spacing >> Horizontal Space...). Even the first line can be indented.

    $\langle P \rangle$
  $\sqsubseteq$

```
assume t < ∞
var i :∈ ℕ
while i > 0 do
    i := i − 1


assert t < ∞
```

Figure 2.0: Incorrect spacing casued by an extra code environment

```
if B then
    ⟨B ⇒ P⟩
else
    ⟨¬B ⇒ P⟩
```

The fragment "sscode" inserts a single spaced code environment.

Make sure that all code belonging to a single example is in one code environment. You should only see one leader (i.e., one green box containing the word "code"). If there are several leaders, delete all but the first using the back-space key. This often needed after backing out of an indented section using F2. Figure 2.0 shows what can happen. If you are looking at this document with SW or SWP, you will see the second leader in front of the word "assert". If you are looking at the typeset document, you will see extra space caused by having two code environments where there should be one. After using F2 to get out of the indent environment I should have used the backspace key to eliminate the second green leader. You might wonder whether a similar trick is needed when you use F2 to leave a nested indent environment; the answer is 'no'.

The fragment "parcode" inserts code consisting of two parallel threads. (It is not singlespaced, but you can use the "singlespaced" fragment to make it so.) You may

while *true* **do**	**while** *true* **do**
compute next value	$P(f)$
$P(e)$	empty the buffer
fill the buffer	$V(e)$
$V(f)$	use the value

Algorithm 2.0: A producer and a consumer

$\dot{q}_{\text{start}} := \epsilon\text{-closure}(q_{\text{start}})$;
var $W := \{\dot{q}_{\text{start}}\}\cdot$
$\dot{Q} := \emptyset$;
$\dot{T} := \emptyset$;
while $W \neq \emptyset$ **do** (
    let $\dot{q} \mid \dot{q} \in W\cdot$
    $W := W - \{\dot{q}\}$;
    $\dot{Q} := \dot{Q} \cup \{\dot{q}\}$;
    for each $a \in S$ **do** (
        let $\dot{r} = \epsilon\text{-closure}(\delta(\dot{q}, a))\cdot$
        if $\dot{r} \neq \emptyset$ **then** (
            $\dot{T} := \dot{T} \cup \{(\dot{q}, \text{``}a\text{''}, \dot{r})\}$;
            if $\dot{r} \notin \dot{Q}$ **then** $W := W \cup \{\dot{r}\}$ **else skip**)
        else skip))
$\dot{F} := \{\dot{q} \in \dot{Q} \mid \dot{q} \cap F \neq \emptyset\}$

Algorithm 2.1: The subset construction algorithm

need to fiddle with the widths of the minipages. See Algorithm 2.0 for an example.

Sometimes you want algorithms to float like figures and tables. You can use the "figure" fragment as in Figure 2.0. You can also use the "algorithm" fragment. Use Alt-4 and select "algorithm". Edit the caption and marker; add your code. Algorithms inserted using this fragment are singlespaced. Algorithm 2.1 is an example.

2.1   Listings

Listings are lines of source code. If you want to include source code in your thesis, you will want listings

2.1.0   If you do want to use listings

You must install the listings package somewhere latex can find it. You should read the documentation: listings.pdf.

You will also want to install the fragments mentioned below.

You can edit the default settings by editing the \lstset command in the preamble (Typeset >> Preamble). For example, if all (or most of) the listing in your thesis are in Java, add "language=Java" to the list of key/value pairs in the \lstset command in the preamble of the Master document.

2.1.1   In-situ listings

In-situ listings are fragments of code that are placed right in your TeX file. Typically you copy text from a source file and paste it in to Scientific Workplace.

Here is a listing that appears "displayed", i.e. as a paragraph in your document.

```
0   program Hello ;
    begin
        write("Hello");
    end.
```

You can also have listings as floating elements, like figures and tables. These have captions and labels, which means you can refer to them using cross-references. See Listing 2.0 for an example.

```
0   data Tree a = Empty | Branch a (Tree a) (Tree a)

    Flatten t = FlattenAndCat t []
    FlattenAndCat Empty xs = xs
    FlattenAndCat (Branch x left right ) ys
5      = FlattenAndCat left (x :: FlattenAndCat right ys)

    five = let 2+2 = 5 in 2+2
```
Listing 2.0: This listing is *in situ*

Use fragment "listing (nonfloating)" for nonfloating listings and "listing (floating)"
for floating listings.

2.1.2 Turning files into listings

The listings package allows LaTeX to read in a source file and turn it into a nicely
typeset listing.

An example can be found in Listing 2.1.

Use the fragment "listing (from file)" and edit the contents of the grey box that
gets inserted.

By default these listings will float. If you don't want that, just remove the
"float=tb" key/value pair. Also it is best to remove the caption and label for non-
floating listings.

Note that floating listings can not exceed a page, which in a MUN thesis is about
40 lines single spaced. In the example, I started this listing at line 18 of the file
(firstline=18) so as to get the float to fit on a page. (The first 17 lines are comments;
and who wants to read those?)

```
0   package tm.clc.parser;
    import java.util.regex.*;
    import tm.utilities.Assert;

    public class CommonParserHelper {
5       static Pattern pat = Pattern.compile("/\\*\\#/?[Tt]\\s*(([a-zA-Z])*)\\↩
    ↪s*\\*/") ;

        public static String extractTagName(String image ) {
            Matcher mat = pat.matcher(image) ;
            if( mat.find() ) {
10               return mat.group(1) ; }
            else {
                Assert.check( "CommonParserHelper.extractTagName␣fails␣to␣↩
    ↪match") ;
        return null ; } }
    }
```

Listing 2.1: This listing comes from a file

2.1.3   In-line listings

In-line listings are short pieces of text that can be included in the normal flow of a paragraph. Use the fragment "listing (inline)". Here is an example: thesis. MagicAlgorithm.runSpell(i);

2.1.4   Typeset the master document

If you use inputted file listings, only typeset the "Master" document. Typesetting a chapter on its own won't work. The reason is that SW/SWP usually will move your document to a temporary location for typesetting. But as it doesn't move your code files, they can't be found from the temporary location. An exception is when SW/SWP typesets a "Master" document; then it doesn't use a temporary location and sanity is restored.

2.1.5 If you don't want to use listings

With Typeset >> Options and Packages... remove "listings" from the package list. Then, in the preamble (Typeset >> Preamble), remove all commands that have to do with listings. You should also remove the List of Listings from the frontMatter.tex document. This will improve compile times and save you from having to install the "listings" package.

References

[Lamport, 1994] Leslie Lamport. *LaTeX: A Document Preparation System*. Addison-Wesley, 2nd edition, 1994.

[Patashnik, 1988] Oren Patashnik. *BibTeXing*, 1988. On the web at http://mirrors.ctan.org/biblio/bibtex/base/btxdoc.pdf.

Appendix A

An Appendix

Appendices are just like Chapters, but come after the TeX \appendix command in the Maser.tex document.

A.0   Here is a section in an appendix

This is Section A.0 in Appendix A.