Typesetting UTM Thesis Using LyX

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Outline

What the Tutorial *is* and what it *is not*

- An introduction to LyX
- NOT a tutorial on how to write a good thesis.
    - Please consult your SV

What is a Thesis?

It is a documented evidence of **defined scope and length** that a candidate is

- Understand relevant theoretical issues
- Technically competent
- Has critical-thinking ability
- Able to *conduct scholarly research*

Different *Names* of Thesis

- According to UTM convention
    - UG FYP - *report*
    - Master by taughtcourse project - *project report*
    - Master by taughtcourse and research (mixed-mode) - *dissertation*
    - Master by research and PhD - *thesis*
- What make them different is the *breadth* and *depth*

FYP vs. Master Project Report

Both as partial fulfillment for the degree

- For UG, as a documented proof that
  - You are ready to be an EE engineer
  - You can propose a solution to a practical problem by integrating knowledge from different courses

- For Master by TC, as a documented proof that
  - You are ready to be an *expert* EE engineer
  - You can propose a solution to a practical problem by integrating *state-of-the-art* techniques and methodologies
  - You ave comprehensive knowledge on you area of research (Master *project report*)

Research Master's vs. PhD

As the full fulfillment for the degree

- The **philosophical** nature of a thesis takes a question about the unknown, investigates it, and reports the findings and the meaning of the findings
- As proof that a candidate is
  - Technically competent
  - Able to conduct scholarly research
  - Has critical-thinking ability
  - Understand relevant theoretical issues
- The difference (Masters vs PhD) are the "originality" and "substantialness" in the context of the research and the thesis
- Additional criteria for PhD
  - An original contribution to knowledge
  - The authority underlying the thesis – extensive (breadth) and intensive (depth) knowledge of their subject

Writing Thesis Requires...

- Structuring thesis based on best practices (and your SV's)
- Collating and formatting figures. Very time consuming! Use standard modeling diagrams when appropriate
- Visualizing how results can be best represented
- Using appropriate SWs that helps you produce good quality thesis (LaTeX/LyX, MS Word with EndNote)

Generic Thesis Structure

- Abstract
1. Introduction
2. Literature Review
3. Research Methodology
4. Proposed Work
5. Results and Analysis
6. Conclusion

www.phdcomics.com

UTM Thesis Format

- The UTM Thesis Manual defines on how theses should be formatted
- The latest is 2007 for MS Word users by MS Word users
- Most researchers (elsewhere but UTM) use LaTeX in technical writing
- The UTMThesis project (http://code.google.com/p/utmthesis) was initiated for seemless thesis typesetting
- The latest template can be downloaded http://www.fke.utm.my/postgraduate
  - Go tho the download section
  - Currently in version 3.13

UTM Thesis LaTeX Template

- Auto-generates front pages, table of contents, references, list of tables/figures, and declarations.
- Easy referencing and figure/table/chapter numbering.
- Document will be properly formatted according to the UTM thesis format (well, almost 99%).
- Reduce the amount of time spent on formatting the thesis, so you can focus on your work.

Why LaTeX? Why not just MS Word?

- MS Word is only practical tool for (very) simple documents.
- LaTeX is a typesetting program - documents are typeset according a predefined *document class and style*
- LaTeX is not WYSWYG, requires compilation to generate outputs.

What is LaTeX? LyX?

- TeX: Typesetting language with macro capability. Credit to Donald Knuth
- LaTeX : Macro package built upon TeX. Credit to Leslie Lamport
- classes: Descriptions of a type of document, using LaTeX.
- styles: Alters the default behavior of LaTeX in some way.
- LyX: Visual, WYSIWYM word-processor that uses LaTeX to do its typesetting. Credit to Matthias Ettrich.

What to Install

Assuming Windows

- Download ProTEXT: http://www.tug.org/protext/ (>1GB)
  - Extract the installer
  - Go to miktex > setup > setupxxx.exe and install MikTEX. Install complete version and use default settings.
- Download LyX: ftp://ftp.lyx.org/pub/lyx/bin/2.1.0/ LyX-2.1.0-Installer-2.exe. We still have problem with newer versions
- Download UTM Thesis LyX template: http://www.fke.utm.my/postgraduate
  - We still have upload problems on https://utmthesis.googlecode.com

For Ubuntu Users

From Software Manager

- texlive
- texlive-common
- texlive-publishers
- texlive-science
- LyX

For Mac Users

- Download Mactex
- LyX

The Template

- You just need the following files to start working.
    - utmthesis.cls UTM thesis - LaTeX class
    - utmthesis-authordate.bst - UTM BibTeX style (authordate)
      OR utmthesis-numbering.bst - UTM BibTeX style (numbering)
    - utmthesis LyX layout
- Open thesis-template.lyx

LATEX-based UTM Thesis Writing Flow

- Insert thesis information (author name, degree, faculty, etc)
- Include preambles (abstract, abstrak, dedication, acknowledgement, etc.)
- Write mainmatters (main chapters)
- Insert the bibliography
- Appendices if any

Thesis Information

```
\title{The Thesis Title}
\titletwo{Second Line (Optional)}
\titlethree{Third Line (Optional)}
\author{The Author}
\degree{Master of Engineering (Electrical)}
\faculty{Faculty of Electrical Engineering}
\titledate{October 2013}
```

Thesis Information (cont'd)

```
\award{4}
1.  Bachelor Degree Project Report
2.  Master's Project Report (By course work)
3.  Master's Dissertation (By course work and re-
search)
4.  Master's Thesis (By research)
5.  Doctor of Philosophy Thesis
6.  Engineering Doctorate Thesis
\superone{M.Y. Supervisor}
\supertwo{M.Y. Other Supervisor}
```

Preambles

- Acknowledgement
- Dedication
- Abstract
- Abstrak
  - Please check with the Dewan Bahasa website
    `http://prpm.dbp.gov.my/` for special terminology.
- Abbreviations
- Symbols

Main Matters: Parts, Chapters, and Sections

The following hierarchy of *sectioning* is supported.

- Part (not really required in thesis, unless your thesis is >1000 pages long)
- Chapter
- Section
- Subsection
- Subsubsection
- Do not go beyond this!

Bibliography

- Do no do manual citations. Dynamic (and smarter way) – Use BibTEX
- Insert ▷ List/TOC ▷ BibTEX Bibliography
- Add database(s) – *.bib (see next slide on how to get one)
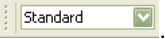- Select style (numbering or author-date)
- To cite 📖

Where to Get BibTEX??

- Mendeley (citations manager) - A good online app
- Google Scholar
- Publishers
- May require manual edit

```
@book{b1,
Author = {Leslie Lamport},
Title = {LaTeX:  A Document Preparation System},
Publisher = {Addison-Wesley Professional},
Year = {1994},
}
```

Appendices

- After bibliography, Document ▷ Start Appendix Here
- Must be at the proper place
- Must be ended with a LATEX command \endmatter
  - Else, ToC will have wrong formatting

LyX Environments

- Different parts of a document have different purposes; we call these parts *environments*.
- Environments are a major part of the "What You See Is What You Mean" philosophy of LyX.
- Certain types of documents have special environments
- An environment may require a certain font style, font size, indenting, line spacing, and more.
- The Environment choice box is located on the left end of the toolbar and looks like this: Standard .

Spellchecking and Tracking Changes

- Enable spell-check
  - Tools ▷ Preferences ▷ Language Settings ▷ Spell Checker
  - Select available spellchecker such as Encant
  - Tick *Spellcheck continuously*
- Document ▷ Change Tracking ▷ Tracking Changes 📝
  - Check changed version on pdf by enabling 📝

Formatting Texts

- Texts are justified by default. You can change the paragraph alignment with the Edit ▷ Paragraph Settings 🔳.
- Fine-Tuning Whitespaces
    - Protected Break, Ctrl+Return
    - Protected Space, Ctrl+Space
- Forced Page Breaks
    - Insert ▷ Formatting ▷ New Page.
    - Insert ▷ Formatting ▷ Page Break (stretches page-fill).
- Using Different Character Styles 🔤
    - Noun style (toolbar button 🅰)
    - Emphasized style (toolbar button 🅰)

Lists and Enumerates

- Lists and sublists (can be made nested)
    - Enumerate 🔢
    - Itemized ▤
    - List (not native to LaTeX) ▦
    - Description ▤

- Footnotes can be added through menu Insert ▷ Footnote or toolbar button ▥.

- Margin notes can be added through menu Insert ▷ Marginal Note or the toolbar button ▤.

Labels and Cross-References

- The use of label ✎and cross-reference 🗐.
- Dynamic numbering of
  - <reference>: prints the float number, this is the default.
  - (<reference>): prints the float number within two parentheses, e.g. for Equation.
  - <page>: prints the page number.
  - on page <page>: prints the text "on page" and the page number.
  - <reference> on page <page>: prints the float number, the text "on page", and the page number.

Typesetting Maths

- Inline Formula for in-text formula
- Numbered Formula (single off-the-line formula) or Eqn Array (multi-line off-the-line formula).
- May *type* instead of clicking the Math toolbar if you know basic LaTeX command for math.

Math Mode Features

- Exponents and Subscripts – e.g., **xˆ2y**, you will get x^{2y} and type **a_1** to get a_1.

- Fractions – by typing **\frac** or using the icon $\dfrac{a}{b}$ in the Math Panel.

- Roots – using the Math Panel button $\sqrt{\square}$ or the commands **\sqrt** or **\root**.

- Operators with Limits – **\sum** for Sum ($\sum$) and **\int** for integral ($\int$) operators

- Math Symbols – includes Greek, Operators , Relations, Arrows. Also AMS additional symbols.

- Altering Spacing – using protected space.

- Functions – button $\overset{\text{exp}}{\text{tan}}$ for function macros, such as sin, lim, *etc*.

- Accents – circumflex, tilde, breve, etc through command or from the Frame decorations symbol set button in the math panel

- Brackets and Delimiters – Auto-sizing delimiter via icon $[\mathbf{0}]$.

- Arrays and Multi-line Equations – Matrices are entered using the Math Panel matrix button .

- Cases – Insert ▷ Math ▷ Cases Environment or the command **\cases**.

Greek Characters

α	\alpha	θ	\theta	o	o	τ	\tau
β	\beta	ϑ	\vartheta	π	\pi	υ	\upsilon
γ	\gamma	ι	\iota	ϖ	\varpi	ϕ	\phi
δ	\delta	κ	\kappa	ρ	\rho	φ	\varphi
ϵ	\epsilon	λ	\lambda	ϱ	\varrho	χ	\chi
ε	\varepsilon	μ	\mu	σ	\sigma	ψ	\psi
ζ	\zeta	ν	\nu	ς	\varsigma	ω	\omega
η	\eta	ξ	\xi				
Γ	\Gamma	Λ	\Lambda	Σ	\Sigma	Ψ	\Psi
Δ	\Delta	Ξ	\Xi	Υ	\Upsilon	Ω	\Omega
Θ	\Theta	Π	\Pi	Φ	\Phi		

Math Operators

$\leq$	`\leq`	$\geq$	`\geq`	$\equiv$	`\equiv`	$\models$	`\models`
$\prec$	`\prec`	$\succ$	`\succ`	$\sim$	`\sim`	$\perp$	`\perp`
$\preceq$	`\preceq`	$\succeq$	`\succeq`	$\simeq$	`\simeq`	$\mid$	`\mid`
$\ll$	`\ll`	$\gg$	`\gg`	$\asymp$	`\asymp`	$\parallel$	`\parallel`
$\subset$	`\subset`	$\supset$	`\supset`	$\approx$	`\approx`	$\bowtie$	`\bowtie`
$\subseteq$	`\subseteq`	$\supseteq$	`\supseteq`	$\cong$	`\cong`	$\Join$	`\Join`*
$\sqsubset$	`\sqsubset`*	$\sqsupset$	`\sqsupset`*	$\neq$	`\neq`	$\smile$	`\smile`
$\sqsubseteq$	`\sqsubseteq`	$\sqsupseteq$	`\sqsupseteq`	$\doteq$	`\doteq`	$\frown$	`\frown`
$\in$	`\in`	$\ni$	`\ni`	$\propto$	`\propto`	$=$	`=`
$\vdash$	`\vdash`	$\dashv$	`\dashv`	$<$	`<`	$>$	`>`
$:$	`:`						

Other Symbols

Must use latexsym, amsfonts or amssymb

$\pm$	\pm	$\cap$	\cap	$\diamond$	\diamond	$\oplus$	\oplus
$\mp$	\mp	$\cup$	\cup	$\triangle$	\bigtriangleup	$\ominus$	\ominus
$\times$	\times	$\uplus$	\uplus	$\bigtriangledown$	\bigtriangledown	$\otimes$	\otimes
$\div$	\div	$\sqcap$	\sqcap	$\triangleleft$	\triangleleft	$\oslash$	\oslash
$*$	\ast	$\sqcup$	\sqcup	$\triangleright$	\triangleright	$\odot$	\odot
$\star$	\star	$\vee$	\vee	$\lhd$	\lhd*	$\bigcirc$	\bigcirc
$\circ$	\circ	$\wedge$	\wedge	$\rhd$	\rhd*	$\dagger$	\dagger
$\bullet$	\bullet	$\setminus$	\setminus	$\unlhd$	\unlhd*	$\ddagger$	\ddagger
$\cdot$	\cdot	$\wr$	\wr	$\unrhd$	\unrhd*	$\amalg$	\amalg
$+$	+	$-$	-				

$\hat{a}$	\hat{a}	$\acute{a}$	\acute{a}	$\bar{a}$	\bar{a}	$\dot{a}$	\dot{a}
$\breve{a}$	\breve{a}	$\check{a}$	\check{a}	$\grave{a}$	\grave{a}	$\vec{a}$	\vec{a}
$\ddot{a}$	\ddot{a}	$\tilde{a}$	\tilde{a}				

$\widetilde{abc}$	\widetilde{abc}	$\widehat{abc}$	\widehat{abc}
$\overleftarrow{abc}$	\overleftarrow{abc}	$\overrightarrow{abc}$	\overrightarrow{abc}
$\overline{abc}$	\overline{abc}	$\underline{abc}$	\underline{abc}
$\overbrace{abc}$	\overbrace{abc}	$\underbrace{abc}$	\underbrace{abc}

Theorems

- LyX has no standard way of inserting theorem, definition, etc.
- Can use native LaTeX way for inserting Theorem environment
- Declare \newtheorem{thm}{Theorem Name} in the LaTeX preamble
- Then call the thm environment

```
\begin{thm}[Euclid]
 The theorem
\end{thm}
```

What are Floats

- A float doesn't have a fixed location.
- It can "float" forward or backward to wherever it fits best to get a high quality layout.
- Caption as part of a float.
- To insert, use the menu Insert ▷ Floats.
  - Figure Floats – Insert ▷ Float ▷ Figure 🖼
  - Table Floats – Insert ▷ Float ▷ Table. ▦
  - Algorithm Floats – Insert ▷ Float ▷ Algorithm.
- Can create subfigure with double Insert ▷ Float ▷ Figure and again, insert ▷ Float ▷ Figure
  - This inserts a "subfigure float" into the float)

Float Placement

Right-clicking on a float-box opens a dialog where you can alter the placement options

Here if possible: try to place the float at the position where it is inserted

Top of page: try to place the float at the top of the current page

Bottom of page: try to place the float at the bottom of the current page

Page of floats: try to place the float at an own page

If you use the default placement, LaTeX will first try out Here if possible, then Top of page, and then the others.

Graphics and Images

- Place the cursor and click on the toolbar icon 🖼or select Insert ▷ Graphics from the menu.
- Then a dialog will appear to choose the file to load.
- You may also copy and paste as well (just like MS Word) – png image
- The image settings can be adjusted
- Supported types
  - Bitmap images GIF, PNG, JPG. Try to avoid if possible.
  - Scalable images SVG, EPS, PDF.

Tables

- Insert a table using either the toolbar button 🎟or the menu Insert ▷ Table
- The default table has lines around all cells and the first row appears separated from the rest of the table (double line)
- You can adjust the settings of the cell and row/column respectively.
- Longtables are also supported.

Algorithms

- Method 1
    - insert ▷ float ▷ algorithm
    - Set caption
    - Edit ▷ paste external selection ▷ as lines (**cntrl+shift+v**)
- Method 2
    - Use algorithmic environments (made obsolete by algorithm2e).
    - Require ERT

Algorithmic Package

- Require Algorithm and Algorithmic packages
- Obsolete (replaced by algorithm2e)

Algorithm 1 Calculate $y = x^n$

Require: $n \geq 0$
Ensure: $y = x^n$
  $y \Leftarrow 1$
  $X \Leftarrow x$
  $N \Leftarrow n$
  while $N \neq 0$ **do**
    if N is even **then**
      $X \Leftarrow X \times X$
      $N \Leftarrow N/2$
    else $\{N$ is odd$\}$
      $y \Leftarrow y \times X$
      $N \Leftarrow N - 1$
    end if
  end while

Need Evil Red Text (ERT)

- Refers to insertion of LaTeX command $\mathbb{T}_{E}\mathbb{X}$ or ctrl+L

```
\begin{algorithmic}
 \REQUIRE $n \geq 0$
 \ENSURE $y = x^n$
 \STATE $y \Leftarrow 1$
 \STATE $X \Leftarrow x$
 \STATE $N \Leftarrow n$
 \WHILE{$N \neq 0$}
 \IF{$N$ is even}
 \STATE $X \Leftarrow X \times X$
 \STATE $N \Leftarrow N / 2$ \ELSE [$N$ is odd]
 \STATE $y \Leftarrow y \times X$
 \STATE $N \Leftarrow N - 1$
 \ENDIF
 \ENDWHILE
\end{algorithmic}
```

File Listings

- Insert ▷ File ▷ plain text to insert ext in verbatim mode.
- Insert ▷ File ▷ Child document
  - Options for include, input, verbatim, program listing.
  - Verbatim in typewriter font
  - Program listing can be configured language-aware

Language-Aware Program Listings

- You may change the type to program listing and configure it as you need

```
breaklines=true
captionpos=b
frame=tb
language=Python
commentstyle={\normalfont\textit}
keywordstyle={\textbf}
```

- Refer to *Listings* LaTeX package.

Inserting Pdfs

- Insert ▷ File ▷ External Materials
- Select pdf
- Use pages option to specify pages to include.

Thesis Writing Best Practices

- Turn-on spelling check
- Enable track changes between thesis versions
- Dynamic bibliography using BibTEX
- Always use cross-referencing
- Dynamic width for figures/tables
- Scalable graphics when available

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