Research Skills

WORKSHOP 4

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This Week – Thesis Writing

- Writing a thesis or dissertation
  - What is a thesis?
  - Structure and content
  - Tips and Pitfalls

What is the thesis?

- The thesis is structured document that poses your research question, how you answered it and what the main implications are. It should show that:
  - You identified a worthwhile problem or question
  - That you solved the problem or answered the question

- Knowing what an examiner will be thinking about when reading your thesis should help when writing it.
  - what is this student's research question?
  - is it a good question? (has it been answered before? is it a useful question to work on?)
  - did the student convince me that the question was adequately answered?
  - has the student made an adequate contribution to knowledge?

- It is these questions that you are ultimately trying to answer when writing a thesis. There is a well defined structure for providing evidence and argument to support your claims.

Thesis skeleton

- When the time comes to write your thesis, the first place you should start is with a table of contents. This forces you to think about the structure of the final document.
- Most theses in engineering/computing will contain the following headings (or some variation on them):

  - Title Page
  - Declaration
  - Abstract
  - Acknowledgements
  - Table of Contents
  - List of Figure, List of Tables, List of Abbreviations, List of Symbols
  - Introduction
  - Background
  - Related Work Review
  - Middle Chapters (Methodology, Theory etc.).
  - Results
  - Conclusion and Future Work
  - Appendices
  - References

Thesis Content

- Title – A single line that describes the main theme of the work. Problem and approach. Avoid abbreviations if possible. Avoid motivations and background. Use adjectives that describe the distinctive features of your work, e.g., reliable, scalable, high-performance, robust, low-complexity, or low-cost.
- Abstract – This is a brief overview of the thesis. Pose the research question in a concise a manner as possible and say how it was answered and what the results were. In a couple of hundred words. No references, sections, equations etc. Understood by novice in the field.
- Introduction - This is a general introduction to what the thesis is all about -- it is not just a description of the contents of each section. Here you can present the research question in detail (problem statement subsection), give the reasons why it is a worthwhile question (motivations subsection) and give an overview of your main results.
- Background - A brief section giving background information may be necessary, especially if your work spans a number of fields. That means that your readers may not have any experience with some of the material needed to follow your thesis, so you need to give it to them.

Thesis Content

- Review of state of the art – A review and critical analysis of related work. We have already discussed this in some detail. See earlier workshops.

- Thesis body – Materials/Methodology/Theory - This part of the thesis can vary a lot from topic to topic. It may have one or several sections and subsections. But it all has only one purpose: to convince the examiners that you answered the question or solved the problem that you set for yourself. This is the “how” part of the thesis. You are going to show the reader how you solved the problem/answerd the question.

- There should be sufficient detail in this section to allow the reader to reproduce what you have done, i.e. you describe your methods.

- Results and Discussion – Here you describe what the main outcomes of the research. If you created/built something, you describe what you created and what it does, and how well it does it. It may be useful here to also compare it like systems. If you performed experiments or crunched data, show what the outputs of the experiments were in their raw form. The discussion will reveal insights into the raw results. Observations that may not be apparent at first glance.

Thesis Content

- Conclusions and Future Work – This chapter will summarise the main findings of the research or the main contributions made. If there are any implications of the work these are also described here. This chapter sums up the work and describes what it all means in the bigger picture.

- It is often the case with scientific investigations that more questions than answers are produced. Does your work suggest any interesting further avenues? Are there ways in which your work could be improved by future workers? If you find that a 'future work' avenue existed before your work was then it is not as a result of your work so take it out.

- Appendices - If there is material that should be in the thesis but which would break up the flow or bore the reader unbearably, include it as an appendix. Some things which are typically included in appendices are: important and original computer programs, data files that are too large to be represented simply in the results chapters, pictures or diagrams of results which are not important enough to keep in the main text.

- References – A complete listing of all works cited in the text. See earlier workshops for more detail on what should be in here.

Getting Started

- Begin by writing the Table of Contents, listing each section and subsection that you propose to include.
- For each section and subsection, write a brief point-form description of the contents of that section. The entire outline might only be 2 to 5 pages long. Now you and your thesis supervisor should carefully review this outline: is there unnecessary material (i.e. not directly related to the problem statement)? Then remove.
- Is there missing material? Then add. It is much less painful and more time-efficient to make such decisions early, during the outline phase, rather than after you've already done a lot of writing which has to be thrown away.
- Be sure to give yourself enough time to write the thesis well. Organising the material takes time so allow enough. You will uncover some gaps when formalising your work that need to be dealt with.
- If english is not your first language, allow even more time. Thesis could be worth 50% of the marks, but will you give it 25% of the time?

Thesis Writing Tips

- Start writing the sections that you are most comfortable with. Writing these sections will generate ideas etc for other sections of the report.
- For a first draft, do not waste too much time trying to make it perfect in terms of appearance in word, latex etc. Content and structure and feedback is more important at this stage.
- Be clear and unambiguous in your writing style. Don't use synonyms.
- Use simple language in so far as it is possible to explain the more complex themes.
- Be consistent in your writing style. For example if referring to a figure or table from the text use the same language each time, e.g. see figure 1.
- Read other well prepared theses.
- Write to your audience. What level of expertise are you writing to (your peers). So include enough detail so that level can understand your work.
- Write or rewrite the introduction at the end. This is normally an overview so it helps to have the rest of the thesis written before you give an overview of it.

Thesis Writing Tips

- Use Times New Roman, 11 or 12 pt font. Arial and other fonts are fine for posters.
- For the first draft of fancy graphs/tables, do them by hand. These can take a long time to do in word, so you need to be sure they are worth having in there.
- if you are presenting information in the form of a table or graph make sure you introduce the table or graph in your text. And then, following the insertion of the table/graph, make sure you discuss it. If there is nothing to discuss then you may want to question even inserting it.
- Be clear about what is yours and what is not. Use references on delimit your work. The only exception is when talking about something that everybody know e.g. basic theory.
- Allocate sufficient time for writing. For a graduate thesis, one quarter of the total research time should be spent writing.
- Conclusion/Implication section, to help the understand what it all means, not to merely restate the research findings.

Thesis Writing Pitfalls

- Avoid making your thesis a chronological listing or story of everything you did. Some things are not worth mentioning. A thesis should be structured not by date but by the headings discussed earlier.
- Do not make the reader work too hard. Again this comes down to organisation and section headings so the reader can find the salient points.
- Avoid sweeping statements like, “Linux is the best operating system”. Can this be proved or is it just opinion.
- Don’t put references in the abstract. It can be used without the rest of the thesis.
- Spelling mistakes. With the plethora of spelling and grammar checking tools available, there is no excuse for having spelling/grammar errors. If these exist it will sound alarm bells in any examiners mind. The “Elements of Style” by Strunk and White for advice on grammar and writing style. http://www.bartleby.com/141/
- Avoid putting computer programs in the thesis body. Algorithms are ok but programs are for the appendix if they need to be included.