Writing a Dissertation/Thesis

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Dissertation vs. Thesis

- Ph.D.: Dissertation
- M.S.: Thesis

What is the difference?
- Thesis is shorter
- Lit review is less extensive
- Research agenda is less extensive
- Thesis doesn’t need to be ground breaking in terms of novelty
- Have one strong publication out of a thesis is typically beyond expectation, while for a dissertation it’s often not enough

There are always exceptions to these differences
- Remember that a strong M.S. thesis can provide a great starting point for a strong Ph.D. dissertation
- I’ll use only the term “thesis” from now on
Should be around 7-8 words
- Try to be precise and don’t use words that are general catch-alls
- Think of what you would want others to Google to find your thesis
- You don’t have to decide the title early on
- In fact, the title should easily emerge from the abstract...
The Abstract

Each thesis comes with an abstract
A very well-written 1-page summary of the document
Luckily there is an expected structure:

1. What is the area and why is it an important area?
2. What is the problem that you tackle and why is it hard?
   - In as simple English as possible
   - Why are the challenges and why do they elude us?
3. What does the literature say about this problem?
   - Results and shortcomings
What is your approach in solving this problem?
   1. How come you solved it?
1. How do you implement your solution?
   - In simple, high-level English
What are the key findings and the overall impact?
   1. What you discovered
   - What it says about future research, application, technology, etc.
The Abstract

- The Abstract is not only a 1-page writing exercise
- It’s a **sanity check**: If you can’t write a compelling abstract, there is likely something wrong with your work
- It’s a **plan** for your argument
- It’s a **story** that you can tell to answer the question “So, what’s your thesis about?”, asked by some potential employer
- No point in trying to have it all polished early on, but really important to write an abstract draft in informal English as early as possible
- And keep revising it as you go
The abstract should lead to a natural chapter organization.

It’s ok to change your mind about chapters as you go, e.g., if a chapter gets too big/small.

Three staples:
- Introduction
- Lit review
- Conclusion
The Introduction

Motivate the problem and state your hypothesis

- **Tell a story** that flows
- Using concrete examples is a good idea here (even figures)
- Use key references
  - e.g., ones that point out that the problem you’re tackling is crucial
  - e.g., ones that make it clear that there is a gap to fill
- Introduce important terminology and acronyms
  - You’ll be able to define all detailed terminology later, but the most important, recurrent terms should be defined here (including acronyms)
- Provide a concrete, if not 100% formal, problem definition
  - Should be understandable by a CS-literate person
- Provide a summarized research roadmap
  - Broad strategy of your approach
  - Tools/Methodologies used
    - Are you doing field studies, algorithms, benchmarks, theorems,...?
- Provide a concrete list of your scientific results/contributions
The Introduction

- Do no oversell your work
  - Be honest
  - Don’t use words like “unprecedented,” “trailblazing,” “revolutionary,” unless you’re ready to defend them
  - Don’t sound like a used car salesman
  - Impact on mankind as a whole is hard to justify
    - Even though compilers impact applications that impact users that impact, say, medicine, that impacts curing cancer, that impacts mankind, you may not want to say it
  - Don’t use big words for the sake of it
    - Plain English is almost always best
  - Don’t make it sounds like your thesis covers your entire field, unless it really does
The Lit. Review

- Make sure you have done an **in-depth** lit review
  - Both seminal and recent work
- Make sure you have followed references up and down
  - Google Scholar allows you to do this easily (demo?)
  - See the “how to do a lit review” slides
- The end result should look like (pieces of) an ACM Computing Surveys article
  - And, if well-done, your lit review could be published
- Be inclusive, with some (explicit?) limits
-Acknowledge the **role** of each paper in the field, and **in relation to your work**
- Don’t belittle a paper just to show off
- Don’t make any harsh/personal criticisms
The Conclusion

- Summary of contributions
  - What were the lessons learned?
  - What were the overall insights?
- Did you solve the problem completely?
  - How much progress have we done in your field because of your work?
  - What are the limitations of your work?
- Do not have a boring cut-and-paste from the Introduction
  - This is where to be reflective
- Do not leave this for the last 2 hours before you have to turn in your draft
- Future work
  - What would you do if you had an extra year?
  - What should 1, 2, 3 follow-up theses be?
Tip #9: Start writing the “easy” chapters

- The introduction is incredibly difficult to write, and is often written last.
- The conclusion is very difficult and is often written next-to-last.
- The lit review shouldn’t be hard to write and could be done early.
  - because you’ve done a relevant portfolio lit review
  - because you’ve maintained an annotated bibliography
- The “meat” chapters are typically the easiest.
  - methodologies, graphs, and results are easier to write about than research vision.

Tip #10: Write a good proposal

Then the thesis writing will be easy!
Writing Tips

See graduate chair presentation on writing tips and advices
The Thing in the Middle

Between the Lit Review and the Conclusion you have a sequence of chapters

In some field there needs to be a Methodology chapter

Defining your outline is something you do with your adviser

There should be a natural progression from one chapter to the next

A thesis is a story!
The Thing in the Middle

Things to be always crystal clear about

- Each assumptions
  - Why is each of them justified?
    - common-sense, previously published work, your own validation

- Each limitation, requirement, constraint of your approach
  - Why is each of them justified or tolerable?

- What your validation plan is
  - Methodology, metrics for evaluation
  - How do we know that what you did “works”

- The scope
  - what’s in scope, what’s out of scope
The Thing in the Middle

- Make sure that all presented results in each section/chapter add up to a cohesive whole.
- Methodology/approach should be presented w/o glossing over details.
  - Glossing over stuff is the opposite of what you do in a thesis.
  - You do not want to have the committee misunderstand your work.
  - Your methodology should always be justified.
    - Previous work does it, I tried 3 options and this one worked best,....
- Talking about things that didn’t work is often as (sometimes more?) interesting as talking about the things that did!
  - Quantitative comparison with previously published work is necessary.
  - Quantitative comparison with approaches that seemed good but didn’t work for (now) understood reasons is a welcome plus.
- If you have intriguing, counter-intuitive results, and, even better, if you can explain them, make sure they’re highlighted.
  - This is what keeps the reader interested.
Don’t expect to cram everything you did as a grad student into the document
But everything that’s relevant should be in there
The document should be self contained
Appendices are us!
Do not tout the advantage of your approach repeatedly
Never forget that 99.99% of readers will be much less familiar than you are with your area
Chapter Structure

Say everything 3 times
The whole thesis
   Introduction: What will be said
   Middle chapters: say it
   Conclusion: What was (really) said
Each chapter has the same structure
   Introduction: What this chapter will say
      What sub-problem of the bigger problem is this about?
      How does this chapter fit in the bigger story?
   Middle sections: Say it
      As detailed as it needs to be, formulae, graphs, tables, etc.
   Conclusion: What this chapter (really) said
      “Teaser” transition to the next chapter
It’s not repetition, it’s linking and progression
   Done right, the reader doesn’t notice any repetition at all
   Not done, the reader will be lost
The Examiner’s View

“Oh no, another thesis to read...”

You want to entice them into reading

“Well, this is so much work, but at least I’ll learn or get up-to-date on cool stuff”

You want to make it easy for your committee members to read your draft

Writing tips unite!

Non spell-checked drafts are death

Reading will be done in planes and even meetings

Reading will be done in many batches

Hence the importance of “signposts” sentences to remind the reader often of where we are in the story of the thesis
The Examiner’s View

First question: “what’s this one about?”
- The abstract had better make it easy to answer that question

“Is the lit review adequate?”
- Is it complete and well-structured?
- Does it relate well to the work, or just a “others have done stuff” statement?
- If the answer is “no,” you’re in trouble

“Is the methodology sound and well justified?”
“Are the results presented clearly and convincingly?”
“Do I believe the achievements claimed in the conclusion?”
“Where has this been published, if at all?”
- Strong publications go a long way here
Administrivia

- See the “Proposal” slides about getting a committee and getting Form II approved
- Plan at least 2 hours for the final defense
- Scheduling is (still) NP-hard
- Providing a final draft to committee members 1 month ahead is a minimum
  - 2-3 weeks may be OK for a M.S. thesis
  - Do not circulate individual chapters
  - May be ok to send an updated draft “in case you haven’t already read chapter 4, this new draft has a much better version”
- Bring Forms III and IV to the final defense
- If you need to have remote participants, check with the graduate chair
The Defense

- Do practice defenses
- When asked a question, give a short answer first before launching into a lengthy one
  - “Essentially, for our purposes, the answer to your question is yes, however there is a little bit of subtlety here, as described in Section 4.3.”
- Know your outline!
- Get to all details if the short answer wasn’t enough
- Don’t make stuff up to make it look like you have a full answer for every question
- Don’t be too defensive at your defense
The Defense

Typical “general” questions:
- If you had to do it again, what would you do differently?
- How do you know that you are done? When is the problem solved?
- How would your work be useful in practice?
- What was the most challenging part of the research?
- What surprised you the most in your results, if anything?
- What’s novel about your work?
- What’s beyond this work?
- How much of your work can be generalized?
- What part of the work was research and was part was engineering?
- ...

What You Can Do Today

- Draft your abstract
- Think of Google keywords for your work
- Write down a tentative thesis title
There are several sources on-line.
I inspired myself from some of them for some of the content in this presentation.

“How to Write a Good (no, Great) Ph.D. Dissertation” by Priya Narasimhan

“How theses get written: Some cool tips” by Steve Easterbrook

Another good one (Google it)

“How to Be a Good Graduate Student “ by Marie desJardins
The End

Questions?
Comments?
Personal Stories?