

CSC 595

Research Methods for Computer Science

Fall 2020



Chapter 5

Writing the Thesis or Project Proposal

Topics

- Project vs. Thesis
- Thesis Proposal

Thesis vs. Project



- There is actually no formal distinction between a thesis and a project;
- Informally, however, a thesis is more of a research task while a project is more of an applied task;
- Definitions and examples follow

What is a Thesis?



True Happiness
Ended Since It
Started

A. An argument

B. An exposition of an original piece of research

Exposition: a comprehensive description and explanation of an idea or theory.

C. The product of an apprenticeship

D. All of the above

- Probably the largest (most self-indulgent) piece of work you'll ever do
- Something that could be published:

E.g. At least one paper in a scholarly journal

You will probably never publish the whole thesis

Thesis Definition – Another one

- A thesis documents process, products, and assimilation of an investigative piece of work.
- Work should be in a current and advanced topic in computer science.
- Not enough to simply report on others' work. You must synthesize, elaborate on, and, ideally, contribute to the body of knowledge you studied.

Some example thesis topics

"Performance comparisons of three string searching algorithms"

"An approximation algorithm with good performance guarantees for the traveling salesman problem with triangle inequality"

"The feasibility of a layered approach to software fault tolerance"

"Effectiveness of exception mechanisms for improving software reliability"

Project Definition

- A project generally involves a significant software implementation and a write-up
- Can be a significant project in a work setting

Examples of project topics:

"A CAI package for teaching tree balancing techniques"

"A package for tracking the progress of students in the MS program"

"Software simulation of the N-Step RISC architecture"

"A program to play go on a 9 by 9 board"

Project Continued



Design and implementation of software

Expected to conform to current software engineering principles and practices.

- Written report should concentrate on various design and implementation issues
- Typically, there will be design rationale including discussion of alternatives considered. Report should also include discussions on methodology used. Project reports vary more than Theses.
- The defense will include a demonstration of capabilities of the software

Which Should You Choose ?



- **Thesis**

Yes. If you want or need to have a publication under your name – Always looks good

If you even think you want to go on for a PhD

If you are not sure, do the Thesis

- **Project**

If you already have a job and do not need to do research to prove yourself

If you have an idea you want to work on within the context of your job – job related project

You are not a good writer and do not want your work published and available for all of posterity

Preparation for Writing Thesis

- What kind of preparation do you need before you are ready to write ?

1. Finished or nearly finished **Literature Review**

During the first year

Can write this section as you finish lit review

2. **Introduction** – Can write it all except results if not done yet

Describe the problem, provide background

3. Finished the program or proof then you can

Report on Results

What Makes a Good Thesis?

- Produce a good thesis, But What does good mean?
 - Should you implement something?
 - Needs a formal proof?
 - An empirical evaluation? If so, which type?
- There is no universal answer to these questions
- Each computer science area has its own expectations of what makes a good thesis
 - Thus depends on the sub-area of the thesis



Advice From Students

<https://cheekyscientist.com/insiders-guide-to-write-a-thesis-when-short-on-time/>



Writing a Thesis Proposal

Thesis Proposal

What is the purpose of the proposal?

- **Proposal is**, in effect, an intellectual scholastic (not legal) contract between you and your committee
- It specifies what you will do, how you will do it, and how you will interpret the results.
- In specifying what will be done it also gives criteria for determining whether it is done.
- In approving proposal, your committee gives their best judgment that approach to research is reasonable and likely to yield anticipated results

Thesis Proposal



- Some of same sections in proposal as are in actual Thesis
- Also includes a Timeline for the proposed work
- **Sample Contents Include:**
- The Introduction
- Literature Review
- Methodology
- Expected Results
- Bibliography or References
- Schedule or Timeline for the work

A Typical Process



- Decide a general area of interest
- Start literature review to narrow down and sharpen problem definitions
- Write the problem statement
- Define significance of the work
- Design methods
- Plan for validation
- Experimental?
- Theoretical proof?
- Estimate a timeline

Topics of Interest

- Once identified, Area of Interest
- Write down a tentative title
- Write down a tentative research theme
- Overall background
- Ask feedback from your advisor if advisor is identified

Literature Review



- Writing the literature review allows you to understand:
 - How other scholars have written about your topic.
 - The range of theories used to analyze materials or data.
 - How other scholars connect their specific research topics to larger issues, questions, or practices within the field
 - The best methodologies and research techniques for your particular topic

Problem Statement

- What is given
- What are the constraints
- What are the objectives/hypothesis
- What are the rationales

Problem Statement Review



- Concise
- Leaves room for multiple solutions
- Specific enough to be solvable in the given time frame and with available resources
- Does not imply a solution
- Answers the questions:
 - Who, what, where, when, and how many?

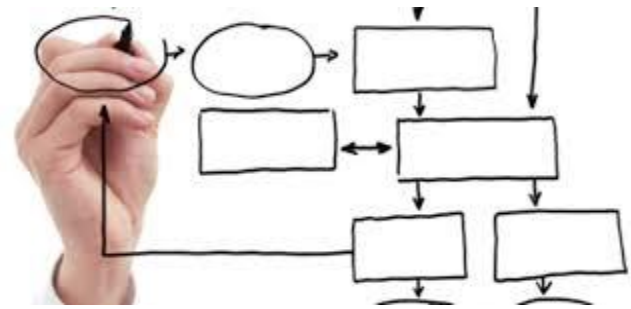
Significance



➤ Why is this work important?

- Show why this is it important to answer this question.
- What are implications of doing it?
 - How does it link to other knowledge?
 - How does it stand to inform policy making?
- Should show how this project is significant to our body of knowledge
- Why is it important to our understanding of the world? It should establish why I would want to read on.
- It should also tell me why I would want to support, or fund, the project.

Methodology



- Varies for different domains and problems
- Can be identifying possible theory to prove a theorem
- **Experimental approach:**

Hypothesis formulation ➡ Experimental design



Data Collection



Data interpretation



Insights and conclusion

- **Method-based:**

Design a new approach/algorithm to solve a hard problem

Validation



Prove theoretically for correctness

➤ **Experimental approach:**

- Find the most related work in literature
- Compare results
- Metrics

➤ **Method-based:**

- Most related current approach in literature
- Compare: fast? Better? In what sense?

TimeLine



➤ Some things to keep in mind:

- Consult your advisor.
- Check important dates for submitting and defending thesis.
- Take various factors into consideration:
 - **IRB approval**, travel; design, testing, and length of experiments;
purchase of necessary equipment or software
- Timeline is not always respected but writing it helps you to plan out your time
- Do a Gantt chart.

Title

- Consider a catchy and easy-to-remember abbreviation

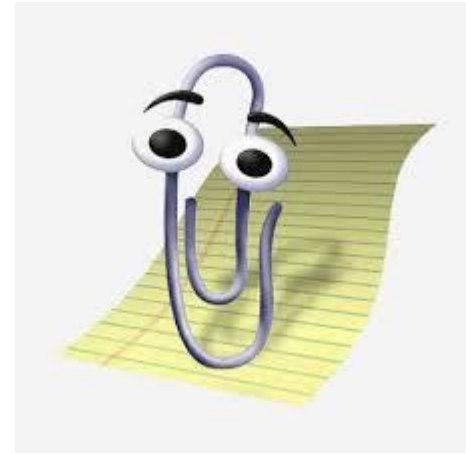
- **Examples:**

SINA: Scalable incremental processing of continuous queries in spatio-temporal databases

Lars: A location-aware recommender system

- Reflects the main research theme of the proposal

Proposal Practical Advice



Proposal is a proposal and not a final contract

- Ideas may not work and will be revised
- Talk to your advisor often
- Start writing once you reviewed some literature and have certain confidence about a research problem
- Writing should happen together with reading and thinking, not at the end
- Write as often as possible, link, organize, and re-organize
- Your proposal will serve as the basis of your thesis

References

Guidelines on Writing a Research Proposal

<https://www2.hawaii.edu/~matt/proposal.html>

How to Write a Thesis Proposal Elmar Juergens Advice

http://www.ideo.columbia.edu/~martins/sen_res/how_to_thesis_proposal.html

How to Write a Good Thesis Proposal

<http://jeapostrophe.github.io/2013-03-26-thesis-p-post.html>

Guidelines for Preparation of Your Masters Thesis

<https://www.unk.edu/academics/gradstudies/admissions/grad-files/Grad%20Files/ThesisGdlnsFinal08.pdf>

Summary



MS
Degree

- Advice on Writing proposals and Theses is abundant
- A proposal seeks to define your problem and help you succeed in writing your thesis
- Good to have something concrete to present to your potential advisor and committee

