



Research Methods in Science in Engineering

## Proposing Your Research

Slide 1

### Outline

- Introduction
- Proposal Document
- Proposal Presentation

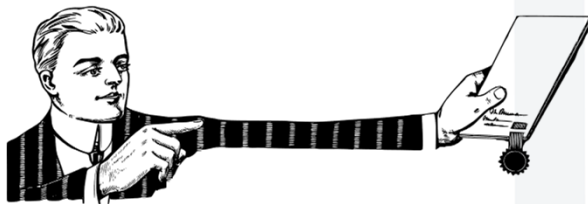
Slide 2

# Introduction

## Purpose of the Proposal

Your research proposal is contract between yourself and your committee.

If you do the proposed research, you committee agrees to sign for your degree.



Things your committee must ensure:

- Is your research new enough?
- Is your research significant enough?
- Is your research difficult enough?
- Is your topic well defined?
- Is your plan achievable?
- Can/will success be measured?

# Proposal Document

## Proposal Document Outline

- Proposal Summary (one page max)
  - Problem statement or hypothesis (~ 0.5 pages)
  - Research plan (~ 0.5 pages)
- Background (~ 4 pages)
  - History and state-of-the-art (~ 2 pages)
  - Prior research (~ 2 pages)
- Proposed Research (2-3 pages)
  - Research topic (1-2 pages)
  - Significance of the proposed research (0.5 to 1.0 pages)
- Research Plan
  - Scope & objectives (0.5 to 1.0 pages)
  - Schedule of tasks and milestones (~ 0.5 pages)
  - Research deliverables (< 0.5 pages)
  - Detail description of tasks (0.5 to 1.0 pages per task)
- References



## Hypothesis Vs. Problem Statement

Proposals that are more scientific than engineering will have a hypothesis statement.

**Hypothesis:** A proposed explanation about what may be true.

Engineering proposals will often have a problem statement instead of a hypothesis.

**Problem Statement:** One or two sentences that explain the key problem(s) that your project will address.

## Problem Statement Section

- What is your topic and why is it important?
- What is the state-of-the-art in this field?
- What have others done?
- What is your research hypothesis or problem statement?
- What new and novel things will your research contribute?
- Why is your research hard and PhD worthy
- What is the impact if you are successful?

## Research Plan Section

- What are the specific goals of your research?
- How are you going to accomplish your research?
- What is your work plan?
- How will you measure your progress?
- How will you know if you are successful in the end?
- Discuss some intermediate results and/or milestones

## Background Section

- History & State-of-the-Art
  - Discuss the history of your topic from the big bang to the present.
  - What has been done in this field to date and by whom?
  - How is the problem addressed today?
  - What is the state-of-the-art?
  - What problems or limitations does the state-of-the-art have?
  - Briefly state how your research contributes new knowledge.
- Prior Research
  - Discuss any related research you have performed.
  - List your publications/presentations with a short one or two sentence description of your work in each.

This section should establish you as a subject-matter expert and prepared to take on your research.

# Proposed Research Section

- **Research Topic**
  - What is your research about and what problem are you trying to solve?
  - What is your research hypothesis or problem statement?
  - What will your research contribute that has not been done before?
  - What is your research new, novel, innovative, difficult and worthy of your degree?
  - Provide an awesome figure that summarizes your research, and fully describe the figure.
- **Significance of the Proposed Research**
  - Why is the research important?
  - What is the potential impact if successful?

# Research Plan Section

- **Scope & Objectives**
  - What is the overarching vision?
  - What is the specific goal of your research?
  - How does your research fit into the overarching vision?
  - What fundamental questions will you answer?
  - What are you going to do? What are you going NOT going to do?
  - What are your objectives in order to meet your final goal?
  - What are your metrics for success?
- **Schedule of Tasks and Milestones**
  - Provide a high-level description of your work plan?
  - What specific tasks will you perform to accomplish your research objectives?
  - Provide a Gantt chart showing schedule of tasks and milestones.
- **Research Deliverables**
  - What will your research produce? List journal articles, conference presentations, device demonstrations, final written dissertation/thesis, other?
- **Detailed Description of Tasks. For each task:**
  - Describe the purpose and outcome of the task in one sentence, the first sentence.
  - Describe all of the work to be performed in this task.
  - List any metrics for success.
  - Identify and discuss any related milestones.
  - Discuss any risks and mitigations.

## References Section

It is common for PhD proposals to have in excess of 100 citations. Most of these will be cited in your background.

Consider using a reference manager!

## Proposal Presentation

# Proposal Presentation Outline

- **Introduction**
  - Problem statement or hypothesis (1 slide)
  - Proposed Research (1 slide)
  - Significance of the Research (1 slide)
- **Background**
  - Provide 1-2 slide summaries of any background topics a person will need to understand your research.
  - State-of-the-Art. Summarize a comprehensive literature search.
  - Prior research.
- **Proposed Research**
  - Scope & Objectives (1 slide)
  - Metrics for success (1 slide)
  - Schedule of tasks and milestones (1 slide)
  - Describe each task (1-2 slides per task)
  - Research deliverables
- **Conclusion**
  - Summary: topic, significance, metrics, timeline and deliverables (1 slide)
  - Publications & presentations (include pending and in progress)
  - References (if not provided on each slide)
  - Acknowledgements: funding source, committee members, etc.
- **Appendix (Optional)**
  - Include anything you wish to have on you to help answer questions.

