

740: Computer Architecture Project Proposal and Topics

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Research Project

- Your chance to explore in depth a computer architecture topic that interests you
- Perhaps even publish your innovation in a top computer architecture conference.
- **Start thinking about your project topic from now!**
- Interact with me and the TAs
- Read the project topics handout well
- Groups of 2-3 students (will finalize this later)
- Proposal due: within 3 weeks of first recitation session

Research Project

- Goal: Develop (new) insight
 - Solve a problem in a new way or evaluate/analyze systems/ideas
 - Type 1:
 - Develop new ideas to solve an important problem
 - Rigorously evaluate the benefits and limitations of the ideas
 - Type 2:
 - Derive insight from rigorous analysis and understanding of existing systems or previously proposed ideas
 - Propose potential new solutions based on the new insight
- The problem and ideas need to be concrete
- Problem and goals need to be very clear

Research Proposal Outline: Type 1

- **The Problem:** What is the problem you are trying to solve
 - Define very clearly. Explain why it is important.
- **Novelty:** Why has previous research not solved this problem? What are its shortcomings?
 - Describe/cite all relevant works you know of and describe why these works are inadequate to solve the problem. This will be your literature survey.
- **Idea:** What is your initial idea/insight? What new solution are you proposing to the problem? Why does it make sense? How does/could it solve the problem better?
- **Hypothesis:** What is the main hypothesis you will test?
- **Methodology:** How will you test the hypothesis/ideas? Describe what simulator or model you will use and what initial experiments you will do.
- **Plan:** Describe the steps you will take. What will you accomplish by Milestone 1, 2, 3, and Final Report? Give 75%, 100%, 125% and moonshot goals.

All research projects can be (and should be) described in this fashion.

Research Proposal Outline: Type 2

- **The Problem:** What is the problem/phenomenon you are trying to evaluate?
 - Define very clearly. Explain why it is important.
- **Novelty:** How has previous research evaluated this? What are its shortcomings?
 - Describe/cite all relevant works you know of and describe why these works are inadequate to solve the problem. This will be your literature survey.
- **Evaluation method:** How will you evaluate the phenomenon/idea? What experimental infrastructure will you design? How would that experimental infrastructure enable you to reliably evaluate the phenomenon/idea?
- **Hypotheses:** What hypotheses will you test?
- **Methodology:** What are your plans for evaluation? What experiments will you run? How will you do the data analysis?
- **Plan:** Describe the steps you will take. What will you accomplish by Milestone 1, 2, 3, and Final Report? Give 75%, 100%, 125% and moonshot goals.

All research projects can be (and should be) described in this fashion.

Heilmeier's Catechism (version 1)

- What are you trying to do? Articulate your objectives using absolutely no jargon.
- How is it done today, and what are the limits of current practice?
- What's new in your approach and why do you think it will be successful?
- Who cares?
- If you're successful, what difference will it make?
- What are the risks and the payoffs?
- How much will it cost?
- How long will it take?
- What are the midterm and final "exams" to check for success?

Heilmeier's Catechism (version 2)

- What is the problem?
- Why is it hard?
- How is it solved today?
- What is the new technical idea?
- Why can we succeed now?
- What is the impact if successful?
- http://en.wikipedia.org/wiki/George_H._Heilmeier

Supplementary Readings on Research, Writing, Reviews

- Hamming, “You and Your Research,” Bell Communications Research Colloquium Seminar, 7 March 1986.
 - <http://www.cs.virginia.edu/~robins/YouAndYourResearch.html>
- Levin and Redell, “How (and how not) to write a good systems paper,” OSR 1983.
- Smith, “The Task of the Referee,” IEEE Computer 1990.
 - Read this to get an idea of the publication process
- SP Jones, “How to Write a Great Research Paper”
- Fong, “How to Write a CS Research Paper: A Bibliography”

Where to Get Project Topics/Ideas From

- Project topics handout
- Assigned readings
 - Mutlu, “Memory Scaling: A Systems Architecture Perspective”
- Recent conference proceedings
 - ISCA: <http://www.informatik.uni-trier.de/~ley/db/conf/isca/>
 - MICRO:
<http://www.informatik.uni-trier.de/~ley/db/conf/micro/>
 - HPCA: <http://www.informatik.uni-trier.de/~ley/db/conf/hpca/>
 - ASPLOS:
<http://www.informatik.uni-trier.de/~ley/db/conf/asplos/>

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