

ECE 18-742 – Research in (Parallel) Computer Architecture

Fall 2014 Syllabus

Course Contacts and Logistics

Instructor: Onur Mutlu, onur@cmu.edu, Office: CIC 4105, 412-268-1186
<http://www.ece.cmu.edu/~omutlu>

Office hours: Tuesdays 12:30-1:30pm, or by appointment

Teaching Assistant: Yixin Luo, yixinluo@cmu.edu, CIC 4th Floor, 734-546-7629
<http://www.cs.cmu.edu/~yixinluo>

Office hours: Thursdays 1:30-3:30pm, or by appointment

Web Page: <https://www.ece.cmu.edu/~ece742>

Course Hours: *Scheduled meetings on Tuesdays, Wednesdays, Thursdays, 10:30am to 12:20pm*

– The schedule will be very dynamic, determined on a weekly basis. There can be zero to three meetings any given week. When there are no meetings, students are expected to work on paper reviews, presentations, literature survey and the research project.

Course Meeting Locations: Official rooms: HH D210 and SH 222 (Some presentation meetings will be held at CIC Panther Hollow 4th Floor Conference Room)

Course Overview

18-742 is an advanced computer architecture course that focuses on research in computer architecture. The course is designed to provide a strong experience in research in computer architecture via a rigorous, self-driven semester-long research project, critical research article reviews, in-class research article presentations and discussions, a literature survey and other assignments that focus on developing critical thinking, idea development, and clear explanation and presentation skills. Since the main focus is on research, the students are expected to be highly motivated and self driven in all aspects of this course.

Either 18-447 or 18-740 is a mandatory prerequisite for 18-742. You cannot take 18-742 if you have not taken either of these courses.

The major class content will be twofold:

1. Critical analysis, review and in-class presentation and discussion of research papers and research seminars in computer architecture: Students will be expected to read and present recent as well as established research papers, critically review and analyze them in writing, and discuss them in class. Most of the class time will be dedicated to such presentations and discussions. I expect to assign at least two presentations per week. There will be minimal number of lectures, if any at all. In addition, students will be expected to attend selected computer architecture seminars and provide reviews of the seminars as well as the papers presented during the seminars.

2. Semester-long research project: Students will be expected to propose and carry out a clearly-defined research project in computer architecture. The goal of the research project will be to substantially advance the state of the art in computer architecture. The project is open-ended and has to be approved by the instructor. Project deliverables will consist of a project proposal writeup, milestone presentations, a literature survey report and presentation, and a final project report, poster and presentation. Students are expected to conduct research projects that are likely publishable.

Since this is an advanced graduate course focused on research, students are expected to discover and critically think on their own – structured lab assignments and homework will not be available,

and feedback will be provided to the student only upon request or as deemed necessary by the instructor.

Course Prerequisites

1. **Either 18-447 or 18-740 is a mandatory prerequisite for 18-742.** You cannot take 18-742 if you have not taken either of these courses.
2. You should be ready to explore on your own and dedicate at least 20 hours per week to doing research in computer architecture.
3. You should have the spirit, excitement and dedication for deep exploration of a topic in computer architecture as well as the same for doing research in computer architecture.

Who Should Take 18-742?

18-742 is a research course and is best suited for graduate and fifth-year IMB students who have a very strong research interest and background in computer architecture. It is intended for students who want to delve deep into computer architecture, learn the state-of-the-art research topics and conduct research in it. If you thrive exploring on your own while being open to feedback on your progress as well as receiving guidance, you might like this course.

Who Should Not Take 18-742?

If you are expecting structured lab and homework assignments and continuous feedback on your progress, this course will not meet your needs. An important goal of this course is to enable you to become an independent researcher and a strong critical thinker, so you should be in the mindset of exploring, thinking critically, and determining your work schedule on your own with only occasional guidance.

Textbooks and Reading/Research Material

Most reading material will be in the form of research papers and articles referenced in class (see the below paragraph for more). The students are expected to dig out other material that would help them understand the concepts better. You are encouraged to talk with me as you dig up papers and sources on your own.

This is an advanced graduate-level course. You will need to do your own research, find many of the readings on your own, consult multiple sources, question assumptions and statements, and talk with me and the TA whenever you have questions. A good source of information on all covered topics is the **research articles** that introduced or built upon the covered topic. These articles are usually published in top conferences (such as ISCA, MICRO, ASPLOS, HPCA) or journals (such as IEEE or ACM Transactions). I strongly encourage you to dig out the original source of the covered topics as well as the research that builds upon it. This will help you become a successful and well-read researcher in computer architecture/systems. When in doubt, ask questions.

Assignments/Grading

The course will be graded on a curve scale. The tentative breakdown of grades is given below:

- 40% - Research Project (detailed breakdown to follow, but will include a proposal writeup/presentation, milestone writeups/presentations, literature surveys, final presentation/poster and final paper)
- 40% - Paper Reviews, Presentations, and Participation in Paper Discussions
- 10% - Class Participation, Quizzes, Ad-Hoc Assignments
- 10% - Exam (Could potentially be an oral or take-home exam)
- 5% - The teaching team's evaluation of your performance

Research Project

This course is a hands-on research-oriented course. You (in groups of two; in some cases, three) are expected to propose, conduct, and experimentally evaluate a 3-month long research project whose goal is to advance the state-of-the-art and/or current understanding in parallel computer architecture or a related subject. The topic of the project is flexible, but it must be approved by me. You will have to find your own project partners. *This is your chance to explore in depth a parallel computer architecture topic that interests you and perhaps even publish your innovation in a top computer architecture conference. I strongly encourage you to start thinking about your project topic as early as possible and interacting with me and the teaching assistant to crystallize it over time.*

More details on the logistics of the research project will be provided in lectures and the project handout.

Paper Reviews and Discussions

Much of research is understanding and critically evaluating published and unpublished work (including your own). *This course will be heavily reading and critical analysis oriented.*

I will assign weekly readings. You will be expected to read and evaluate them critically, write reviews describing the problem solved, key ideas, and strengths/weaknesses of the reading from a technical perspective. You will be asked to present the paper and describe your evaluation in some class meetings and always be asked to participate in the in-class discussions. You will be evaluated on the quality of your critical evaluations and participation in discussions.

Late Policy

No late assignments will be accepted unless valid prior arrangements are made well in advance.

Academic Honesty: ECE Department and Course Policy on Cheating

Simply put, cheating is submitting work that is not your own; material handed in for grading must be the product of individual effort; anything else constitutes cheating. Cheating in any form or shape will result in a **failing grade** for the course. **No exceptions will be made.** Students are referred to the University Policy about Cheating and Plagiarism Policy: <http://www.ece.cmu.edu/student/integrity.html>