CSE60321 Advanced Computer Architecture

Spring, 2010

Class: 356A Fitzpatrick Hall
Tues. & Thurs. 11:00am - 12:15pm

Instructor: **Dr. X. Sharon Hu**
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Office Hours: Mon. 3-4pm & Thur. 1-2pm or by appointment

TA: **Tam Chantem**
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Office Hours: Tues. 10-11am & Wed. 11am-12noon or by appointment

Required Texts:

1. J.L. Hennessy and D.A. Patterson, *Computer Architecture: A Quantitative Approach*, 4th edition, Morgan Kaufmann.
2. Papers selected from relevant journals and conferences in the relevant topic areas.

Course Overview and Objectives

This course introduces classical as well as state-of-art architectural approaches to designing high performance computer. Topics include macro- and micro-architectural approaches to exploiting instruction level parallelism, thread level parallelism, data-level parallelism, multi-core architectures, memory hierarchy and storage, power-aware computing, etc. Emphasis is given to the techniques of quantitative analysis and evaluation of modern computing systems, such as the selection of appropriate benchmarks to evaluate and compare the performance of alternative design choices in system design.

At the conclusion of this course, you are expected to be able to do the following:

- Measure and report computer performance, and articulate quantitative principles of computer design.
- Describe main architectural approaches to improve computer performance, analyze their pros and cons, and argue their values under different application scenarios.
- Identify major factors that effect the performance of a computer system, evaluate and compare the performance impact of various architecture techniques.
- Apply the architectural approaches to design and implement all major components in a modern high performance computer system.
- Summarize and explain research results from given journal/conference papers in the computer architecture area.

Course Policies and Procedures:

- The lecture notes will contain major points to be discussed in a lecture and will be made available on the day of the intended lecture. It is your responsibility to print out the notes before each class.
- Reading assignments will be given for each lecture. It will be extremely helpful if one does the reading assignment before the lecture.
- There will be two exams (midterm and final), regular homework assignments, as well as a final project. Details of the exams and the project will be provided later. The midterm exam date is temporarily set to March 4th. The final exam will be on May 7th, 10:30am-12:30pm.
- Only under unusual circumstances (medical excuse or prior instructor approval) may make-up exams be considered. Otherwise, a zero point will be counted towards one's grade.
- Homework should be turned in prior to the start of the class on the due date. Homework will be accepted up to three days after the due date. Late homework will receive a deduction of 20% of the maximum grade for each additional day. However, if a student abuses this privilege by routinely handing in homework late, the privilege will be withdrawn.
- For some homework assignments and the project, students may be required to work in teams. Instructions on how to form a team will be given with the assignment. An evaluation form must be filled for each team-oriented assignment. The form is available on the class webpage. Note that the ratings on the form should reflect each individual's level of participation and effort and sense of responsibility, not his or her academic ability. These results will be used to adjust homework grade for individual effort.
- **The University's Academic Code of Honor must be strictly followed. Violation of academic integrity will be handled according to the procedures dictated by the Graduate School.**

Grading Guidelines:

- Inquiries about graded homework, lab reports, quizzes and tests will be accepted only if made **within one week** after they are handed back. Such inquiries should be made in writing, which clearly explains the complaints. Only after reviewing the written complaints, can the instructor make any grade adjustments.
- Grade components:

Homework	30%
Midterm Exam	15%
Final Exam	25%
Final Project	25%
Class Participation and Others	5%

Tentative Course Schedule:

Topics	*Number of Lectures*
Class overview and technology trends	1
Quantitative aspects of computer architecture	1
Review of Instruction Set Architectures and MIPS	2
Review of computer organization and pipelining	1
Instruction-level parallelism and its exploitation	5
ILP limitations	2
Multithreading	2
Memory hierarchy	4
Multicore and Multiprocessing	5
Power-aware architectural techniques	3