

Syllabus of CS4200/5200: Computer Architecture

Spring 2012, Credit Hrs: 3, CS Dept/College of EAS

Time & Loc.: MW 4:30pm -- 5:45pm, ENG 109

Instructor:

Prof. Xiaobo (Joe) Zhou

Office: 176 Engineering Building, 255-3493 (office), Email: zbo@cs.uccs.edu

Office Hours: MW 3pm--4pm, 176 Engineering, or by appointment (email preferred)

Course website: http://www.cs.uccs.edu/~zbo/teaching/CS4520/CS4520_Spring12.html

Course Description:

Computer architecture is the science and art of selecting and interconnecting hardware components to create a computer that meets functional, performance and cost goals. In this course, you will learn how to completely design a correct single processor computer, including processor datapath, processor control, pipelining optimization, instruction-level parallelism and multi-core, memory/cache systems, and I/O. You are going to see that no magic is required to design a computer. You will learn how to quantitatively measure and evaluate the performance of designs.

This course serves you two ways. First, for those who will continue in computer architecture, it lays foundation of detailed experience necessary to take more advanced courses. Second, for those students not continuing in computer architecture, it gives an in-depth understanding of, and insights into, modern computers, their evolution, and trade-offs present at the hardware/software boundary. It also solidifies an intuition about why hardware is as it is.

More details of the syllabus and all lecture notes are available on the course website.

Course Format

The material presented in the course will be complemented by the following textbooks.

A **Required:** J. L. Hennessey and D.A. Patterson, "Computer Architecture: A Quantitative Approach", Morgan Kaufman, 5th edition (2011).

B Reference: D. A. Patterson and J. L. Hennessey, "Computer Organization and Design: The Hardware/Software Interface", Morgan Kaufman, 2008 (fourth edition), which was required in CS2160 "Computer Organization and Assembly Language" and you should still have it.

Some content to be covered is not illustrated in details in book A. You may refer to B for more details. However, I have prepared many lecture notes and slides to cover the missing contents.

Tentative Schedules

- Introduction of Computer Architecture (1-2 lectures)
- Quantitative Measure of Performance for Evaluation of Designs (3 lectures)
- Instruction Set Architectures: MIPS (1 lecture)
- Instruction Set Architectures: principles and examples (2 lectures)
- Process Design: Data path and control units (3 lectures)
- Pipelining: Advanced design technologies (2-3 lectures)
- Pipelining: hazards (2 lectures)
- instruction-level parallelism (1-2 lectures)
- Memory subsystems: Caches (6 lectures)
- Memory subsystems: Virtual Memory (1-2 lectures)
- Input/Output subsystems: Interfacing I/O to CPU (2-3 lectures)
- Server Virtualization and Datacenters (1~2 lectures)

Prerequisites

- CS 2160; computer organization and assembly language
- CS4200/5200 assumes the background of the above courses, specifically,
 1. Knowledge of a high-level language (C) and understanding of computer data structures
 2. Understanding of assembly language programming: opcodes, operands, etc.
- If you want to take the class without the prerequisites, you need to make up the prerequisites.

Grading

The final grade will be composed of

- In-class discussion and attendance 4%
- Homework 20%
- Project & Readings 20%
- Midterm (in class, closed book) 20%
- Final (in class, closed book, comprehensive) 36%

Grades will be assigned as follows:

- $90 \leq \{A\}$; $87 \leq \{A-\} < 90$
- $84 \leq \{B+\} < 87$; $80 \leq \{B\} < 84$; $75 \leq \{C+\} < 80$
- $70 \leq \{C\} < 75$; $65 \leq \{D+\} < 70$; $60 \leq \{D\} < 65$
- E/F: below 60

Requirements

- The last day to drop without special permission from your dean: March 30, 2012
- Students are expected to attend all lectures, though one absence is not counted. Missing lectures are extremely risky since the teaching pace is fast and the coursework is heavy!
- Homework assignments are important part of the course and are to be completed individually. There will be about six homework assignments and two readings. There will be one four-week project. CS4200 attendants should execute project in (two-person) teams. Your teammate(s) might be designated by the instructor (based on random selection) before the project is released. CS5200 attendants should execute project individually. Assignments must be due in class on the due date in hard-copy. C/C++ might be the language to do the project.
- Late homework/reading/project submissions lose 30% of their values per day, except under extreme non-academic circumstances, such as illness. In such cases, you have to provide sufficient and convincing proof, i.e., documents from the doctors.
- If a submission is delayed more than three business days, it will not be graded and score is 0.
- FOR FAIRNESS, NO MAKE-UP EXAMS, exceptions are the same as those of late homework.
- There will be one midterm exam and one final exam, which are close-book and close-notes. However, you can carry one double-side help sheet of 8.5 by 11in.
- The midterm exam is scheduled to be in the classroom, 4:30 pm-5:45pm, March 7 (Wed), 2012. The final will be in the classroom, 4:30pm-7:00pm, May 9 (Wed), 2012.

Links to Information Assurance Related Website

- National Security Agency: <http://www.nsa.gov/>
- NIST, Computer Security Division, Computer Security Resource Center: <http://csrc.nist.gov/>
- Common Criteria for Information Technology Security Evaluation: <http://www.commoncriteriaportal.org/>
- U.S. Department of Homeland Security: <http://www.dhs.gov/>
- ITU (International Telecommunication Union): <http://www.itu.int/>
- Internet Society (ISOC): <http://www.isoc.org/>
- The Internet Engineering Task Force (IETF): <http://www.ietf.org/>
- Internet Architecture Board (IAB): <http://www.iab.org/>
- International Organization for Standardization (ISO): <http://www.iso.org>
- IEEE Computer Society: <http://www.computer.org>
- Association for Computing Machinery (ACM): <http://www.acm.org/>
- USENIX: The Advanced Computing Systems Association: <http://www.usenix.org/>

Others

If you have a disability for which you are requesting an accommodation, you are encouraged to contact the Disability Services Office, located in Main Hall #105 (Phone # 255-3354), within the first week of classes.

Cheating, unfortunately, it is necessary to mention it here. Cooperation is not the same as cheating. It's OK to ask someone about the concepts before you start to do homework or project assignments; however, copying other people's code or solution sets is strictly prohibited. Any work submitted for a grade must include the following statement and be signed and dated. If this is missing or not signed and dated, the work will be returned un-graded. Please prepare a big envelope for your homework.

We need the strict rules, because everyone wants to be, and will be, treated fairly in this class!

I have neither given nor received unauthorized assistance on this work.

Signed:

Date: