Course description

Computer architecture is the art and science of selecting and interconnecting hardware components to build a computer that satisfies desired constraints, such as performance, function, power, and cost goals. This course is to quantitatively and qualitatively examine design trade-offs. We will learn, for example, how processors execute many instructions concurrently and how today’s supercomputers are built by using large number of microprocessors.

The goal of this course is to help students develop competence in analysis, design, and evaluation of new technologies in computer architecture. This course serves students in two ways. For those who will continue in computer architecture, it lays foundation of state-of-the-art techniques implemented in current and future high-performance microprocessors and multiprocessors. It helps the students develop understanding of engineering trade-offs in the design of computers. For those students not continuing in computer architecture, it helps them to gain understanding of fundamental architectural principles and the techniques in today’s computers and their interplay with software.

At the end of this course, students will be able to:

- Obtain understanding of fundamental architectural principles
- Measure the performance of modern microprocessor designs
- Analyze simulation data to evaluate designs
- Construct alternative computer architecture designs
- Acquire knowledge about state-of-the-art CPU simulators

Required Text:

This course covers advanced topics of computer architecture. The course material will be from the text book

and complemented with material from a reference book

• *Parallel Computer Architecture*, Culler and Singh, Morgan Kaufmann, 1998

and a number of recent conference and journal publications. The course material, including lecture notes, problem sets, and reading papers will be posted in the course homepage “http://www.ece.eng.wayne.edu/~czxu/ece7660.html”

**Prerequisites:**

ECE4680/CSC4110, or consent of instructor. This course assumes that you are familiar with the following material:

• Knowledge of a high-level language and data structures
• Understanding of assembly language programming: opcodes, operands, etc.
• Basic logic design
• Simple pipelines and caches

If you feel that your background is lacking in some of these, please review the material of relevant courses and come to see me.

**Topics:**

• Performance and cost
• Instruction set architecture and MIP example
• Pipeline and superscalar microarchitecture
• Dynamic scheduling and Tomasulo algorithm
• Instruction level parallelism
• Storage hierarchy principles and caches
• Symmetric multiprocessors and multithreading
• Distributed shared addressing machines
• Interconnection network
• Clusters of workstations/servers

**Required Work and Grading Policies**

Final grades will be based on the following weights:

• Class participation — 5%
• Three homework assignments — 30%
• Two midterm exams (Oct 20 and Dec 1, in class time) — 30%
• Term project (due 10:40am, December 16) — 35%.
For CSC7110 students, the term project weight is reduced to 25% and the midterm exams weight is up to 40%.

Attendance: you are expected to attend every lecture in its entirety. Do not schedule other classes or commitment that conflict with any part of the lecture time. Attendance is recorded and will be used in determining your final grade.

There are three homework assignments, which help sink the concept and principles covered in class. Unless specified otherwise, you should assume that ALL of the homework assignments are to be done alone without referring to any other person or any material (books, papers, web pages, etc) other than the textbook and handouts.

The objective of term projects is to develop your in-depth interest and knowledge in some of the topics covered in this course. You are expecting to complete a term project in line with this objective, submit written report, and make an oral presentation or demonstration. The projects should be conducted individually or in a group of 2. You are responsible for selecting your project topic in the areas clearly related to the topics studied in the class, even though a number of topics will be suggested in the class.

Projects should be started as soon as you can. You must decide on a project topic and submit a two-page proposal for approval by a deadline date that will be announced in class. You may consult with me before that date regarding your project topic. **Project proposals are due October 27, 2005.** The proposals must contain the following information:

- goal of the project
- how the experiments will be performed
- timeline for expected project milestones
- a brief summary of related work with appropriate references.

The proposal must include a title, your name, and a short statement describing the project, its significance, and the approaches to be taken. **The final report is also due the presentation day, scheduled for Monday, December 16, 2005.** You should end-up with a report of up to 15 double-spaced pages (12 point size and single spaced). The report should be in the following format:

1. Cover Page: title, your name/id, abstract
2. Introduction: informal statement of your problem/work, its importance, related work, informal description of your approaches, and the organization of your report.
3. Main body: detailed description of your work, highlighting your own ideas and methodology
4. Conclusions
5. References

The final grade will be distributed as A (100–90), A- (85–89), B+ (80–84), B (75–79), B-
Professional Integrity

Cheating, unfortunately, it is necessary to mention it here. Since institutions of higher education must provide society with engineers who subscribe to the highest principles of integrity, instructor encourages integrity and works to insure the learning environment is intolerant of cheating. 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 and altering other people's code or solution sets is strictly prohibited.

Space does not permit listing all forms of cheating. In general, the instructor defines cheating as any activity that gives a student an unfair test advantage or credit where it is not appropriate. The instructor welcomes comments, in person or otherwise, which will insure that grading is conducted in a just manner. Students who are caught cheating face possible expulsion from the University and will receive a grade “F”. 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 ungraded.

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

Policy on withdrawal

- The last day to drop a class with a tuition refund is Monday, Sept 19
- The College of Engineering does not allow withdrawal from courses after the FIFTH week of classes except under exceptional circumstances. FAILING of a class is not an acceptable excuse for withdrawal after the 5th week. All requests for withdrawals after the 5th week must be made to the Associate Dean for Academic Affairs.
- The last day to file degree or certificate is Friday, Sept 30.

Policy on deferred grades
A grade of “I” can only be assigned if all of the following criteria are met:

1. you are not currently failing the class and,
2. there is not a substantial quantity of work yet to be completed,
3. there is no extra work required of the instructor beyond the normal duties of grading the paper/exam,
4. there is no need for you to attend the class in subsequent terms.

The final decision to assign an incomplete grade rests with the instructor.
An “I” grade must be made up within one year of assignment of the grade. The grade of “X” will be assigned only if there is no basis on which to provide you with a grade (i.e., you never showed up in the class).

Examination policy

The final examination schedule was listed above. If you have any conflicts with the examination date, please notify the instructor as soon as possible. The following documentation is required for rescheduling of an examination:

[Medical Excuse:] A signed letter from a physician from the day of the examination indicating that the student had a valid medical reason for missing school. This letter must be on the physician’s letterhead and the name and phone number of the physician must be legible. (Note: For cases of extended medical treatment, the letter can be dated prior to the examination, if the physician’s recommendation for leave extends beyond the examination date.)

[Employment Conflict:] A signed letter from the student’s direct supervisor indicating that an absence from the Detroit-area is required for the student’s employment for the dates surrounding the examination.

[Death in the Family or Family Illness:] A copy of the death certificate or obituary for the family member who has died. For illness of a family member for whom a student is the primary care-giver, a signed letter from the family member’s physician for the day of the examination.

[Transportation Problem:] In the event that you are prevented from arriving on campus due to a transportation delay, the following should be provided:
1. A copy of the police report concerning a traffic accident
2. A copy of the receipt for towing from a towing service
3. A signed letter from the Customs and Immigrations Officials at the Detroit/Windsor border indicating that a student was delayed for questioning

The final determination of the validity of an excuse is the jurisdiction of the faculty member. In all of the above instances, all reasonable attempts must be made to contact the faculty member to notify them of the problem BEFORE the examination. This can be done via email or via phone. If notice is not provided before the examination, no documentation will be accepted.

There is no make-up exam policy. If an exam is missed then its grade will be distributed evenly between the remaining exam and the project.