CISC662 - COMPUTER SYSTEMS: ARCHITECTURE - Fall 2009

Syllabus

Instructor: Michela Taufer
Office Hours: TR 10:45 AM–11:45 AM or by appointment
Office: Smith Hall, 406
Office Phone Number: 0071
Email Address: taufer@udel.edu
TA: TBD
TA office hours: TA lab in Smith Hall
TA e-mail: TBD
TA office: WF 10 AM - 11 AM or by appointment
Class Time: TR 3:30PM - 4:45PM
Room: Pearson Hall, Room 114
Course Material: http://www.cis.udel.edu/~taufer/courses.php
Prerequisites: Computer Architecture (CISC360) or equivalent

Course Description: This course provides a systematic study of core concepts of computer architecture design. These concepts have been developed in the last 50+ years, guided by extraordinary technology advancements, and the constant designer effort to get maximum performance out of desktop computers while minimizing the cost. The main focus is on key principles for high-performance low-cost desktop design. It covers in detail instruction set architectures, pipeline architecture, cache and virtual memories, methods for exploiting instruction level parallelism, multiprocessors and I/O devices. The workload is demanding and the course has regular homework assignments (approximately one assignment per 1.5 weeks), a midterm exam, and a final.


Learning Outcomes:

1. Knowledge and Comprehension
   a. describe the various ways that computer performance can be measured and explain the pros and cons of each
   b. explain the issues associated with instruction set architecture design
   c. explain the concept of and describe the challenges associated with instruction level parallelism
   d. describe the general design of a processor that implements instruction level parallelism
   e. explain the purpose of speculative execution and describe several techniques used to support its implementation
   f. describe how dynamic scheduling overcomes data hazards
   g. describe how dynamic hardware prediction can reduce branch penalties
   h. discuss the various techniques to implement branch prediction
   i. explain how a multiple-issue processor works
   j. explain the role of compilers in terms of performance enhancement
   k. give examples of how a compiler can exploit instruction level parallelism
   l. describe how a cache works and the various cache configurations
   m. enumerate various methods for enhancing cache and memory performance
   n. describe the main difference between multiprocessor architectures that support shared memory
and those that support only message passing

2. Application and Analysis
   a. given an address trace, be able to simulate the functioning of a cache
   b. use on-chip performance counters to evaluate the performance of different versions of an application
   c. apply a given snoopy cache consistency protocol to a particular code segment
   d. apply a given directory cache consistency protocol to a given code segment

3. Synthesis and Evaluation
   a. use the CPU performance equation to compare the performance of processor architectures
   b. apply Amdahl's speedup law to understand the value of an architectural modification
   c. analyze the performance of a code segment in a given instruction execution pipeline
   d. identify data, control and structural hazards for a given processor architecture/code segment pair
   e. evaluate the cache performance of a given architecture/application pair
   f. compare the performance of different cache configurations

Grade Policy:

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<tr>
<td>Class participation</td>
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<tr>
<td>Homework (4) – 10% each</td>
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<td>Midterm exams</td>
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<td>Final Exam</td>
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<td>TOTAL</td>
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You can use the following chart to predict your grade in class. You need to get the specified number of points or more to obtain the grade from the same column. Scores in form x.y are rounded up if y>5, otherwise they are rounded down.

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A grade on a midterm exams and homework must be contested within one week of notification.

Class slides: Class slides will be posted in the course webpage at least 24 hours before the class starts.

Homework: Homework is to be submitted through e-mail. Send the e-mail to taufer@udel.edu with a PDF attachment. **No other file types will be accepted.**

No late homework will be accepted. Make-up homework assignments can only be given out for excused absences. Generally, absences due to illness, observing a religious holiday, or emergency are recognized as excused absences. If you are aware that you will be absent and miss a deadline, inform the instructor prior to the deadline through e-mail. This naturally does not hold for severe illness and emergency (since those events cannot be predicted) but does for religious holidays.

If you have difficulties doing the homework, ask for the help early. Come to office hours, or set an appointment with the instructor or TA. Since homework assignments will be the basis for work in class (participation) and the final exam, it is important that you understand the answers to homework problems.

Class Participation: Class meetings will be interactive and you are expected to participate in a
meaningful way. Your meaningful participation will be based on your having completed reading and homework assignments as well as understood material presented in class meetings. Short questions will be assigned with the reading assignments. Answers will be collected before the class starts. The answers have to be written with the computer and printed – no handwritten sheet will be accepted.

**Attendance:** Please make every effort to attend the class regularly. Although class slides will be available before each lecture, they can hardly replace all the clarifications and the announcements made in class. If you do miss a class, please obtain class notes from one of your classmates and talk to them to see if you missed some important announcements.

**Late policy:** When you come in late you are disturbing both the instructor and your classmates. Please make every effort to come on time. However, if you do happen to be late, come in and join the class (even if you are 30+ min late).

**Academic honesty:** You may study for homework and exams in a group or alone. However, all the work you submit must be your own. This means that you cannot write homework answers in a group. Students may not use the web to locate answers to any assignment. If you do not have time to complete an assignment, it is better to submit partial solutions than to get answers from someone else. Cheating students will be prosecuted according to University guidelines. Students should get acquainted with their rights and responsibilities as explained in the Student Guide to University Policies (http://www.udel.edu/stuguide/06-07/code.html#honesty).

**Asking for help:** If you need help, do not hesitate to ask for it. There are no stupid questions, and nothing you ask will negatively affect your grade. On the contrary, students that ask for help early generally manage to improve their understanding of the material and achieve better grades. Also, remember that office hours are the time dedicated to meeting with students and answering their questions. The instructor and the TA are happy to have you come and make use of this time.

If you have any problem with the class (difficulties understanding the material or doing the homework assignment, excused absence, emergency that prevents you from meeting a homework deadline, need a special accommodation, etc.), please e-mail the instructor or TA, come to office hours, or simply find the instructor in the office. You can also call by phone if there is an emergency and you have no access to e-mail.

**Seat Claim Policy:** (From POLICIES AND PROCEDURES - Winter Session 2008 - http://www.udel.edu/winter/policies-0.htm) Unless excused by the faculty member, students holding a confirmed assigned seat in a class will have relinquished their seat if they have not personally appeared in class to claim the seat by the:

- 2nd class meeting for a class scheduled once a week,
- 2nd class meeting for a class scheduled two times a week,
- 3rd class meeting for a class scheduled three times a week,
- 3rd class meeting for a class scheduled five times a week.

If the student does not claim the seat, within the time period specified above, and does not drop the course, any applicable tuition will be charged, and the Instructor has the option of assigning the student a grade of "Z" (the equivalent of a failing grade) at the end of the term.

It is the responsibility of the student to drop each course that they do not plan to attend, even when the student's registration is canceled for non-payment of fees. Failure to drop a course will result in "Z" grade. Therefore, attendance will be taken for the first two class meetings. Please make sure that you sign the attendance sheet.