EE382N-10 – Parallel Computer Architecture
Fall 2009
Syllabus and Course Description

Instructor: Prof. Derek Chiou
ENS 540
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232-7722

Lectures: MW 5PM-6:15PM
ENS 126

Office Hours: M 6:30PM-7:30PM, W 4PM-5PM or by appointment

Unique number: 17200

Course Home Page:
On Blackboard. You can try to get there from the following link but will have to login.
https://courses.utexas.edu/webapps/portal/frameset.jsp?tab_tab_group_id=_11_1&url=%2Fwebapps%2Fblackl

Course Objective:
This course is intended to be a first graduate course in parallel computer architecture. The course will focus primarily on fundamental parallel computer architectures, their evaluation and the tradeoffs made in their design, but will also touch on how the machines are used.

Prerequisites: Students must ***know***
the principles of computer architecture. You should have done well in EE360N or an equivalent class. What I have been finding talking to students is that many have not taken a 360N equivalent class; it's really much more similar to a graduate class in computer architecture than an undergraduate class.

Students are strongly encouraged to have some understanding of concurrency and synchronization – i.e., CS372, EE345M or EE360P or equivalent. Other knowledge that is helpful includes operating systems, algorithms (e.g., EE360C) and compilers (CS375). You should also be very comfortable programming in C and C++. If you have any doubts of whether you have the appropriate knowledge, come talk to me.

Recommended Texts: *Parallel Computer Architecture*, Culler, Singh and Gupta and *Scalable Parallel Computing*, Kai Hwang and Zhiwei Xu. Neither book is perfect and both are out of date, but they do cover much of the relevant material.

Evaluation: Your grade will be determined by the following:

Three problem sets (5% each) and two programming labs (12% each) worth a total of 39% of your grade. I strongly encourage teams of two (or one team of three if we have an odd number of students). You are not allowed to use the same partner more than once per problem set or programming lab (in other words, you will have a total of five different partners). For those of you who don't have five friends to cycle through, please let me know and I will assign partners. Only one writeup
per group is required and all students in the group will receive the same grade. The solutions should

be a joint effort; both parties should both contribute to and understand the solutions. It should be noted on the problem set who did what.

- A single exam on November 23rd worth 15% of your grade. This exam will likely be an oral exam.
- Class scribe worth 3%
- A class project worth 33% of your grade (8% on the proposal/literature search due November 2, 15% on the writeup due November 30
  and 10% on the presentation that will be held during our scheduled final time which is tentatively December 11 from 7PM-10PM but the registrar reserves the right to change that.). The project will be fairly open-ended but will essentially start with a question such as "How can parallelism be used to help debugging/performance monitoring" or "How can a directory-based cache coherency algorithm be modified to improve reliability" and a set of papers that are a starting point in that topic area. Such questions could very well be the start of one or more Ph.D. theses, but I want you to get as far as you can in the topic area. The proposal/literature search should pose the question and describe at least three papers in the field and should be about 8 pages long. The writeup should be an 8 to 10 page paper and a presentation to be held either the last week of class or on the day that our final would otherwise be scheduled. You may find that you need to run experiments to test/confirm results, etc. You should group into teams of two or three for the project. You are allowed to team up with anyone that you partnered with on problem sets or programming labs.
- 10% subjective based on class participation. Though I do not grade on attendance, it is hard to participate in class if you are not there.

I will be grading homeworks, labs, and projects using a +, √, -, 0 grading scheme. I don't need 1 part out of 100 resolution to determine your grade, so I won't waste time getting to that resolution. However, your final grade might include a + or a -.

Meetings:
All students are required to meet with me at least once during the first three weeks of class. This meeting is intended for me to get to know you and for you to get to know me at little better. You are, of course, welcome to come anytime during office hours and can make appointments to see me outside of office hours.

College of Engineering Drop/Add Policy:
The Dean must approve adding or dropping courses after the fourth class day of the semester.

Cheating:
The problem sets should only be done within your dynamic group. Discussion of the problem set with anyone outside of your group will be considered cheating. The problem sets are, in some sense, group take home exams. The requirement of always switching partners helps me to better evaluate your ability, rather than the combination of you and your partner. It is ok to discuss your class project with others outside of your group, but only to gather information (for example, you can write to the author of a paper for clarification) and not to bounce ideas off of each other. For the oral exam, you will be required to sign a document stating that you did not receive any help with the exam nor would you give any help for the exam.

If you cheat, you violate the soul of the University, which we take very seriously, and will deal with in the harshest possible way. If you have any question as to what is permitted and what is not, ask the instructor FIRST. If you don't ask first, and you do something that is not allowed, the response "I thought it was okay" is not an acceptable justification.

Allegations of Scholastic Dishonesty will be dealt with according to the procedures outlined in Appendix C, Chapter 11, of the General Information Bulletin, http://www.utexas.edu/student/registrar/catalogs.

Students with Disabilities:
The University of Texas at Austin provides upon request appropriate academic accommodations for qualified students with disabilities. For more information, contact the Office of the Dean of Students at 471-6259, 471-4641 TTY or the College of Engineering Director of Students with Disabilities at 471-4382.

Topics I intend to cover, in no particular order:

- Why parallel computing?
- Programming parallel computers
- Single instruction stream parallel machines
- Bus-based machines (CMP, SMP)
    - Coherent memory
    - Bus-based consistency protocols
- Synchronization
- Interconnection networks
- Message Passing
- Scalable Shared Memory
    - Incoherent
    - Coherent
        - Directory-based
        - Consistency protocols
- Hybrid Message Passing/Shared Memory Machines
- Dataflow machines
- Special-purpose parallel machines
    - Routers, network processors
- Parallel computer performance models

Important Dates:

Note: Classes are normally scheduled for Mondays and Wednesdays. We will have guest lecturers during the semester. In addition, the Computer Architecture seminar series is held on Mondays from 3:30PM-4:30PM. I will try to remind you if there is an interesting seminar.

Since what we do in lecture is highly dependent on what we did the previous lectures, I prefer a living schedule, rather than a static one. Thus, a detailed class-by-class schedule, including when due dates, can be found at the following link:

http://spreadsheets.google.com/pub?key=t2VdzrmHyf58zGzvQyVUVIg&output=html