

## **ECE512: Computer Microarchitectures: Hardware and Software**

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**PREREQUISITE:** ECE412 (new ECE511) and CS321 (or intensive reading).

### **REQUIRED TEXT:**

1. EE512 Class notes, Spring 2005
2. EE512 Class Reading, Spring 2005.

### **RECOMMENDED TEXT:**

1. TBD

**OBJECTIVE:** To address microarchitecture and software issues in the design of modern computer systems. The course will cover systems for both traditional and embedded applications.

**EXAM:** There will be one exam which covers all lectures and reading assignments.

**LECTURES:** The lectures address the following important issues of high performance computer design. The emphasis, whenever possible, is on the tradeoffs between hardware and software in achieving high performance at low cost.

- Instruction fetch and decode efficiency
- Pipelining and concurrent execution
- Predication and speculation
- Data register, cache, and memory system design
- Energy consumption management
- Compatibility, software migration and binary translation
- Compilation complexity and cost
- DSP and application specific design considerations
- Multiprocessor considerations

**PROJECT:** Students are encouraged to join in pairs for the term project. Each term project is divided into two stages. At the first stage, students propose a survey project that will cover at least 10 articles or papers. The end product of this stage is a one-page proposal plus a reading list. The one-page project proposal must explain how the survey is related to the course objective. The contents of the survey reports must be significantly beyond the lecture materials. Suggested topics for the survey project include:

- high performance memory system design

- parallelization and program analysis
- runtime optimization and software migration issues
- compiler considerations in advanced microarchitecture design
- operating system considerations in advanced microarchitecture design
- energy consumption reduction techniques
- application specific architecture and microarchitecture techniques
- future fabrication and circuit impact on microarchitecture

The second stage will result in a survey report between 5 and 10 pages in length in two-column format. You should also include a copy of all referenced papers and documents as an attachment to the report, preferably in a CD ROM. Each team will be asked to give either a 30-min presentation or a 15-min presentation in class. The length will be determined according to the technical contents and relation to the course objective. The presentation slides should also be submitted at the end of the presentation.

Selected previous term projects are available for copying from Prof. Hwu. Outstanding term projects this semester will be made available to the future classes. The emphasis of both stages of the term project should be on the learning aspect rather than publication.

**GRADING:**

40% Exam      30% Project report      20% Project presentation      10% Classroom participation

**CLASS POSTING:** There will be a web site ([www.crhc.uiuc.edu/ece512](http://www.crhc.uiuc.edu/ece512)) for the class information this semester. We will post announcements, lecture notes, homework solutions, and project information at the web site.

**Makeup Classes:** I will be out of town a few time during the semester. As a result, we will hold several makeup classes on Fridays, during the scheduled class time on Mon/Wed. I will announce these makeup classes at least one week ahead.

**CONTACT INFORMATION:** Students are required to send an e-mail to [w-hwu@uiuc.edu](mailto:w-hwu@uiuc.edu) by the third lecture with the following information:

- (1) full name, and campus ID
- (2) home department
- (3) e-mail address
- (4) office and/or home phone number
- (5) research area
- (6) expectations for the course, and
- (7) major schedule constraints on potential make-up classes.