CIS 6930: Advanced Computer Systems (Fall 2006)

Instructor: Prof. Soontae Kim
Classroom and time: PHY 120, TR 3:30 - 4:45
Office hours: M/R 10:30am -12:00 pm

Course description

This course covers advanced architectural issues in modern computer systems and addresses important issues that arise from technology scaling and architectural trends. The objective is for the student to gain a broad understanding of modern computer systems and emerging issues, and research experience in simulation-based architecture research.

Instead of using a textbook, we will read and discuss technical papers from computer architecture related conferences and journals. First, we will gain an in-depth understanding of modern microprocessors, the complexity of the major hardware structures, simultaneous multi-threading (SMT), and chip multiprocessing (CMP). Based on this fundamental knowledge, we will explore issues of power, temperature, and reliability. Also, we will look at issues of memory hierarchy in SMT and CMP, and some application-specific processors.

Topics

Fundamentals of modern computer architecture
- pipelining, superscalar architecture, branch prediction, memory hierarchy

Detailed design issues of the major microarchitectures
- instruction fetch, register renaming, instruction issue, register files, caches

Simultaneous multi-threading (SMT)
on-Chip MultiProcessors (CMP)
Power/temperature issues
Reliability issues
New memory hierarchy in modern architectures
Application-specific processors

Prerequisite: undergraduate computer architecture and/or graduate-level computer architecture courses. Programming skills (C/C++ and UNIX)

Course materials: Papers from recent conferences and journals. Textbook is not required.

Schedule (tentative)

Week 1: pipelining
Week 2: superscalar architecture
Week 3: memory hierarchy
Week 4: instruction fetch & branch prediction
Week 5: register renaming & instruction issue
Week 6: register file design and functional units design
Week 7: advanced memory hierarchy
Week 8: advanced dataflow techniques & exam
Week 9: relevant paper presentations to projects by students
Week 10: simultaneous multithreading
Week 11: on-chip multiprocessing
Week 12: power/temperature management
Week 13: reliability issues 1
Week 14: reliability issues 2

Week 15: project presentations

Grading: There will be one midterm exam and no final exam. Students are required to submit reviews of assigned papers after the midterm exam.

Exam:	30%
Term project:	30%
Review of papers:	20%
Participation & Presentation:	20%