

CS465 Computer Architecture

Syllabus

Dr. Stephan Ehrlich

Brief Course Description:

Computer architecture is concerned with the structure and behavior of the various functional modules of the computer; and how they interact to provide the processing needs of the user. In particular this course covers computer systems ranging from PCs through multiprocessors with respect to hardware design and instruction set architecture. This includes units and related technologies such as primary and secondary memory, caches, central processing unit (CPU), and pipelines.

A menu of "possibilities" will be presented, analyzed, and evaluated based on the technology available today. In no event should it be assumed that the architecture that looks strongest today will be the best in the new millennium.

My approach will be that it is methodology, not conclusions, that must be emphasized. For while methodology is relatively timeless, conclusions are not.

Course Objectives:

To familiarize each student with:

- 1- evaluation techniques
- 2- functional modules and related technologies
- 3- relationship between hardware design and instruction set architecture
- 4- future developments

Classroom Policies:

Students are expected to attend and participate in all classes. Attendance is taken at the beginning of each class. Please notify the instructor in advance of any anticipated absence whenever possible. It is your responsibility to make up any material missed whenever you're absent.

Course Requirements and Grading Policies:

Students will be evaluated in one of two ways based on a midterm, final, and optional term paper as follows:

Midterm and Final, no Term Paper
Midterm- 40% Final- 60%

Midterm and Final, Term Paper (with an Oral Presentation)
Midterm- 30% Final- 50% Term Paper (with an Oral Presentation)- 20%

All tests are closed book and the final is comprehensive. The results will be converted to a letter grade in keeping with the grading policies of the college.

Teaching Strategies:

Lecture format, built around the textbook readings with numerous examples chosen to illustrate theoretical concepts. Lots of drill with emphasis on practice, practice, and more practice. Questions are encouraged and discussion of material stressed.

Material Covered:

- 1 - Introduction to Computer Architecture
 Overview and history

The cost factor
Performance metrics and evaluating computer designs
Memory hierarchy

- 2 - Instruction set design
 - Assembly / machine language
 - Von Neumann machine cycle
 - Microprogramming / firmware (extra, not in book)
 - Memory addressing
 - Classifying instruction set architectures
 - RISC versus CISC (optional, as time permits)
- 3 - Pipelining
 - General considerations
 - Comparison of pipelined and nonpipelined computers
 - Instruction and arithmetic pipelines, examples
 - Structural hazards and data dependencies
 - Branch delay and multicycle instructions
 - Superscalar computers (optional, as time permits)
- 5 - Memory System Design
 - Cache memory
 - Basic cache structure and design
 - Fully associative, direct, and set associative mapping
 - Analyzing cache effectiveness
 - Replacement policies
 - Writing to a cache
 - Multiple caches
 - Upgrading a cache
 - Main Memory
 - Virtual memory, structure, and design
 - Paging
 - Replacement strategies
 - Secondary memory (optional, as time permits)
- 8 - Multiprocessors and Multiple Computers
 - SISD, SIMD, and MIMD architectures
 - Centralized and distributed shared memory- architectures
 - Cache Coherence