COE 501 – Spring 2019
Computer Architecture

College of Computer Sciences & Engineering
King Fahd University of Petroleum & Minerals

Professor: Muhamed Mudawar, Room 22/410-2, Phone 4642

Office Hours: MW 10 am – 11:50 am

Course URL: http://faculty.kfupm.edu.sa/coe/mudawar/coe501/

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Catalog Description

Computer architecture fundamentals, trends, and performance. Hardware and software approaches to ILP, dynamic speculative, VLIW, and superscalar execution models. Examples and case studies. Dynamic branch prediction techniques. Memory hierarchy, cache and virtual memory, cache coherence, memory system performance. Parallel architecture models, coherence protocols, and interconnection networks. Students are expected to carry out a research project.

Prerequisite: Graduate Standing

Textbook

Computer Architecture: A Quantitative Approach, 5th edition, John Hennessy and David Patterson, Morgan Kaufmann, 2011.

Course Modules and Topics

1. Defining computer architecture, classes of computers, technology trends, power in integrated circuits, cost, performance metrics, Amdahl's law, and benchmarks.
2. Instruction set architectures, simple pipelined processors, structural, data, control hazards, forwarding, dealing with exceptions and interrupts.
3. Memory hierarchy design, DRAM, cache organization, multi-level caches, cache optimizations, virtual memory, cache performance.
4. Instruction-Level Parallelism, data and control dependences, loop unrolling and compiler scheduling, branch prediction, dynamic scheduling, multiple-issue, speculation, out-of-order execution, precise exceptions, VLIW approach, limitations of ILP.
5. Data-level parallelism, Vector architecture, vector length, vector performance, SIMD instructions for multimedia, Graphics Processing Units (GPU) architectures, memory access, detecting and enhancing loop-level parallelism.
6. Thread-level parallelism, multi-threaded cores, multiprocessor architectures, memory models, cache coherence, and synchronization.

Grading Components

Problem Sets / Quizzes	20%
Assignments / Project	30%
Midterm Exam	25%
Final Exam	25%