

COMPUTER ARCHITECTURE AND MACHINE ORGANIZATION

FALL 2013

1 COURSE OVERVIEW

M/W/F 12:20-13:10

COORDINATES: KHKH 3-230

<https://ay13.moodle.umn.edu/course/view.php?id=4610>

INSTRUCTOR:

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OBJECTIVES: We are going to cover basic principles of computer architecture design. Subject to limitations of the underlying process technology, architectural design practices emerge in tailoring computer systems to specific application domains.

PREREQUISITES: A solid understanding of logic design principles is expected.

REFERENCE MATERIAL: "Computer Organization and Design: The Hardware/Software Interface" by Hennessy/Patterson, revised 4th Edition represents the main textbook. "Designing Computer Systems with Verilog" by Lilja/Sapatnekar is recommended.

EXAMS: We will have a final and a midterm. At least one of the exams may be designated as an open book/notes/... take-home to be submitted 24 hours after the release of questions (the following exam dates are to be interpreted as release dates in this case).

Final: December 14, 10:30-12:30

Midterm: October 23, 12:20-13:20

HOMEWORKS: There will be 4 homeworks. Homeworks may cover classic research papers, and include thought-provoking open-ended challenge questions.

MACHINE PROBLEMS: You will need a Verilog simulator for the machine problems. As an open source tool, we have Icarus Verilog available in CSE labs. You can also have the following tools installed on your personal computer:

- Icarus Verilog (recommended):
<http://iverilog.icarus.com>
- ModelSim PE Student Edition:
http://www.mentor.com/company/higher_ed/modelsim-student-edition (free for use by students in their academic coursework). You may need to register.
- Xilinx ISE WebPACK:
<http://www.xilinx.com/products/design-tools/ise-design-suite/ise-webpack.htm> (free version of

Design Studio). You may need to register.

GRADING:	Final	30%
	Midterm	30%
	Machine problem ($\times 4$)	25%
	Homework ($\times 4$)	15%

MECHANICS:

- **Academic dishonesty: Independent of the scope (be it a homework assignment, exam, ...), any conduct leads to F as the immediate final grade.**
- The students are expected to attend all class meetings. Office hours are not designated to serve as make-up lectures.
- If the students fail to submit all of the homeworks, their final will not be graded.
- If the students fail to submit all of the machine problems, their final will not be graded.
- If the students fail to take the midterm, their final will not be graded.
- Any non-submitted or non-graded item will be processed with a grade of 0.

2 COURSE OUTLINE

- **Impact of Technology on Computer System Design:** Historical perspective and future trends.
- **Quantitative Analysis of Computer Systems:** Metrics and benchmarks.
- **Instruction Set Architecture:** Assembly language programming.
- **Computer Arithmetic:** Fixed and floating point arithmetic, adder/subtractor/multiplier/divider design.
- **Computer Microarchitecture:** Pipelining basics, pipeline hazards, instruction-level parallelism.
- **Memory System Design:** Memory hierarchy, cache memory, virtual memory.
- **Parallel Computer Architecture:** (Chip) multiprocessors, cache coherence, synchronization.
- **Computer System Design:** Storage systems, input/output systems, networks.