ECE 341: Introduction to Computer Hardware

An overview of computer architecture and programming from a hardware viewpoint. Topics covered include: digital logic; arithmetic operations; pipelining; CISC/RISC; memory hierarchy; virtual memory; input/output techniques; computer system components.

CS 201 is a prerequisite. Students are expected to have a basic knowledge of computer organization, instruction set architecture data representation in binary and hexadecimal notation, and assembly language programming.

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ECE 341 Office Hours: Wednesday 11am-noon, Friday 2-3pm. Or by appointment!

TA: Neel Joshi
Office Hours: Monday 2-3:30, Tursday 10-11:30 (In FAB Circuit Lounge)

Required Text: Computer Organization and Design: The Hardware/Software Interface, 5th Edition
Patterson and Hennessy, 2014.

D2L website active: Lecture notes, homework assignments and dropbox, announcements, etc.

Course Concepts/Student Learning Outcomes

1. Knowledge of the software and hardware interface and how a programmer can improve performance.
2. Knowledge of forces that drive the development of new computer architectures and design.
3. Ability to interpret different performance criteria used to make design decisions.
4. Ability to write machine descriptions at the register-transfer level that can execute instructions.
5. Understanding of what decisions must be made to develop a successful HW/SW system design.

Outline of Course Content

Tentative start week	Topic		Read
1	**Introduction**	Context, architecture concepts, manufacturing technology, trends	1.1-1.5
	Representation of information		2.4, 2.9
			(skim 3.5)
2	**Performance/Power**	measurement	1.6-1.11
	MIPS Architecture	Instruction set, software conventions	2.1-2.3, 2.5-2.8
3	**Logic design**	Gates, combinational logic, HDL	B.1-B.3, B.7-B.8
		Clocks, memory elements, flip-flops, registers	(ignore verilog)
	Arithmetic design	Constructing a basic ALU, faster addition	B.5-B.5, 3.1-3.3
		add,sub, mul, div, FP	
4	**Processor design**	datapath, single cycle, simple design	4.1-4.4
5	**Multicycle Design**	microcoded designs	notes
	Review		
6	**MIDTERM**		
	Pipelining	instruction, data, and control hazards	4.5-4.9
7			
	Memory	Caches	5.1-5.4
8		Virtual Memory	5.7
		memory hierarchy	5.8
9			
	Input/Output Basics	communication, interfaces, interupts, devices, error checking	notes
10	**Advanced Architecture Ideas**	performance, power, parallelism, and programming	6.1-6.5, 4.10
	Course review		

Course Requirements: midterm (30%), final (40%), homework (30%)

There will be approximately 5 homework assignments. To pass the course, each assignment must be turned in on or before its due date. Assignments may be done in groups. If you choose to work in a group, please turn in only one solution, indicating the names of all group members. Of course, individually, you will be expected to understand the material and demonstrate so on exams.

The text is in widespread use across the country and solutions can sometimes be found through web surfing or from previous classes. **Doing so is very counterproductive!** To pass exams, you'll need to develop analysis skills by working through problems. I strongly encourage you to come to my office hours after struggling and we'll work out the correct answer together.

Professionalism:

In our worldwide discipline, we must work with many men and women from different cultures, races, sexual preferences, religions, political affiliations, etc. To pass this course, each student must demonstrate they are a good team player. Students are expected to work/learn in a harassment free environment with the highest professional standards.

Academic Honesty: I enjoy teaching very much, and consider students to be professionals. Thus cheating is an extremely depressing thing for me to encounter and will be taken very seriously. Cheating is definitely not just a harmless prank. It can have very serious effects, harmful to your standing at the university, and also possibly very harmful to your job prospects when you seek employment after graduation. The penalty for cheating is an F in the course and a letter describing the incident sent to the Vice Provost for Student Affairs. Please avoid any actions during an exam (e.g. talking, looking around, etc.) which might make the exam proctors doubt your honesty.

Doing Well: Lectures cannot cover all aspects of the material. Much of the detail will be learned through exercises or supplied by consulting the book. The reading assignments are absolutely crucial to success in the course, so make sure that you set aside enough time to do the reading carefully, thoroughly and thoughtfully. In each chapter, there are two sections that should receive special attention: *Fallacies and Pitfalls* and *Concluding Remarks*. Ask me about anything that you don't understand, no matter how minor it seems. Finally, note that grading is non-competitive, so it is possible for everyone to do well.