Department of Electrical and Computer Engineering
The University of Texas at Austin

EE 460N, Spring, 2019
Yale N. Patt, Instructor
TAs: Aniket Deshmukh, Chester Cai, Mohammad Behnia
Course Outline
January 23, 2019 (Revised: February 13)

January 23: Lecture 1: Intro to the course. Levels of Transformations. Basic architectural choices. Science of Tradeoffs.

January 24,25: First Discussion Session. Bookkeeping, overview, expectations, PL0, Intro/Focus.

> Programming Lab 0 is due, Sunday night, January 27, 11:59pm. (The program itself will be empty. The purpose of the assignment is to make sure we are on the same page re: using the system.)

January 28: Lecture 2: Intro/Focus, continued. Intro to Instruction Set Architecture, with examples taken from many diverse ISAs. ISA tradeoffs. Detailed discussion of LC-3b, with Assembly language constructs. The Assembler, how it works. PL1.

January 30: Lecture 3: Microarchitecture, LC-3b data path, state machine, microsequencer, two-level microprogramming, Wilkes' Diode Matrix, Choice of ASICs, FPGAS, EMT instruction for enhanced performance instruction.

January 31,February 1: Discussion Session. ISA, microarchitecture, PL1.

> Problem set 1 due before class, February 4. (Emphasis: ISA, uarch of the LC-3b, the Assembly Process.)

February 4: Lecture 4: Microarchitecture, continued.

February 6: Lecture 5: Microarchitecture, continued.

February 7,8: Discussion session: Microarchitecture, PL1.

> Programming Lab 1 is due, Sunday night, February 10, 11:59pm. (Write a program in LC-3b Assembly Language. Write an Assembler. Assemble the program you have written.)

February 11: Lecture 6: Microarchitecture Performance Enhancements. Intro to Pipelining

February 13: Lecture 7: Pipelining, continued. Scoreboarding. Intro to Tomasulo algorithm.

February 14,15: Discussion session: Pipelining, Scoreboading, Tomasulo, Other speedups, PL2.

> Programming Lab 2 is due, Sunday night, February 18, 11:59pm. (Write a program in C that simulates at the instruction cycle level the baseline LC-3b ISA. Test your simulator with the output of the assembler for the application program written in Programming Lab 1.)

February 18: No class.

February 20: Lecture 8: Out-of-order execution, continued. (Tomasulo and its tragic flaw). Correction

of the flaw (the reorder buffer) and its wholesale adoption! Branch Prediction (The HEP)

February 21,22: Discussion Session. Prepare for first midterm.

Problem set 2 due before class, February 25. (Emphasis: uarch of the LC-3b, the Assembly Process, Pipelining Branch Prediction, Tomasulo)

February 25: Lecture 9: The notion of Process, the unit of work managed by the Operating System, and its implications on Interrupts and Exceptions and Virtual memory.

February 27: Lecture 10: Exam 1.

February 28, March 1: Discussion Session. PL3, Discuss the exam.

March 4: Lecture 11: Physical memory, unaligned access, interleaving, SRAM, DRAM.

March 6: Lecture 12: Physical Memory, continued.

March 7,8: Physical Memory, PL3.

Programming Lab 3 is due, Sunday night March 10, 11:59pm. (Finish the clock-cycle level Simulator for the LC-3b. Test it on the application program written in Programming Lab 1.)

March 11: Lecture 13: Virtual memory, page tables, TLB, VAX model, IA32 model, contrast with segmentation.

March 13: Lecture 14: Virtual memory, continued.

March 14,15: Discussion session: Virtual Memory.

March 18-24: No class, Spring break.

March 25: Lecture 15: Cache Memory.

March 27: Lecture 16: Cache Memory, continued.

March 28,29: Discussion session: Cache Memory, PL4.

Problem set 3 due before class, April 1. (Emphasis: Virtual Memory, Cache Memory.)

April 1: Lecture 17: Input/Output.

April 3: Lecture 18: Input/Output, continued.

April 4,5: Discussion session: Cache Memory, I/O, PL4.

Programming Lab 4 is due, Sunday night April 7, 11:59pm. (Interrupts/Exceptions)

Note: April 8 is the last day to Q-drop without aggravation.

April 8: Lecture 19: Integer Arithmetic.

April 10: Lecture 20: Floating point arithmetic and the IEEE Standard.

April 11,12: Discussion session: Arithmetic, Prepare for second midterm.

Problem set 4 due before class, April 15. (Emphasis: I/O, Arithmetic)

April 15: Lecture 21: Review or catch up.

April 17: Lecture 22: Exam 2.

April 18,19: Discussion session. PL5, Go over exam.

April 22: Lecture 23: Single-thread parallelism (SIMD, VLIW, Vectors, DAE, HPS, Data Flow)

April 24: Lecture 24: Single-thread parallelism, continued.

April 25,26: Discussion Session. Sinlge-thread paralellism, PL5.

Programming Lab 5 is due, Sunday night April 28, 11:59pm. (Virtual memory)

April 29: Lecture 25: Intro to Multiprocessing, Amdahl's Law, Speed-up, efficiency, Interconnection networks.

May 1: Lecture 26: Cache Coherency, Sequential Consistency.

May 2,3: Discussion session. PL6, multiprocessing.

May 6: Lecture 27: Pot Pourri – RISC, Intro Intellectual Property, Measurement methodology, GPUs, Spatial computing, Meganonsense, Directions in the future etc.

May 8: Lecture 28: Last class, free for all!

May 9,10: Discussion session: PL6, Review of the course, Prepare for Final Exam,

Programming Lab 6 is due, Friday afternoon, May 10, 5pm. (Pipelining)

Problem set 5. To be used as a study guide, not to be turned in.

Final exam: Probably Friday, May 17, 7-10pm.

Please note: The Registrar has the right to change the dates of the final exams. Please keep checking the Registrar's web site and our announcements to be sure when/where the final exam will be given.