Department of Electrical and Computer Engineering
The University of Texas at Austin
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TAs: Luke Mason, Rathna Sivakumar, Margaret Lee, Roy Mor
Course Outline ECE460N, Spring Semester, 2025.

**January 13, 2025 Lecture 1**: Intro to the course. Details of the LC-3b ISA.
Multiplication: a series of shifts and adds.

**January 15: Lecture 2:** Microcoded implementation of the LC-3b.

**January 16,17:** Discussion Section: Preparation for Programming Lab 1; PL0

**January 16:** 4th class day, last day to ADD a class without permission.

   Programming Lab 0 is due, Sunday night, January 19, 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 20:** No class, University closed, MLK Day

**January 22:** No class, extra discussion section.

**January 23,24:** Discussion Section: PL1, PL2

   **Programming Lab 1** is due Sunday night, January 26, 11:59pm.
   (Write a program in LC-3b Assembly Language. Write an Assembler.
   Assemble the program you have written.)

**January 27:** Lecture 3: Overview of Computer Architecture (Chapter 1). Levels of
Transformations. Basic architectural choices. Science of Tradeoffs. Speculation. Design
Choices. Hardware vs. Software. Bandwidth, Role of Parallelism, Role of Speculation,
Overview of Quantitative Insights, Role of the Architect, Alternative Design Points.

**January 29:** 12th class day, last day to DROP class without permission. Last day to
ADD a class (Approval required)

**January 29:** Lecture 4: Finish Chapter 1. The ISA (Chapter 2), Intro to Instruction Set Architecture, with examples taken from many diverse ISAs. ISA tradeoffs.

**January 30,31:** Discussion Section: The ISA, Assembly Process, PL2

> **Programming Lab 2** is due Sunday night, February 2, 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 3:** Lecture 5: Finish Chapter 2, the ISA.

**February 5:** Lecture 6: Microarchitecture Basics (Chapter 3), LC-3b data path, state machine, microsequencer, two-level microprogramming, Wilkes' Diode Matrix, Choice of ASICs, FPGAS, EMT instruction for enhanced performance, pipelining.

**February 6,7:** Discussion Section: Chapter 2,3, PL3

> **Problem set 1** is due before class, February 10.  (Emphasis: ISA,
> microarchitecture basics, the Assembly Process)

**February 10:** Lecture 7: Microarchitecture Enhancements, (Chapter 4).
Out-of-order execution, Branch Prediction, The HEP.

**February 12:** Lecture 8: The notion of process (Chapter 5), the unit of work managed by the Operating System, and its implications on Interrupts/Exceptions and on Virtual memory.

**February 13,14:** Discussion Section: Out-of-order execution, Branch Prediction, PL 3.

> **Programming Lab 3** is due, Sunday night February 16, 11:59pm.
> (Finish the clock-cycle-level Simulator for the LC-3b.
> Test it on the application program written in Programming Lab 1.)

**February 17:** Lecture 9: Physical Memory (Chapter 6), SRAM, DRAM, NVM.

Interleaving, Unaligned accesses.

**February 19:** Lecture 10, Physical Memory, continued.

**February 20,21:** Discussion Section: Process, Physical Memory, Prepare for first midterm.

> **Problem set 2** due before class, February 24.  (Emphasis: out-of-order execution, branch prediction, process, physical memory, I/O, Process).

**February 24:** Lecture 11: Review or catch up

**February 26:** Lecture 12: Exam 1

**February 27,28:** Discussion Section: Go over Exam 1.

**March 3:** Lecture 13: Virtual Memory (Chapter 7), Translation and Protection, contrast with segmentation, one level and two level page tables, the PTE, TLB, IA32 model, VAX model,

**March 5:** Lecture 14: Virtual Memory, continued.

**March 6,7:** Discussion Section: Virtual Memory, PL4

> **Programming Lab 4** is due Sunday night, March 9, 11:59pm.  Add state, data path, and microsequencer to handle interrupts and exceptions.

**March 10:** Lecture 15: Cache Memory (chapter 8), tag store, data store, sets, ways, write through, write back, cache coherence.

**March 12:** Lecture 16: Cache Memory, continued.

**March 13,14:** Discussion Section: cache memory.

**March 17-22:** Spring break

**March 24:** Lecture 17: Fixed point arithmetic (chapter 10)

**March 26:** Lecture 18: Floating point arithmetic (chapter 11), Floating point arithmetic and the IEEE Standard, Instruction formats, Gradual underflow, Rounding modes, NaNs, Floating Point Exceptions.

**March 27,28:** Discussion Section: Arithmetic. PL5.

> **Problem set 3** is due before class, March 31.  (Emphasis on Virtual Memory, Arithmetic).

**March 31:** Lecture 19: Single thread parallelism (chapter 12), SIMD, including Vectors, VLIW, DAE, HPS, Data Flow.

**April 2:** Lecture 20: Single thread parallelism, continued.

**April 3,4:** Discussion Section: Single-thread parallelism, PL5.

> **Programming Lab 5** is due Sunday night April 6, 11:59pm.
> (Adding state, data path, and microsequencer to handle Virtual memory)

**April 7:** Lecture 21: Multithread parallelism (chapter 13) Intro to Multiprocessing, Amdahl's Law, Speed-up, efficiency, Interconnection networks, Cache Coherency, Memory Consistency.

**April 9:** Lecture 22: Multithread parallelism, continued.

**April 10,11:** Discussion Section: Multithreaded parallelism, Prepare for second midterm Exam.

> **Problem set 4** is due before class, April 14.

**April 14:** Lecture 23: Review or Catch up.

**April 16:** Lecture 24: Exam 2

**April 16:** last day an undergraduate can Q-drop, withdraw, or change a class to pass/fail.

**April 17,18:** Discussion Section: Go over Exam 2.

**April 21:** Lecture 25: Input/Output, (chapter 9), Asynchronous/Synchronous, Arbitration, Transaction.

**April 23:** Lecture 26: If we have time, a special topic!

**April 24,25:** Discussion Section: PL6, multiprocessing, Review of the course, Prepare for Final exam.

**April 28:** last class day, last day an undergraduate can (with required approvals) request a non-academic Q-drop.

**April 28:** Lecture 27: Last class, Free for all

> **Programming Lab 6** is due, Monday afternoon, April 28, 5pm. (Pipelined implementation of the LC-3b)

> **Problem set 5** is to be used as a study guide for the final exam, not to be turned in.

**April 29 and 30:** Study days.

**May 1,2,3,5:** Final exams .

**Final exam:** Probably Friday, May 2, 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 the final exam will be given.