CSc 252 - Computer Organization - Fall 24

TuTh 12:30-1:45 pm, Commons 305

Course Description

Basic machine organization; elementary hardware concepts; CPU internals. Machine operations and instructions; assembly language concepts and programming.

Instructor and Contact Information

Instructors:

<u>Diana Diazh</u>

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Russell Lewis

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TAs:

See class webpage for up-to-date information.

Office Hours

Exact office hours subject to change, consult the class webpage for up-to-date information.

Websites

Class Homepage: <u>https://lecturer-russ.appspot.com/classes/cs252/fall24/</u> Discord: See link on class homepage

D2L: https://d2l.arizona.edu/d2l/home/1436455

Textbook: <u>https://learn.zybooks.com</u>

Course Format and Teaching Methods

We will be using an online textbook through zyBooks. Sections from the textbook will be assigned each week; you will need to read them before class on the first lecture day. (We will be checking, and giving you a grade for completion.)

In class, we will be mixing lecture with periodic class activities. While we will not be collecting these activities for a grade, you are required to work diligently with your table, and arrive at the best answer you can. Ask questions, early and often, to maximize your success in this class!

Course Objectives

Key topics:

- Binary numbers and arithmetic
- Assembly language programming: common concepts and their implementation in MIPS
- Functions, data structures, and the memory model in assembly
- Simple hardware implementations, starting at the gate level and working upwards
- Simple CPU design, including ALUs, instruction decode, and basic pipelining

Expected Learning Outcomes

By the end of the semester, the student will:

- Demonstrate understanding that a computer is made up entirely of a set of integers, and understand how other types of variables are encoded as integers, and arranged in memory
- Demonstrate understanding how computational operations (such as addition, comparison, or branching) can be implemented using simple electrical devices
- Demonstrate understanding how higher-level programming constructs (variables, data structures, functions, etc.) are built from simpler elements
- Demonstrate the ability to think of a computer program as a finite set of time-discrete steps, each of which is made up of extremely simple operations, and be able to explain how these small steps can be used to implement complex, multi-cycle calculations

Makeup Policy for Students Who Register Late

Students who register for class late will be allowed to make up missed assignments; all missed assignments will be due at the same time as the third homework/project. Students will not be allowed to register for the class more than two weeks after it begins, save in truly exceptional circumstances.

Course Communications

The primary path for outside-lecture communications will be the class Discord server, the link to which is available through D2L and the class website. If a student has an issue which cannot reasonably be resolved through Discord (inappropriate to discuss publicly, private issue, etc.), then the student may email their TA, or the instructor.

Required Texts or Readings

[Required] Online textbook through learn.zybooks.com. (Use class code ARIZONACSC252LewisFall2024.)

The textbook will be the online version of: Patterson and Hennessy, Computer Organization and Design, 5th Ed. Morgan Kaufmann.

Required or Special Materials

None

Required Extracurricular Activities

None

Assignments and Examinations: Schedule/Due Dates

<u>Projects</u>

This class will have programming projects, due most weeks. The following schedule gives approximate due dates for each one. The schedule below is approximate; as I assign the projects, it may occasionally be necessary to adjust due dates. Likewise, the topics mentioned are my current plans, and are subject to change. It is possible that I might assign **fewer** projects than listed below; however, I will not assign more.

Projects will be due at 7pm.

PreProject

due on or about Wed, 4 Sep

Simulation Project 1	due on or about Wed, 11 Sep	Basics of Binary
Assembly Project 1	due on or about Wed, 18 Sep	Introduction to MIPS
Simulation Project 2	due on or about Wed, 25 Sep	Logic Networks
Assembly Project 2	due on or about Wed, 2 Oct	Loops, Arrays, and Strings
Simulation Project 3	due on or about Wed, 9 Oct	An ALU
Assembly Project 3	due on or about Wed, 16 Oct	Intro to Functions
Simulation Project 4	milestone 1: due on or about Wed, 23 Oct	Instruction Decode
	milestone 2: due on or about Wed, 30 Oct	Single-Cycle CPU
Assembly Project 4	due on or about Wed, 6 Nov	Assembly: TBD
Simulation Project 5	due on or about Wed, 13 Nov	Pipelined CPU
Assembly Project 5	due on or about Wed, 20 Nov	Assembly: TBD
no project	Thanksgiving Week	
Assembly Project 6	due on or about Wed, 4 Dec	Assembly: TBD
Simulation Project 6	due on or about Wed, 11 Dec	Simulation: TBD

<u>Late Days</u>

This class offering does not allow any Late Days.

<u>Tests</u>

This class will have 6 short tests. Each will be given during lecture, and take less than the full class period (25 minutes); after the test is complete, we will do some more lecture. (See below for details about the Final.)

Tests will be given on the following days:

Test 1	Thu, 12 Sep
Test 2	Thu, 26 Sep
Test 3	Thu, 10 Oct
Test 4	Thu, 24 Oct
Test 5	Thu, 7 Nov
Test 6	Thu, 21 Nov

<u>Homeworks</u>

Each Test will have a corresponding Homework, which is due at 7pm 2 days before the Test. The Homeworks will be turned in electronically (just like projects). We will inspect them to make sure that the students completed the assigned problems, but will not grade them for correctness.

Homeworks are intended as test preparation; as such, students are **encouraged** to work in groups. However, every student must turn in their own paper copy of the homework; shared papers will not be accepted.

zyBook Readings and Quizzes

Most weeks, a few sections from the zyBook textbook will be assigned. The zyBooks website automatically checks completion of these sections; the sections must all be completed by the

beginning of the first lecture that week. We will collect completion information from the website, and will give points based on that information.

Readings are due at midnight. The planned due dates for the various readings are:

"Week 2"	Mon, 2 Sep
"Week 3"	Mon, 9 Sep
"Week 4"	Mon, 16 Sep
"Week 5"	Mon, 23 Sep
"Week 6"	Mon, 30 Sep
"Week 7"	Mon, 7 Oct
"Week 8"	Mon, 14 Oct
"Week 9"	Mon, 21 Oct
"Week 10"	Mon, 28 Oct
"Week 11"	Mon, 4 Nov
"Week 12"	Mon, 11 Nov
"Week 13"	Mon, 18 Nov
"Week 14"	Mon, 25 Nov
"Week 15"	Mon, 2 Dec

Final Examination

The Final exam will run 2 hours (120 minutes). Other than its length, its format will be similar to the 6 previous tests.

As per University policy, the Final will be:

Wed 18 Dec, 1-3 pm

University Policies Regarding Finals:

Final Exam Regulations and Final Exam Schedule: https://registrar.arizona.edu/faculty-staff-resources/room-class-scheduling/schedule-classes/final-exams

Grading Scale and Policies

Grading Scale

I will use a simple grade cutoff scheme. This means that if you earn the number of points listed for a given grade, you are guaranteed that grade. At the end of the semester, I reserve the right to **lower** these cutoffs, meaning that it might be easier to earn a good grade (but it is unusual for me to do so). However, I guarantee that I will not raise these cutoffs (making it harder to earn a good grade).

- 90% A
- 80% B
- 70% C
- 60% D

Point Distribution

Points will be distributed as follows:

- 5% zyBooks Readings
- 20% Assembly Projects
- 9% Simluation Projects
- 1% "pre-project"
- 5% Homeworks (exam prep)

(drop 1 homework) (drop 1 test)

(drop 1 week)

(drop 1 asm)

(drop 1 sim)

- 40% Tests
- 20% Final

Within each category, points are distributed evenly; that is, every Test is worth the same as every other (except the Final), every Assembly Project is worth the same as every other, and every Simulation Project is worth the same as every other. Thus, the exact value of each item will depend on the number of each item that is assigned.

Grading Schedule

Projects will be graded, typically, within 7 days of the due date. If exceptions have to be made occasionally, staff will inform the students about the delay and the reason for it.

Tests will be graded within 10 days.

Incomplete (I) or Withdrawal (W):

Requests for incomplete (I) or withdrawal (W) must be made in accordance with University policies, which are available at

https://catalog.arizona.edu/policy/courses-credit/grading/grading-system.

Dispute of Grade Policy:

If you have an issue with how any item was graded, you must submit a request for a regrade within 7 days of when the item was returned to you. For the Tests, please use GradeScope's "Regrade Request" feature; for other items, email your TA. If you and your TA cannot come to agreement, you may email me, but please use the ordinary path first.

Honors Credit

Unfortunately, I am not able to offer Honors Credit for this course this semester.

Scheduled Topic and Activities

For a list of assignment and test dates, please see the **"Assignments and Examinations:** Schedule/Due Dates" section above.

The lectures will cover the following material. Note that this schedule is approximate, and may need to be modified slightly during the semester.

Students are responsible for all material covered in lecture (as well as the required reading), even if the actual lectures deviate from this overview.

Mook 1	Class intro
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- Week 2 Binary integers and addition
- Week 3 MIPS introduction
- Week 4 Logic gates and adders
- Week 5 MIPS: loops and arrays
- Week 6 ALUs
- Week 7 MIPS: functions
- Week 8 Simple CPU overview
- Week 9 Instruction formats, simple CPU details
- Week 10 Pipelining, part 1
- Week 11 MIPS: recursion
- Week 12 Pipelining, part 2: Hazards and forwarding

- Week 13 Carry lookahead adders; multipliers
- Week 14 Caches
- Week 15 Floating point
- Week 16 TBD

Classroom Behavior Policy

To foster a positive learning environment, students and instructors have a shared responsibility. We want a safe, welcoming, and inclusive environment where all of us feel comfortable with each other and where we can challenge ourselves to succeed. To that end, our focus is on the tasks at hand and not on extraneous activities (e.g., texting, chatting, reading a newspaper, making phone calls, web surfing, etc.).

Safety on Campus and in the Classroom

For a list of emergency procedures for all types of incidents, please visit the website of the Critical Incident Response Team (CIRT): <u>https://cirt.arizona.edu/case-emergency/overview</u>

Also watch the video available at

https://arizona.sabacloud.com/Saba/Web_spf/NA7P1PRD161/app/me/ledetail;spf-url=common%2Fl earningeventdetail%2Fcrtfy00000000003841

University-wide Policies link

Links to the following UA policies are provided here: <u>https://catalog.arizona.edu/syllabus-policies</u>

- Absence and Class Participation Policies
- Threatening Behavior Policy
- Accessibility and Accommodations Policy
- Code of Academic Integrity
- Nondiscrimination and Anti-Harassment Policy

Department-wide Syllabus Policies and Resources link

Links to the following departmental syllabus policies and resources are provided here, https://www.cs.arizona.edu/cs-course-syllabus-policies :

- Department Code of Conduct
- Class Recordings
- Illnesses and Emergencies
- Obtaining Help
- Preferred Names and Pronouns
- Confidentiality of Student Records
- Additional Resources
- Land Acknowledgement Statement

Subject to Change Statement

Information contained in the course syllabus, other than the grade and absence policy, may be subject to change with advance notice, as deemed appropriate by the instructor.