CSE 230 Computer Organization and Assembly Language

Disclaimer: this page is the official syllabus for the course; paper copies will not be distributed. During the semester, changes may be made to the syllabus. If the change is significant, notification will be given in class, and an announcement will be made in Canvas. Minor editing changes will not be announced. The student is responsible for reading this syllabus at the beginning of the semester to acquaint himself or herself with the course policies, and for checking the syllabus periodically throughout the semester for relevant information.

Course Essentials:

Course management: We'll be using Canvas on MyASU for everything from announcements to assignments. Make it a habit to check in regularly so you don't miss out on any updates or important info.

Questions and Communication: For communication and questions, please join the Discord channel - https://discord.gg/VhA4CW9WXp

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ASU Tutoring:

Did you know Fulton Schools of Engineering offers free virtual tutoring for CSE and SER? Take advantage of this awesome resource! Please visit the Fulton Virtual Tutoring Page. (https://fultonapps.asu.edu/tms/)

Course Description:

Register-level computer organization. Instruction set architecture. Assembly language. Processor organization and design. Memory organization. IO programming, Exception/interrupt handling.

Course Objectives:

At the end of the course the student shall be able to:

1. Explain how programs written in high-level languages are executed by a computer system.
2. Write relatively simple assembly language programs employing flow of control constructs and procedures.
3. Explain what hardware factors impact program performance and how to write programs for performance.
4. Explain techniques used by computer hardware designers to improve performance.
5. Explain the reasons for the ongoing transition to multiprocessor architectures.
6. Explain data representation, instruction sets, and addressing modes.
7. Explain how a datapath can be implemented as a single-cycle or pipelined design.
8. Explain how the memory hierarchy impacts performance.

Prerequisites:

Credit is allowed for only CSE 230 or EEE 230. Three (3) credit hours. Lecture/No lab.

- CSE 120 or EEE 120 with C or better;
- CSE 100, 110 or 200 with C or better
  OR
- Computer Science or Computer Systems Engineering Graduate student;

Review the following from the prerequisites:

- C programming:
  - If-else
  - Pointers
  - Arrays
  - Linked Lists
  - Loops (for, while)
  - Functions
- 120 Basics:
  - Binary Arithmetic / Boolean Algebra

- Combinational Logic, MUX, Decoder
- Sequential Logic, D-FlipFlop

Course Material and Resources:

We'll be using ZyBooks for our textbook. It's interactive and great for the hands-on learning we'll be doing. Make sure you get access right away! Plus, don't forget to bring your MIPS Green Card to every class.

- Chapters 1 - 6 from the textbook:
  - In Praise of Computer Organization and Design: The Hardware/ Software Interface, Fifth Edition
  - Computer Organization and Design, The Hardware/Software Interface, Fourth Edition

- **Mandatory:** This course will be using zyBooks for the above textbook. You will need to purchase by clicking on the first reading materials link (Buy or Register Zybooks).
- **Bring to every class:** The MIPS Green Card from the textbook or a copy of it.
- **Canvas:** All material and assignments will be accessible through Modules.

MIPS Software Simulators:

- ZyLab: Embedded Simulator in ZyBooks. ***Required for Zylab submissions.***
- MARS: MIPS Assembler and Runtime Simulator
- SPIM: A MIPS32 Simulator - More difficult to install and use.

Course Schedule (tentative):

The following topics are tentative and may be changed during the semester.

Week	Topics	Reading Modules
1	Chapter 1 - Computer Abstractions and Performance	1.1-1.7

2	Chapter 2 - Introduction, ALU and Data Transfer Instructions	2.1-2.4 and 2.6
3	Chapter 2 - Branch Instructions and Machine Code	2.5 and 2.7
4	Chapter 2 - Procedure Execution	2.8
5	Chapter 2 - Linking, Loading, and Summary	2.9-2.12
6	Chapter 3 - Binary and Floating Point Arithmetic	3.1-3.5
7	Midterm Review/Midterm	
8	**Fall Break**	
9	Chapter 4 - Single Cycle Implementation	4.1-4.4
10	Chapter 4 - Multicycle Implementation and Pipeline Implementation	4.5-4.7
11	Chapter 4 - Pipeline Hazards and Exception Handling	4.8-4.11
12	Chapter 5 - Memory Hierarchy, Multi-level and Direct Mapped Caches	5.1-5.3

13	Chapter 5 - Associative Caches	5.4 and 5.8
14	Chapter 5 - Virtual Memory	5.7
15	Chapter 6 and Final Exam Review	6.1-6.4 and 6.10
16	Final	

Assessments

Your performance will be assessed through a mix of exams, ZyLabs, assignments, quizzes, and in-class challenges. Each is designed to reinforce your learning and keep you engaged. **Just a reminder: please keep all discussions and work on all assessments, except in-class challenges individual.** This means no talking with peers, collaborating, or using tools like ChatGPT. Thanks for your understanding!

Exams:

This course will have two exams, one midterm (Chapters 1-3) conducted during the last class before the Spring break and the final exam (Chapters 1-6) will be conducted at the last week of classes. These exams should be taken in-person only. No exam will be dropped. You are allowed to bring a 1 page (2-sided) cheat sheet, a calculator, and MIPS Green sheet.

Zylabs:

There will be 6 MIPS simulation assignments to be submitted through Zybooks. One lowest score will be dropped. For each Zylab:

- 4 points - Auto graded based on successful simulation
- 1 point - Manual Score based on code specifications

Assignments:

There will be 7 homework assignments and 1 lowest score will be dropped.

- All submissions should be typed text or word or pdf documents. Except for diagrams, charts or tables, answers MUST be provided in typed form. Handwritten submissions, Scanned submissions, unreadable and unclear answers will be graded with 0 points.
- For grading purposes, DO NOT copy the questions, label the question number correctly and segment your submission. Unsegmented submissions will be graded with 0 points.
- The assignments should be submitted on Canvas.
- No late submissions will be accepted.

Video Quizzes:

Every week, you are required to watch videos related to the material and answer a quiz. These quizzes will be conducted through Canvas and will have to be taken before the topic is discussed in class ONLY. You will have 2 attempts and the highest score will be considered. You are allowed to access any material and discuss doubts with the TAs or the instructor but no discussion with your peers. The discussion with TAs and/or instructor should NOT be the answer to the questions. The quizzes will have fill in the blank or multiple choice questions and will be autograded. There will be No partial credit. 12 highest scored quizzes will be counted towards required credit. No late submissions or extensions will be accepted.

Assignment Extensions: Please note that I can't offer extensions for assignments. However, don't worry—your lowest score will be dropped for each assessment, so you have some flexibility if things don't go as planned! You may utilize this during unforeseen situations. This policy can be quite beneficial if you're ever in a situation where you can't submit an assignment on time. Just make sure you're aware of the deadlines and manage your time to make the most of the dropped score policy.

Grading Policy: (subject to change till first day of classes)

Grade Distribution:

Item	Number of Items	Point Value	Percent of Grade
Reading	N/A	20	20%
Midterm	1	10	10%
Final	1	15	15%
Zylabs	5 out of 6	5	25%
Assignments	6 out of 7	4	24%

Video Quizzes	12 out of 13	0.5	6%
Bonus Questions	5	1	5% (Bonus)
			105 %

Note: Canvas calculations are confusing and sometimes inaccurate. To obtain your final score, just add all your scaled scores on canvas.

Final Grade:

Final Grade	Percentage
A+	>= 98%
A	>= 90% and < 98%
B+	>= 85% and < 90%
B	>= 80% and < 85%
C+	>= 75% and < 80%
C	>= 70% and < 75%
D	>= 60% and < 70%
E	< 60%

Incomplete Grade:

In the Student Services Manual, SSM 203-09 Grade of Incomplete discusses the University policy regarding incomplete grades. This ASU knowledge base article also discusses the policy. In general, an instructor may assign a grade of incomplete (I) when a student is otherwise doing acceptable work, but is unable to complete the final work due to extenuating

circumstances beyond the student's control. My policy is that the student must have taken every exam, except possibly the final exam, up to the end of the semester when the student requests an I grade. The student must also have completed all but the final one or two homework assignments and quizzes. If I agree to assign an I grade, you will have one year from the date when final letter grades are due to be submitted to the Registrar's Office to complete the missing work and submit it to me for grading. The student must complete the incomplete grade request form and submit it to me at the first instance when he or she decides to request an I grade and no later than the time when I submit final letter grades. Once final letter grades have been assigned and submitted to the Registrar's Office, I will not entertain any incomplete grade requests.

Grading Appeals:

- Any questions, corrections, or appeals on grades of Assignments or exams must be done within ONE week after it has been graded.
- State the problem and the rationale for any change in your grade in your appeal.
- If your request has not been addressed (either grade change or reason why your request cannot be approved) a week after your request was made, you may talk to the instructor during the Office Hours

Attendance Policy

There is a strong and well-established correlation between class attendance, learning, and performance; therefore, regular class attendance and participation is expected. There will be in-class challenges during every class based on the concepts taught in class. These are counted towards your final grade.

Excused Absence/Delayed Exam Policies:

ONLY for exams, you will be provided an alternative option for the exam, if and only if you provide **valid** documentation from

- a doctor/physician's note accompanied by valid medical reports; for medical reasons,
- your employer; for a reason related to your job,
- ASU; due to an approved ASU function,
- or other appropriate documentation depending on the circumstances

Tips for success:

To thrive in this course, stay engaged! Attend every class, keep up with readings and assignments, and don't hesitate to ask questions—whether in class, on Canvas, or during office hours. The more you put in, the more you'll get out of this course.

Remember, I'm here because I care about your success. I want this course to be a valuable and enjoyable experience for you. Together, we'll explore the fascinating world of computer organization, and I'm excited to see what you'll achieve!

I believe that students must be actively involved in their own learning process, that one of the purposes of college education and the Arizona State University mission is for students to develop skills such as problem solving, independent learning, critical thinking, and effective written and spoken communication. Some more tips for success in this course include:

- Attend and be prepared for every class
- Read the textbook and watch the assigned videos.
- Begin and complete the assignments well before the due date.
- Prepare thoroughly for and complete every exam and quiz.
- Do any additional exercises (questions at the end of the chapter or Zylab exercises for MIPS code practice) you must, to understand the material.
- Ask questions in class. If you do not feel comfortable asking the question in class, ask questions later on Canvas or during office hours.
- If you do not complete an assignment by the deadline, complete it anyway later (no credit), you might learn something.
- If you miss points on an assignment, quiz, or exam, determine why your answer was graded incorrect and learn the correct answers.
- Seek help from the instructor, teaching assistant, or a tutoring center before you are too far behind on your understanding of the subject.
- Check Canvas and your email every day for new announcements and updates.

Having said all that, I want you to know that I care about all of my students and their education. I want all of you to succeed, to feel you have gained something from the course, to have some fun in the process, and I will do all I reasonably can to assist you in your efforts!

Academic Integrity:

We uphold the highest standards of academic integrity, so make sure you're familiar with ASU's policies (https://provost.asu.edu/academic-integrity/policy). If you ever need support, whether it's academic or personal, know that resources are available, and we're here to help you navigate them.

Students are responsible for reviewing this policy and understanding each of the areas in which academic dishonesty can occur. In addition, all engineering students are expected to adhere to both the ASU Academic Integrity Honor Code and the Fulton Schools of Engineering Honor Code. All academic integrity violations will be reported to the Fulton Schools of Engineering

Academic Integrity Office (AIO). The AIO maintains a record of all violations and has access to academic integrity violations committed in all other ASU colleges/schools.

You will likely learn just as much (or more) from your interaction with other students as you will from the TA or instructor. Unless otherwise instructed, feel free to discuss and exchange ideas. There is a thin line, however, between collaboration and plagiarizing the work of others, i.e. cheating. In order that you not cross that line, you are required to compose your own unique solution to each problem and each project. You cannot use any code written by any of your classmates. Another way to avoid crossing the line is to give credit to others when you use their ideas. This is common in scientific literature and something you should get into the habit of doing. If you use an idea that was developed by someone else or jointly with some group, be sure to make a note of that in the problem write-up.

For this course, you are allowed to discuss the topics to understand the material and collaborate only for in-class challenges. No collaboration or using tools like ChatGPT for exams, assignments, quizzes or Zylabs. No uploading questions on websites and/or obtaining solution online. Some obvious acts of cheating are:

- Turning in work/code/report done by someone else or online
- Copying work/code/report done by someone else or online
- Sharing/posting/uploading your work/code/report with someone else or online
- Similarity due to collaboration on Assignments or Zylabs

Any student caught cheating on a homework assignment, Zylab, quiz, or exam, will be penalized with: (1) a score of 0 on the assessment; (2) a potential one to four letter grade reduction in the student's final letter grade, e.g., an A may become an E; and (3) **notification of the Academic Integrity Policy violation to the Fulton Schools of Engineering Academic Integrity Office (AIO) for disciplinary action.**

After the report is made to the AIO, all discussions will be through the AIO ONLY. No discussions/requests with the TAs or the instructor.

Generative AI

Generative AI is a technology that can often be useful in helping students learn the theories and concepts in this course. However, unless explicitly allowed by your instructor, the use of generative AI tools to complete any portion of a course assignment or exam will be considered academic dishonesty and a violation of the ASU Academic Integrity Policy. Students confirmed to be engaging in non-allowable use of generative AI will be sanctioned according to the academic integrity policy and FSE sanctioning guidelines.

Disability Accommodations:

Suitable accommodations will be made for students having disabilities. Students needing accommodations must register with the ASU Disabilities Resource Center and provide documentation of that registration to the instructor. Students should communicate the need for an

accommodation in sufficient time for it to be properly arranged. See ACD 304-08 Classroom and Testing Accommodations for Students with Disabilities. The Student Accessibility and Inclusive Learning Services center (formerly named the Disability Resource Center; 480-965-1234; Matthews Center; email: drc@asu.edu) is the central location for students requiring accommodation.

Harassment and Sexual Discrimination:

Arizona State University is committed to providing an environment free of discrimination, harassment, or retaliation for the entire university community, including all students, faculty members, staff employees, and guests. ASU expressly prohibits discrimination, harassment, and retaliation by employees, students, contractors, or agents of the university based on any protected status: race, color, religion, sex, national origin, age, disability, veteran status, sexual orientation, gender identity, and genetic information.

Title IX is a federal law that provides that no person be excluded on the basis of sex from participation in, be denied benefits of, or be subjected to discrimination under any education program or activity. Both Title IX and university policy make clear that sexual violence and harassment based on sex is prohibited. An individual who believes they have been subjected to sexual violence or harassed on the basis of sex can seek support, including counseling and academic support, from the university. If you or someone you know has been harassed on the basis of sex or sexually assaulted, you can find information and resources at https://sexualviolenceprevention.asu.edu/faqs.

Mandated sexual harassment reporter: As a mandated reporter, I am obligated to report any information I become aware of regarding alleged acts of sexual discrimination, including sexual violence and dating violence.
ASU Counseling Services, https://eoss.asu.edu/counseling, is available if you wish to discuss any concerns confidentially and privately.

Photo requirement

Arizona State University requires each enrolled student and university employee to have on file with ASU a current photo that meets ASU's requirements (your "Photo"). ASU uses your Photo to identify you, as necessary, to provide you educational and related services as an enrolled student at ASU. If you do not have an acceptable Photo on file with ASU, or if you do not consent to the use of your photo, access to ASU resources, including access to course material or grades (online or in person) may be negatively affected, withheld or denied.

Policy against threatening behavior

Students, faculty, staff, and other individuals do not have an unqualified right of access to university grounds, property, or services (see SSM 104-02). Interfering with the peaceful conduct of university-related business or activities or remaining on campus grounds after a request to

leave may be considered a crime. All incidents and allegations of violent or threatening conduct by an ASU student (whether on- or off-campus) must be reported to the ASU Police Department (ASU PD) and the Office of the Dean of Students.

Student Copyright Responsibilities

You must refrain from uploading to this course shell, discussion board, website used by the course instructor or any other course forum, material that is not your own original work, unless you first comply with all applicable copyright laws. Course instructors reserve the right to delete materials from the course shell on the grounds of suspected copyright infringement.

The contents of this course, including lectures and other instructional materials, are copyrighted materials. Students may not share outside the class, including uploading, selling or distributing course content or notes taken during the conduct of the course. Any recording of class sessions by students is prohibited, except as part of an accommodation approved by the Disability Resource Center. (see ACD 304–06, “Commercial Note Taking Services” and ABOR Policy 5-308 F.14 for more information).

Policy regarding expected student behavior

Students in this class are expected to acknowledge and embrace the FSE student professionalism expectation located at: https://engineering.asu.edu/professionalism/

Looking forward to a fantastic semester with all of you!

We will follow ASU COVID policy in the class.

Welcome to CSE 230: Computer Organization and Assembly Language!