



Course Syllabus

Course Information

CS/SE 2340.006 & 502 – Computer Architecture

Term:

Fall 2024

Days & Time and Location:

Section 006: MW 1:00PM-2:15PM @ GR 2.530

Section 502: MW 5:30PM-6:45PM @ FN 2.214

Instructor Contact Information

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Office hours: Wed 10-11am, ECSS 3.609

also by appointment using MS-Teams

Course Pre-requisites, Co-requisites, and/or Other Restrictions

CE/CS/TE 1337 or equivalent, and CE/CS/TE 2305 or equivalent.

Course Description

This course introduces the concepts of computer architecture by going through multiple levels of abstraction, the numbering systems and their basic computations. It focuses on the instruction-set architecture of the MIPS machine, including MIPS assembly programming, translation between MIPS and C, and between MIPS and machine code. General topics include performance calculation, processor datapath, pipelining, and memory hierarchy. Students that have credit for CS 2310 or CS/SE4340 cannot receive credit for this course (3 semester hours).

Student Learning Objectives/Outcomes

After successful completion of this course, the student should

- be able to write a fully functional, stand-alone medium size assembly language program
- have an ability to represent numbers in and convert between decimal, binary, and hexadecimal and perform calculations using 2's complement arithmetic
- understand the basic model of a computer including the datapath, control, memory, and I/O components
- be able to program efficiently in an assembly level instruction set, including the use of addressing modes and data types

- understand the role of compilers, assemblers, and linkers and how programs are translated into machine language and executed
- be able to demonstrate comprehension of a pipelined architectures including datapaths and hazards
- understand the memory hierarchy including caches and virtual memory
- be able to demonstrate comprehension of computer performance measures and their estimation

Required Textbook:

"Computer Organization and Design - The Hardware/Software

Interface – 6th Edition", Patterson and Hennessey, Morgan-Kaufmann, 2021.

ISBN-13: 978-012820109-1. **Note: there are several editions of the same title, make sure that you get the correct edition (for MIPS).**

Required Course Materials:

RISC ASSEMBLER/SIMULATOR

It is assumed you are familiar with the PC environment, can create and edit text files, run programs, etc. The programs will be in assembly language for the MIPS processor. This course uses the MARS MIPS assembler and simulator. MARS is available, free, for download from the Internet through the site:

<http://courses.missouristate.edu/kenvollmar/mars/>.

The MARS simulator can assemble MIPS assembly language source files, load and run them with a users console window for input/output, and debug them if they do not work properly.

Special instructions for Mac users:

How to install MARS onto a MAC

<https://www.youtube.com/watch?v=rifYIagXuBU>

More tips found on John Cole's [website](#).

Some Mac users have had trouble getting MARS to run. Thanks to Josh Brown, a former student, we have this:

You need to allow Full Disk Access in your System Preferences in macOS. [Here](#) they mention that you need to search for 'JavaLauncher.app'. This is an issue due to macOS changes with security management. To give Full Disk Access to JAR files on macOS:

1. Go to System Preferences.
2. Click on Security and Privacy.
3. Search for 'Full Disk Access'.
4. Click on the lock at the bottom left to be able to make changes.
5. Click on the '+' icon at the bottom left of the FDA panel and a Finder prompt will appear.
6. Go to System/Library/CoreServices/JavaLauncher.app
7. Select the JavaLauncher.app and click 'Open'

That's it. You should be able to access files through your Java application. This helped to fix my issue with MARS MIPS not saving files properly on my laptop. I constantly needed to save it elsewhere.

Assignments & Academic Calendar

Exams: There will be three exams during the course: two midterms and a final exam. The midterm exams will be limited to material covered during the immediate unit and the final exam will be during finals period. Test material will be taken mainly from classroom lectures.

You will be able to bring 2 sheets of paper (4 sides) to the exam. One sheet is the MIPS Reference card (double sided). The second sheet is hand-written notes. The second sheet can not be a printout.

Assignments: There will be regularly assigned reading, homeworks and programming assignments. Reading assignments should be done before the class session.

Homeworks (HW) will be solving problems by hand and not include assembly programming tasks. Programming assignments (Prog) will require the student to spend time programming in assembly code. It includes a program to demonstrate the correct operation of the assigned tasks. All of the programming assignments will build up skills needed for the final project. You will get 1 week to complete HW's and 2 weeks for completing programming assignments.

All assignments should be submitted using your eLearning account.

Each programming assignment must contain:

1. A copy of the final working assembly language source code with comments and documentation. The file should be "text-only" and the extension must be ".s" or ".asm".
2. A screenshot showing keyboard input and displayed output from the console.

Project: A team programming project will be assigned. Details will be announced in the class.

The descriptions and timelines contained in this syllabus are subject to change at the discretion of the Professor.

Tentative Class Schedule

L#	Date	Lecture	Readings	Due
L01	Mon, Aug 19	Introduction to Computer Architecture	Chapter 1	
L02	Wed, Aug 21	Assembly Language Programming and MARS	Appendix A	
L03	Mon, Aug 26	CPU Performance	Chapter 1	
L04	Wed, Aug 28	Data Representation	Chapter 2	Prog #1
	Mon, Sep 2	<i>Labor Day - Holiday, No class</i>		
L05	Wed, Sep 4	Signed Number Representation	Chapter 2	
L06	Mon, Sep 9	Arithmetic, Logical Operations	Chapter 2	HW#1
L07	Wed, Sep 11	Memory Operations	Chapter 2	
L08	Mon, Sep 16	Shifters, Conditional Decisions	Chapter 2	
L09	Wed, Sep 18	Machine Language	Chapter 2	Prog #2
	Mon, Sep 23	Exam I Review		
	Tue, Sep 24	Exam I (testing center)		
	Wed, Sep 25	<i>No class</i>		
L10	Mon, Sep 30	Procedures, Stack	Chapter 2	
L11	Wed, Oct 2	Recursive Procedures, File I/O	Chapter 3	
L12	Mon, Oct 7	Binary Arithmetic, Multiply, Divide	Chapter 3	
L13	Wed, Oct 9	Fixed and Floating point, Instructions	Chapter 4	Prog #3
L14	Mon, Oct 14	Processor: Datapath	Chapter 4	
L15	Wed, Oct 16	Processor: Control	Chapter 4	HW#2
	Mon, Oct 21	Exam II Review		
	Tue, Oct 22	Exam II (testing center)		
	Wed, Oct 23	<i>No class</i>		
L16	Mon, Oct 28	Processor: Pipelining	Chapter 4	
L17	Wed, Oct 30	Processor: Hazards and Branch Prediction	Chapter 4	
L18	Mon, Nov 4	Processor: Exceptions, Interrupts	Chapter 4	
L19	Wed, Nov 6	Other ISA's and Processors	Chapter 2, 5	HW#3
L20	Mon, Nov 11	Introduction to Memories and Caches	Chapter 5	
L21	Wed, Nov 13	Associative caches, Cache Performance	Chapter 5	
L22	Mon, Nov 18	Virtual Memory	Chapter 5	
L23	Wed, Nov 20	Memory: Advanced topics	Chapter 6	Term Project
	Mon, Nov 25	<i>Fall break - Thanksgiving - No class</i>		

	Wed, Nov 27	Fall break - Thanksgiving - No class		
L24	Mon, Dec 2	Inputs/Outputs		
	Wed, Dec 4	Final Exam Review		HW#4
	Wed, Dec 11	Final Exam (Section 006 1PM - 2:15PM GR2.530)		
	Wed, Dec 11	(Section 502 (3PM - 4:15PM FN2.214))		

Grading Policy

The grade each student will earn from this class will be based on a weighted score calculated by using the following table:

(Course weighting is subject to change)

Type	#
Exam I	20%
Exam II	20%
Final Exam	20%
Assignments (Prog+HW)	20%
Project	15%
Attendance	5%
Total	100%

Grades will be assigned according to the scale below

Score	Grade
93.0 - 100	A
90.0 - 92.9	A-
87.0 - 89.9	B+
83.0 - 86.9	B
80.0 - 82.9	B-
77.0 - 79.9	C+
73.0 - 76.9	C
70.0 - 72.9	C-
67.0 - 69.9	D+
60.0 - 66.9	D
Below 60.0	F

Programming assignments grading:

Code Development	30%	(compile w/o error)
Program Execution	20%	(run successfully)
Program Design	25%	(conform to spec)
Documentation	15%	(program, comments)
Coding Style	10%	(clear, efficient)

You will receive deductions if your program:

Does not have .asm as the file extension: -5%

Does not include SysCalls.asm and did not have it included in the ZIP file: -5%

Does not have your name and other header information: -5%

Is not properly commented (almost every line): -15%

Does not exit properly (exit syscall). -5%

Doesn't compile/assemble: -30%

Course & Instructor Policies

- **Attendance policy:**
 - **CS Department:** 3 consecutive unexcused absences leads to one letter grade drop (B+ to B); 4 or more consecutive unexcused absences lead to a failing grade (F).
 - **Additionally, for this course:** 6 unexcused absences total leads to one letter grade drop (B+ to B), 8 or more unexcused absences lead to a failing grade (F).
- All midterm exams will be at the Testing Center and **seat reservation is required**. Seat reservations must be made for each exam and should be done at the beginning of the semester. If you do not reserve your seat you will not be able to take the exam and I cannot do anything about it, so **do not email me if you cannot take an exam because you failed to reserve your seat**.
- The final exam date, time and location is TBD
- There will be no makeup exams under normal circumstances.
- No late assignment will be accepted!
- I do not read e-Learning e-mails. Please use my UTD email account above for any communications.

- Emails **must** include class/section numbers in the subject to help me locate you (I have multiple classes/sections in the semester.) **Emails without class/section information will be silently ignored.**

Examples of Unexcused Absences

- Skipping class for a job interview or internship or a job is not an excused absence.
- Skipping class for a yearly physical or a dental cleaning is not an excused absence.
- Skipping class because you need to sleep is not an excused absence.
- Traffic and road accidents are not excused absences.
- If missing class is because of anything other than documented health or scholastic reasons, the absence is not excused.

Examples of Excused Absences

- If a student misses a lecture due to illness or health issues, and has a doctor's note, the absence will be excused.
- If a student has an campus sponsored academic or athletic event, and has the relevant paperwork, the absence will be excused.
- Students who have an exam after the lecture at the testing center may leave the lecture quietly with no penalty.
- Students who have an exam before the lecture at the testing center, and miss attendance quizzes can see me at the end of class and be counted on the roll.

Class Materials

The instructor may provide class materials that will be made available to all students registered for this class as they are intended to supplement the classroom experience. These materials may be downloaded during the course, however, these materials are for registered students' use only. Classroom materials may not be reproduced or shared with those not in class, or uploaded to other online environments except to implement an approved Office of Student AccessAbility accommodation. Failure to comply with these University requirements is a violation of the [Student Code of Conduct](#).

Class Attendance

The University's attendance policy requirement is that individual faculty set their course attendance requirements. Regular and punctual class attendance is expected. Students who fail to attend class regularly are inviting scholastic difficulty. In some courses, instructors may have special attendance requirements; these should be made known to students during the first week of classes.

Class Participation

Regular class participation is expected. Students who fail to participate in class regularly are inviting scholastic difficulty. A portion of the grade for this course is directly tied to your participation in this class. It also includes engaging in group or other activities during class that solicit your feedback on homework assignments, readings, or materials covered in the lectures (and/or labs). Class participation is documented by faculty. Successful participation is defined as consistently adhering to University requirements, as presented in this syllabus. Failure to comply with these University requirements is a violation of the [Student Code of Conduct](#).

Class Recordings

Students are expected to follow appropriate University policies and maintain the security of passwords used to access recorded lectures. Unless the Office of Student AccessAbility has approved the student to record the instruction, students are expressly prohibited from recording any part of this course. Recordings may not be published, reproduced, or shared with those not in the class, or uploaded to other online environments except to implement an approved Office of Student AccessAbility accommodation. Failure to comply with these University requirements is a violation of the [Student Code of Conduct](#).

Comet Creed

This creed was voted on by the UT Dallas student body in 2014. It is a standard that Comets choose to live by and encourage others to do the same:

"As a Comet, I pledge honesty, integrity, and service in all that I do."

Academic Support Resources

The information contained in the following link lists the University's academic support resources for all students.

Please see [UT Dallas Syllabus Policies and Procedures](#).

UT Dallas Syllabus Policies and Procedures

The information contained in the following link constitutes the University's policies and procedures segment of the course syllabus. Please review the catalog sections regarding the credit/no credit or pass/fail grading option and withdrawal from class.

Please go to [UT Dallas Syllabus Policies and Procedures](#) for these policies.