Course Syllabus

Course Information

CS 2340.501
Computer Architecture
Spring 2024

Time: Tues, Thurs 5:30-6:45pm
Location: JO 4.614
Modality: Face-To-Face, In-Person

Professor Contact Information

Dr. Alice Wang
Telephone: (972) 883-4836
MS-Teams: Wang, Alice
Email: alice.wang@utdallas.edu

If you are sending an e-mail to Dr. Wang, kindly start the subject line with the ***course number*** and ***section***.

Example:
To: Alice.Wang@utdallas.edu
Subject: CS2340.501: What is a Cache?

Building: Engineering and Computer Science North (ECSS)
Office: 3.609
Office Hours: upon request

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

Prerequisites: (CE 1337 or CS 1337) with a grade of C or better or equivalent and (CE 2305 or CS2305) with a grade of C or better. (Same as SE 2340)

Restrictions:
Students that have credit for CS 2310 or CS/SE4340 cannot receive credit for this course

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. (3 semester hours).

Student Learning Objectives/Outcomes

After successful completion of this course, the student should

- CLO1: Be able to write a fully functional, stand-alone medium size assembly language program (e.g. a basic Telnet client)
- CLO2: Have an ability to represent numbers in and convert between decimal, binary, and hexadecimal and perform calculations using 2's complement arithmetic
- CLO3: Understand the basic model of a computer including the datapath, control, memory, and I/O components
- CLO4: Be able to program efficiently in an assembly level instruction set, including the use of addressing modes and data types
- CLO5: Understand the role of compilers, assemblers, and linkers and how programs are translated into machine language and executed
- CLO6: Be able to demonstrate comprehension of a pipelined architectures including datapaths and hazards
- CLO7: Understand the memory hierarchy including caches and virtual memory
- CLO8: 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/.

How to install MARS onto a MAC
https://www.youtube.com/watch?v=rifYIagXuBU

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.

Assignments & Academic Calendar

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

Lectures

Lecture Number	Date (501)	Lecture	Readings	Assignments
1	Tue, Jan 16	Introduction		
2	Thu, Jan 18	Intro to computer organization	CH 1	
3	Tue, Jan 23	Introduction to Assembly Language Programming	Appendix A	
4	Thu, Jan 25	Performance and Power	CH 1.6-1.7	
5	Tue, Jan 30	Data Representations: Bin/Oct/Hex	CH 2.4	
6	Thu, Feb 1	Number Representations: signed	CH 2.4	HW #1 due (Fri)
7	Tue, Feb 6	Fixed and Floating point	CH 3.5	
8	Thu, Feb 8	Operations and Operands	CH 2.2-2.3	HW#2 due (Fri)
9	Tue, Feb 13	Logical Operations, Decisions	CH 2.6-2.7	
10	Thu, Feb 15	Procedures, Other ISA's	CH 2.8, 2.16-19	
	Tue, Feb 20	Review		HW #3 due (Wed)
	Thu, Feb 22	**Exam I - testing center**		
11	Tue, Feb 27	System Software	CH 2.11-2.14	
	Thu, Feb 29	*No class*		
12	Tue, Mar 5	Integer Arithmetic	CH 3.1-3.4	
13	Thu, Mar 7	Floating Point Arithmetic	CH 3.5	HW #4 due (Fri)
	Tue, Mar 12	Spring Break		
	Thu, Mar 14	Spring Break		
14	Tue, Mar 19	Processor: Datapath	Ch 4.1-4.3	
15	Thu, Mar 21	Processor: Pipelining Introduction	CH 4.6	
16	Tue, Mar 26	Processor: Pipelined Datapath and Control	CH 4.7	
	Thu, Mar 28	Review		HW #5 due (Fri)
	Tue, Apr 2	**Exam II - testing center**		
17	Thu, Apr 4	Processor: Data and Control Hazards	CH 4.8-4.9	
18	Tue, Apr 9	Processor: Exceptions & Interrupts	CH 4.10	
19	Thu, Apr 11	Processor: Instruction level parallelism	CH 4.11	HW #6 due (Fri)
20	Tue, Apr 16	Introduction to Memories	CH 5.1-5.2	
21	Thu, Apr 18	Introduction to Caches	CH 5.3	

22	Tue, Apr 23	Cache Performance	CH 5.4	
23	Thu, Apr 25	Virtual Memory	CH 5.6-5.10	HW #7 due (Fri)
Review	Tue, Apr 30	Review		
	Thu, May 2	**Exam III - In this room**		

Grading Policy - Assignment Weights

Type	#
Exam I	20%
Exam II	20%
Exam III	20%
Assignments	40%
Total	100%

Grading Scale

Score	Grade
97.0 - 100	A+
93.0 - 96.9	A
90.0 - 92.9	A-
83.0 - 89.9	B
80.0 - 82.9	B-
73.0 - 79.9	C
70.0 - 72.9	C-
60.0 - 69.9	D
Below 60.0	F

Programming Assignment 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)

Course & Instructor Policies

Expectations of Student Skills

All students are expected to be aware of how to:

- upload files to Blackboard
- how to create a PDF
- how to download and install software on a computer
- how to write assembly code
- how to walk through an algorithm
- how to write a computer program

and most importantly:

- how to read a problem
- how to read the entire problem

Science is Dispassionate

- Science, Engineering, and Mathematics are dignified disciplines.
- Pleading for grades is unacceptable for this course.
- Bargaining for grades is unacceptable for this course.
- If you miss your assignments and exams in the semester due to
    - Prolonged illness
    - Family concerns
    - Internships
    - Employment
    - Other personal choices
- Then ***you should drop this course.***

Late work

- If a situation occurs on campus, such as inclement weather, power outage, or network outage, or server problems, then assignments will be extended at the discretion of the instructor.
- Otherwise, no late assignment will be accepted.

Course & Instructor Policies, continued

Exams

- The current assignment plan for this semester is to have three exams during the semester, no final exam.
- Exam 1 and 2 will be at the Testing Center and seat reservation is required. Review the Student Guidelines. Seat reservations must be made for each exam and should be done at the beginning of the semester via this link. 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.
- Exam 3 will be in this room during class time
    - You will need the Respondus Lockdown Browser. Make sure the browser works before you come to the exam. Not having a working browser can result in a grade of zero
- There will be no makeup exams under normal circumstances.

Inappropriate behavior is not acceptable.

This course is a lecture course at a branch of the University of Texas. The instructor does not care about the policies of previous courses, previous universities, or previous nations. The argument that a student's behavior was acceptable in another instructor's course or institution does not apply to the current course.

FORMAL NOTICE: No form of bias is permitted in this course, including the use of crude humor. Anyone harassing the instructor, grader, or fellow student with inappropriate comments will fail the course. This includes references written into computer programs, answering "joke" emails in class, or playing inappropriate videos. The instructor will decide what is inappropriate.

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 Accessibility 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.

Students are expected to attend every lecture. Absences are the responsibility of the student.

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.

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 roll-call, can see me at the end of class and be counted on the roll.

For this Semester: Attendance is required for the course:

- During each class, there may be an attendance quiz on e-Learning.
- Questions may be on the last class, current class or something completely random. It is not important if you get the question correct, just that you have completed the quiz in the allotted time and in the classroom.
- **Missing four in-class quizzes due to unexcused absences leads to one letter grade drop, missing five leads to an F grade.**

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 Accessibility 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 Accessibility accommodation. Failure to comply with these University requirements is a violation of the Student Code of Conduct.

Due to the catalog requirements for this course, the lectures will not be recorded on a regular basis.

Cheating
Attempting to or succeeding in gaining an unfair advantage in the academic arena is an act of academic dishonesty. Plagiarism, Collusion, and Fabrication are three examples of cheating.

Plagiarism
"To submit to your instructor a paper or comparable assignment that is not truly the product of your own mind and skill is to commit plagiarism." The most obvious is quoting entire sections of a text or research paper and claiming it is original work. Be sure to cite your sources, and acknowledge the work of others, or learn how to paraphrase but do not forget to footnote.

Collusion
Giving your work out to another source, even if its "Please let me see your code. I promise I will not copy.." is collusion. This includes email, securing cloud services such as BOX or GitHub, even just handing off a thumb drive. Sometimes this is deliberate…sometimes one student has stolen another's work. Sitting down together with different machines and talking and discussing and comparing output is not collusion. Handing off entire completed assignments is collusion.

Fabrication
Submitting a result for a grade, and it turns out the references do not exist. Or writing a program that generates an output without performing any algorithm. For example, turning in a computer program with nothing but output statements while ignoring all the inputs and configurations required by the project is fabrication.

A Fourth Form Of Cheating, Theft
Many students use software and servers such as GitHub and Google Drive to manage documents and programming code. ***It is the responsibility of the student to ensure that their accounts are secure***. If one cohort has accessed the account of another cohort ***with or without*** permission, then both cohorts will be considered culpable. Why? The first cohort for taking the information, and the second cohort for being negligent.

When Academic Dishonesty occurs, I ask the students involved to see me. Depending on the outcome of that interview, I proceed to the next step and submit the forms to the university. If a student is found in violation of academic conduct, the result will be a -100 (not a 0) on the entire assignment.

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 http://go.utdallas.edu/academic-support-resources.

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 http://go.utdallas.edu/syllabus-policies for these policies.

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