CS2340.003 Course Syllabus

Course Information

CS2340.003 Computer Architecture

Fall 2023

Professor Contact Information

Name	John Cole
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Office Hours	See Web site: https://personal.utdallas.edu/~John.Cole/#Office

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Course Modality and Expectations

Instructional Mode	1. In-person. You will be expected to be in class. Attendance is not mandatory but will be taken. Classes will not be presented online unless the University requires it and will not be recorded unless the University requires it.
Meeting Time and Place	Monday/Wednesday from 10:00 to 11:15 AM Room: ECSS 2.311
Course Platform	Traditional classroom.
Expectations	You will attend every class on time, participate when appropriate, and silence your phone and put it somewhere off the desk and out of reach.
Asynchronous Learning Guidelines	None. Unless the University requires it, this class will not be offered asynchronously.

General Course Information

Prerequisites	**CS1337 and CS2305** with a grade of C or better.
Course Description	This course introduces the concepts of computer architecture by going through multiple levels of abstraction, and 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. That was the catalog description. This course teaches you how computers work internally, including how to write in assembly language, how to create abstractions in an environment where there are none, and the relationship between machine code, assembly language, and high-level languages, specifically C++. You will also learn how memory works, how to evaluate processor performance, and much more.

Learning Outcomes	After successful completion of this course: 1. Students should be able to convert numbers between bases 2, 10, and 16 and perform binary 2's complement arithmetic calculations. 2. Students will create and debug Assembly language programs that include (a) integer operations, (b) floating-point operations, (c) control structures, (d) functions and macros, (e) static memory allocation for varied data types, (f) dynamic memory allocation, (g) standard I/O, and (h) memory-mapped I/O. 3. Students will critique programs for efficient use of data types, addressing modes, and instructions, as well as for readability and maintainability using a provided rubric. 4. Students will calculate computer performance measures. Students will use performance metrics to evaluate a chosen CPU architecture. Students will define terms used in CPU technical brochures. 5. Students will differentiate between systems programs such as compilers, assemblers, linkers, and loaders, and explain how they are used by operating systems to convert programs into machine language to be executed. 6. Students will explain the flow of information through a computer's core components, including the datapath, control, memory, and I/O. 7. Students will diagram the flow of data, code, and control signals through a pipelined architecture. Students will evaluate the presence or absence of hazards in a pipelined architecture, and explain how the hazards could be avoided. 8. Students will diagram and explain the memory hierarchy, including caches and virtual memory. Students will explain the different memory technologies used in computers. 9. Students will contrast the four types of parallelism.
Required Text	*Computer Organization and Design - The Hardware/Software Interface* – 6th Edition, Patterson and Hennessey, Morgan-Kaufmann, 2013. ISBN-13: 978-0128201091. Note: Make sure that you get the correct edition and processor (MIPS).
Required Course Materials	This course will involve coding in the MIPS assembly language using MARS (MIPS Assembler and Runtime Simulator). Get it free here: http://courses.missouristate.edu/KenVollmar/mars/ The MARS simulator's help screen is very useful.

Course Policies

Grading Criteria	Major assignments 35% Tests (3) 60% Quizzes 5% Attendance: 0%	A=93-100 A-=90-92 B+=87-89 B=83-86 B-=80-82 C+=77-79 C=73-76 C-=70-72 F=below 70
Make-up Exams	Not allowed except for documented serious medical reasons. "I forgot to sign up with the testing center" is not a medical reason.	
Extra-Credit Work	None given. Please do not ask.	
Late Work	Reduction of 25 percent per day or partial day for any late submissions unless otherwise stated in the assignment. That is, if the assignment is worth 100 points, you will lose 25 points per day, in addition to points lost because of the quality of work.	
Grade Information	I do not curve individual assignments, but I may curve the entire course a little. Do not count on this. Do your best work. Grades will be posted in eLearning and you can use the weights above to see where you stand.	
Who Grades What	Online quizzes are auto-graded by eLearning. Your instructor grade tests. The grader grades programs.	
Grade Disputes	If you have an issue with your grade on a test or homework, talk to me. You have **one week** after a grade is posted to do so. Do not come in at the end of the semester looking for a better grade on the first test.	
Online Quizzes	You may be given quizzes in eLearning. Often, these will be due **before** the lecture that covers the material. The purpose is to get you to read the material before you hear it in class. You may also be given in-class work to complete. These may not be made up if you miss them, and late work is not accepted.	

Class Attendance

The University's attendance policy requirement is that individual faculty set their course attendance requirements. Computer Science Department policy is that if you miss three consecutive classes your grade will drop one letter grade. Missing four in a row is failing.

Regular and punctual class attendance is expected regardless of modality. 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. These attendance requirements will not be used as part of grading (see Class Participation below for grading information).

Class Participation

Regular class participation is expected regardless of course modality. Students who fail to participate in class regularly are inviting scholastic difficulty. Participation 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.

NOTE: if the instructor records any part of the course, then the instructor will need to use the following syllabus statement:

The instructor may record meetings of this course. Any recordings will be available to all students registered for this class as they are intended to supplement the classroom experience. 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. If the instructor or a UTD school/department/office plans any other uses for the recordings, consent of the students identifiable in the recordings is required prior to such use unless an exception is allowed by law. Failure to comply with these University requirements is a violation of the Student Code of Conduct.

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.

Tentative schedule of topics. This is subject to change, and an updated version can be found at https://personal.utdallas.edu/~John.Cole/2022Fall/CS2340Fall2022Schedule.htm			
Week	Date	Topic	Reading
1	Aug 21	Syllabus and instructor Web site review	Syllabus from coursebook
	Aug 23	Introduction to Computer Organization	Ch. 1.1-1.5
2	Aug 28	Introduction to Assembly Language Programming	Appendix A
	Aug 30	Performance evaluation, Amdahl's law	Ch. 1.6, 1.9
3	Sep 4	Labor Day holiday -- No class	
	Sep 6	Data Representations: Binary, Hexadecimal, Octal	Ch. 2.3
4	Sep 11	Number Representations: signed, floating point	Ch. 2.4
	Sep 13	Instruction Representation	Ch. 2.5
5	Sep 18	Assembly operations: Load, Store, Add, Subtract, etc. Addressing modes.	Ch. 2.2
	Sep 20	Comparing, Branching, Looping	Ch. 2.7
6	Sep 25	Bit and byte manipulation, etc.	Ch. 2.6
	Sep 27	Test 1 Review	
7	**Oct 2**	**Test 1 in the Testing Center**	
	Oct 4	Subroutines in Assembly Language	Ch 2.8, A.6
8	Oct 9	Memory Allocation and the Heap	Slides
	Oct 11	Integer Arithmetic	Ch 3.1-3.4
9	Oct 16	Addressing Modes and System Software	Ch. 2.12-2.13
	Oct 18	Floating Point Arithmetic	Ch. 3.5
10	Oct 23	File Input & Output	Slides
	Oct 25	Memory-Mapped I/O	Slides
11	Oct 30	Interrupts and Exceptions	Ch. 4.9, A.7
	Nov 1	Test 2 Review	Ch. 4.1-4.4
12	**Nov 6**	**Test 2 in the Testing Center**	
	Nov 8	Processor: Datapath & Control	Ch. 4.5
13	Nov 13	Processor: Pipelining	Ch. 4.6-4.8
	Nov 15	Advanced Instruction Level Parallelism	Ch. 4.11
14	Nov 21	Thanksgiving Break	

	Nov 23	Thanksgiving Break	
15	Nov 27	Introduction to memory hierarchy	Ch. 5.1-5.3
	Nov 29	Virtual memory	Ch. 5.4-5.7
16	Dec 4	Comparing ISAs	Ch. 2.16, 2.17, Slides
	Dec 6	Test Review	
	TBA	**Test 3 in the testing center.**	

Off-campus Instruction and Course Activities
Not Applicable.

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

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