Course Syllabus
CS/SE 2340.502 –Computer Architecture

Fall 2023

Course Information

Prerequisites: CE/CS/TE 1337 or equivalent, and CE/CS/TE 2305 or equivalent.
Class Time: Monday, and Wednesday, 5:30 pm - 6:45 pm
Class Location: ECSS 2.415

Contact Information

Instructor: Dr. Wafa Jaffal
Email: wafa.jaffal@utdallas.edu
Office: ECSN 3.608
Office Hours: Friday 3:00-4:00 pm vis MS Teams, or by appointment
Teaching Assistant/Grader: TBD
Email: TBD

Class Resources

eLearning: The course website is hosted on eLearning, where you can access the syllabus, lecture slides, assignments, quizzes, grades, and announcements. You are responsible for checking the website regularly for any updates or changes.

The course will be in person for lectures and discussions, and via MS teams for office hours. You will need a stable internet connection, a webcam, and a microphone to participate. The MS Teams Invite will be posted on your team's calendar.

Email the grader for homework grading related questions only.

Course Description

This course introduces the basic concepts and principles of computer architecture, including instruction set design, datapath and control, pipelining, memory hierarchy, input/output, and parallelism. The course also covers the performance evaluation and optimization of computer systems, as well as the trade-offs between hardware and

software. The course will use MIPS as an example of a RISC architecture, and will involve programming in assembly language.

Student Learning Objectives/Outcomes

By the end of this course, you will be able to:

1. Explain the structure and function of the major components of a computer system, such as the processor, the memory, and the I/O devices.
2. Understand the role of compilers, assemblers, and linkers and how programs are translated into machine language and executed.
3. Have an ability to represent numbers in and convert between decimal, binary, and hexadecimal and perform calculations using 2's complement arithmetic
4. Design and implement simple programs in MIPS assembly language, and understand the relationship between assembly language and machine code.
5. Analyze and compare different instruction set architectures, and understand the impact of instruction set design on performance, cost, and compatibility.
6. Describe and implement the basic techniques of datapath and control design, such as combinational and sequential logic.
7. Explain and apply the concepts of pipelining, such as hazards, stalls, forwarding, and branch prediction, and understand the benefits and limitations of pipelining.
8. Understand and evaluate the memory hierarchy, such as caches, virtual memory, and memory management, and understand the trade-offs between capacity, speed, and cost.

Required Textbook

The required textbook for this course is:

- Book: David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, 6th Edition, Patterson and Hennessey, Morgan-Kaufmann, 2021. **Make sure that you get the correct edition (for MIPS).**
- RISC ASSEMBLER/SIMULATOR : 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/*.

You are expected to read the assigned chapters before each class, and to bring the textbook to class for reference. The textbook also contains exercises and problems that you can use for self-study and practice.

Class Schedule

The following is a tentative schedule of the topics to be covered in this course, along with the corresponding textbook chapters and dates of the assignments and quizzes. The schedule is subject to change depending on the pace and progress of the class. Any changes will be announced on eLearning and during the class:

Date	CH	Topic	Reading	Assignment/ Quiz
21-Aug		Syllabus		
23-Aug	**Ch1/ Appendix A**	Intro to computer organization	1.1-1.5	
28-Aug		Introduction to Assembly Language Programming	A.1-A.4	
30-Aug		Performance evaluation	1.6-1.9	HW1
4-Sep	**Ch2**	Data Representations: Bin/Oct/Hex/Signed	2.3-2.4	
6-Sep		Assembly Ops: Load/Store/Add/Sub/etc	2.2	
11-Sep		MARS Demo-Data, Stack, Code, Registers		Quiz1
13-Sep		Comparing, Branching and Looping	2.7	HW2
18-Sep		Bits and bytes manipulation & other instructions	2.6	
20-Sep		Input & Output -SysCalls & Interrupts	A.7	Quiz2
25-Sep		**Exam I review**		
27-Sep		**Exam I**		
2-Oct		Subroutines in Assembly language-Functions, Stack, SysCall	2.8	HW3
4-Oct		Subroutines in Assembly language-Recursion	2.8	Quiz3
9-Oct		Addressing modes & System software		Assign project
11-Oct		Instructions Representation	2.5	HW4
16-Oct	**Ch3**	Number Representations: signed, floating point		Quiz4
18-Oct		Integer Arithmetic	3.1-3.4	
23-Oct		Floating Point Arithmetic	3.5	HW5
25-Oct		**Exam II review**		
30-Oct		**Exam II**		
1-Nov	**Ch4**	Processor: Datapath & Control		HW6
6-Nov		Processor: Pipelining		
8-Nov		Processor: Pipelined Datapath		Quiz5
13-Nov	**Ch5**	Introduction to memory hierarchy		
15-Nov		Virtual Memory		
20-Nov		No Class		
24-Nov				
4-Dec		**Exam III review**		Project Due Date
6-Dec		**Exam III**		

Course & Instructor Policies

- Assignments must be turned in on the due date, by 11:59 pm (The link to submit will expire). Submit via eLearning and don't submit via email.
- Late assignments are deducted by 20% if prior permission has been granted due to extenuating circumstances.
- No Makeup for Quizzes under any circumstances.
- Makeup exams are not given unless prior permission has been granted due to extenuating circumstances.
- There are no extra credit points or do-overs in this class.
- You are expected to attend all classes, participate in discussions, and complete all assignments and quizzes on time.
- You are expected to follow the academic integrity policy of the university, and to avoid any form of cheating, plagiarism, or collusion. Any violation of the policy will result in a zero grade for the assignment, quiz, or exam, and may also lead to further disciplinary actions.
- You are expected to respect the instructor, the TA, and your fellow classmates, and to maintain a professional and courteous behavior in class and online. Any form of harassment, discrimination, or disruption will not be tolerated.
- You are encouraged to seek help from me if you have any questions or difficulties with the course material, assignments, or quizzes.
- You are responsible for checking your email, and eLearning regularly for any course-related announcements or updates.

Grading Policy

The grade will be based on a weighted score calculated by using the following table:

Exam I	15%
Exam II	10%
Exam III	25%
Assignments	20%
Project	20%
Participation/Quizzes	10%
	100%