Computer Architecture
CDA 4205, 3 Credits
Computer Science and Engineering – Spring 2022

Instructor: Md Rubel Ahmed (You can call me "Rubel", preferred)
Office: ENB 249A Office Hours: Thursdays 2:00pm - 5:00pm
Email: mdrubelahmed@usf.edu Phone: (813) 5705540
Classroom: SOC 150 Class Time: MW 5:00pm - 7:10pm
Course Webpage: ***myusf*** CANVAS system
TA: Jhon Doe Office Hour: ENB 249A Email: jhond@usf.edu

Welcome!

I welcome you to the Computer Architecture course. This course is your pathway to understand the ubiquitous computing systems around you. The goal of this course is to give you an advance level of understanding of the underlying computing system that will help you at least 1. Be a better programmer 2. Switch to computer engineering major 3. Take VLSI courses in the future and so on. This course includes several extensive projects will be working on in group/individual that amalgamates your programming as will as system level knowledge together. You will also be able to provide specification for an application specific computing system.

Course Objectives:
Upon successful completion of the course, student will be able to:

- Identify the basic parts of a computer system
- Develop a cost-effective computing system for specific application
- Quantitatively evaluate a computer architecture design
- Articulate the design issues of processor or other component
- Provide an efficient memory system for a cost/computation perspective
- Use different architecture and simulation tool
- Understand different technical papers on computer architecture published in top premier

Student Learning Outcomes:
Towards the end of the course, student should be able to:

- Describe key terminology like power, performance, area etc. of a system
- Write assembly code for RISC system
- Analyze and test x86 code on simulators
- Analyze the data path and control path an architecture
- Differentiate the performance bottleneck of a pipelined system
- Construct a multi-cache system for a given example problem

Prerequisite:
CDA3201 Logic Design Course with a grade of C or better is MANDATORY.

Required Textbook:
Computer Organization and Design - The Hardware/Software Interface
David A. Patterson and John L. Hennessy, Morgan Kaufman, 5th Edition

Chapter Outline:

Moore's law
Abstractions and Terminology
Performance

Instruction Set Architecture
Computer Arithmetic
Processor Data path and Control Design and Pipelining
Memory Hierarchy, Cache Memory Design
Multicores, Multiprocessing, Clusters, Clouds (*if time permits*)

Additional learning material will be uploaded on canvas if required and will be announced in the class as necessary.

Grading:

Test#1	25%	on 8th week	Scale: 90% and above	- **A**
Test#2	35%	Final week	80-89%	- **B**
HW/Quiz	25%	weekly	70-79%	- **C**
Projects (2)	15%		60-69%	- **D**
			Less than 60%	- **F**

Projects
Two group projects will be assigned for the course. The number of members in each group will be determined after the add/drop week passed.

Software will be used in this course for is called *Mars Simulator*.

Mars is a lightweight interactive development environment (IDE) for programming in MIPS assembly language, intended for educational-level use with Patterson and Hennessy's Computer Organization and Design. You can download MARS from *softpedia*.
Link:

Deliverable: Zipped project file through *CANVAS*

HW/Quizzes
Quizzes will be online through *CANVAS*.
There will be homework in every other week of quiz. Quiz or homework material will be based on the topics covered throughout the week. HW/Quizzes are individual. Co-operation is encouraged for class and topic discussions, not during the time of working on the assignments.

Course Policies: Grades

- **Late Work Policy:**
  - The penalty for handing in an assignment late is a deduction equal to 20% of the assignment's maximum score per day (not just per weekday when the class is in session, this penalty is also assessed for off-day and holiday!), a weekend (Saturday through Sunday) counts as 2 (two) days for penalty-assessment purpose, a long-weekend (Friday through Monday) counts as 3 (three) days. The penalty is waived if you have an official university excuse as the reason for the lateness.
  - Homework submissions 3 days later than the deadline will not be accepted.
- **Group Work Policy:**
  - Everyone must take part in a group project.
  - All members of a group will receive the same score; that is, the project is assessed and everyone receives this score.
  - Everyone must take part in a group essay (see essay assignments below). The grading criteria are the same as the group project.
  - Once formed, groups cannot be altered or switched, except for reasons of extended hospitalization.
- **Regrade Policies**

- Regrade requests must be submitted, in writing, to the instructor within seven calendar days of either: (1) the date the graded material is returned in class or (2) the date the grades are posted on Canvas, whichever occurs first.
- Regrade requests must be written on a separate sheet of paper and must be attached to your original submission.
- Regrade requests must specify the question(s) to be regraded. Regrade requests must include a brief description of why the question(s) should be regraded.
- The instructor reserves the right to regrade the entire submission.
- Graded material which has been modified in any way since it was returned to the student will not be regraded.

✧ **Final Examinations Policy**
All final exams are to be scheduled in accordance with the University's final examination policy.

Course Policies: Technology and Media

✧ **Canvas:**
This course will be offered via USF's learning management system (LMS), Canvas. If you need help learning how to perform various tasks related to this course or other courses being offered in Canvas, please view the following videos or consult the Canvas help guides. You may also contact USF's IT department at (813) 974-1222 or help@usf.edu.

Course Policies: Student Expectations

✧ **Homework Policies**
- All assignments are individual, and the final submission must be your own work.
- Homework submissions must be submitted electronically through Canvas and no hard copies will be accepted. Your handwriting must be legible, otherwise, loss of credits may be incurred and even not be graded with 0 for assignment.

✧ **Exam Policies**
- Exam 1 will be at the normal class meeting time.
- Requests for make-up examinations are not to be taken lightly. I will only make exceptions to this policy in case of excused absences. You must provide sufficient documentation to prove that your absence is excused.
- You must bring your University of South Florida identification card to each exam. The identification card will be verified during each exam.
- The dates provided for the exams are tentative. Changes to an exam date will be announced in-class at least one week prior to the exam.

✧ **Attendance Policies**
- Students are expected to attend all classes.
- You are responsible for all material presented during each lecture. Material presented during the lecture may not be in the textbook.
- Students who anticipate the necessity of being absent from class due to the observation of a major religious observance must provide notice of the date(s) to the instructor, in writing, by the second-class meeting.

✧ **Disability Access**
- Students with disabilities are responsible for registering with Students with Disabilities Services (SDS) to receive academic accommodations. SDS encourages students to notify instructors of accommodation needs

at least 5 business days prior to needing the accommodation. A letter from SDS must accompany this request.

- If you require extra time on exams due to your disability, you are required to make arrangements to take your exams with the SDS office. You will not receive extra time if you choose to take your exams with the course instructor.

✧ **Disruption to Academic Process:**
Disruptive students in the academic setting hinder the educational process. Disruption of the academic process is defined as the act, words, or general conduct of a student in a classroom or other academic environment which in the reasonable estimation of the instructor: (a) directs attention away from the academic matters at hand, such as noisy distractions, persistent, disrespectful or abusive interruption of lecture, exam, academic discussion, or general University operations, or (b) presents a danger to the health, safety, or well-being of self or other persons.

✧ **Academic Integrity of Students:**
Academic integrity is the foundation of the University of South Florida System's commitment to the academic honesty and personal integrity of its university community. Academic integrity is grounded in certain fundamental values, which include honesty, respect, and fairness. Broadly defined, academic honesty is the completion of all academic endeavors and claims of scholarly knowledge as representative of one's own efforts. The final decision on an academic integrity violation and related academic sanction at any USF System institution shall affect and be applied to the academic status of the student throughout the USF System, unless otherwise determined by the independently accredited institution.

✧ **Sexual Misconduct/Sexual Harassment Reporting:**
USF is committed to providing an environment free from sex discrimination, including sexual harassment and sexual violence (USF System Policy 0-004). The USF Center for Victim Advocacy and Violence Prevention is a confidential resource where you can talk about incidents of sexual harassment and gender-based crimes including sexual assault, stalking, and domestic/relationship violence. This confidential resource can help you without having to report your situation to either the Office of Student Rights and Responsibilities (OSSR) or the Office of Diversity, Inclusion, and Equal Opportunity (DIEO), unless you request that they make a report. Please be aware that in compliance with Title IX and under the USF System Policy, educators must report incidents of sexual harassment and gender-based crimes including sexual assault, stalking, and domestic/relationship violence. If you disclose any of these situations in class, in papers, or to me personally, I am required to report it to OSSR or DIEO for investigation. Contact the USF Center for Victim Advocacy and Violence Prevention: (813) 974-5757.

✧ **Professionalism Policy:**
Per university policy and classroom etiquette; mobile phones, iPods, etc. **must be silenced** during all classroom and lab lectures. Those not heeding this rule will be asked to leave the classroom/lab immediately so as to not disrupt the learning environment. Please arrive on time for all class meetings. Students who habitually disturb the class by talking, arriving late, etc., and have been warned may suffer a reduction in their final class grade.

✧ **End of Semester Student Evaluations:**
All classes at USF make use of an online system for students to provide feedback to the University regarding the course. These surveys will be made available at the end of the semester, and the University will notify you by email when the response window opens. Your participation is highly encouraged and valued.

✧ **Campus Emergencies:**
In the event of an emergency, it may be necessary for USF to suspend normal operations. During this time, USF may opt to continue delivery of instruction through methods that include but are not limited to: Canvas, Elluminate, Skype, and email messaging and/or an alternate schedule. It's the responsibility of the student to monitor the Canvas site for each class for course specific communication, and the main USF, college, and department websites, emails, and MoBull messages for important general information.

Tentative Schedule

Week #	Date	Contents
1	Jan. 7 – Jan. 11	Syllabus, Introduction, CPU Performance,
2	Jan. 14 – Jan. 18	Instruction Set Architecture
3	Jan. 21 – Jan. 25	MIPS Assembly Language Programming (No Class on Monday)
4	Jan. 28 – Feb. 1	MIPS Assembly Language Programming II
5	Feb. 4 – Feb. 8	Procedures and the Runtime Stack
6	Feb. 11 – Feb. 15	Integer Multiplication and Division
7	Feb. 18 – Feb. 22	Floating-point Project 1 due
8	**Feb. 25 – Mar. 1**	**Review & Exam 1 (Chapter 1 – 3, Appendix A)** **Complete mid-term Evaluation**
9	Mar. 4 – Mar. 8	Single-Cycle Datapath and Control Design
10	**Mar. 11 – Mar. 15**	**Spring Break**
11	Mar. 18 – Mar. 22	Single-Cycle Datapath and Control Design II
12	Mar. 25 – Mar. 29	Pipelined Datapath and Control
13	Apr. 8 – Apr. 12	Exceptions and Interrupts
14	Apr. 15 – Apr. 19	Memory System Design
15	Apr. 22 – Apr. 26	Review (Apr. 25 & 26 Reading Days, No classes) Project 2 due
16	**Apr. 27 – May 2**	**Final Exam: 7:30 am – 9:30 am, Monday, Apr. 29**

N.B: Dates are subject to change on inevitable circumstances.

Important Dates to Remember

Jan. 11	Friday	Drop/Add ends, fee liability/tuition payment deadline
Feb. 27	Wednesday	Exam 1
Mar. 23	Saturday	Last day to withdraw without refund & no academic penalty
Apr. 29	Monday	Final Exam