California State University Stanislaus
Department of Computer Science
Syllabus

Instructor: Dr. Xuejun Liang
My Office: DBH 282
Office Hours: MW 1:00 p.m.-2:00 p.m. & Th 11:00 a.m.-12:00 a.m.
ZOOM Meeting ID: 4438930033, Phone: (209) 667-3169, Email: xliang@csustan.edu

Class Information:

Classroom: Bizzini 102 / Online
Class Date & Time: MWF 2:00 p.m.- 2:50 p.m.
Class Website: https://www.cs.csustan.edu/~xliang/Courses/CS3740-23F

Hybrid In-Person & Online - Synchronous. In-person class meetings will be on campus at the room, day, and time listed. Online class meetings will be at the day and time listed. On-camera participation may be required.

Catalog Description:

CS3740: Computer Organization. (3 Units) Pre-requisites: CS 2700. Instruction set architecture design, digital logic techniques, cache memory, virtual memory, I/O architectures and devices, computer performance enhancements. Selected topics on embedded systems, parallel computer architecture and processing approaches.

Textbook:

The Essentials of Computer Organization and Architecture, Fifth Edition, by Linda Null and Julia Lobur, Jones & Bartlett Learning, 2019

Computer Architecture Simulator:

Computer Architecture Simulators for Different Instruction Formats

References:

1. Computer Organization and Design: The Hardware/Software Interface, 4/e, David A. Patterson and John L. Hennessy, Morgan Kaufmann Publishers, 2008
2. Structured Computer Organization (6th Edition), Andrew S. Tanenbaum, Prentice Hall, 2012

Course Outcomes:

After successful completion of this course, students will be able to:

1. Describe the organizations of a computer, its major functional units, its instruction set, its instruction formats, its instruction execution, as well as interrupts and I/O operations, and translate assembly instructions into object codes.
2. Describe memory hierarchy, cache memory, and virtual memory, and compute the cache miss ratio and the effective memory access time for a simple program, and the physical address for a given virtual address.
3. Describe I/O architectures, I/O bus operations, magnetic disks, solid state drives, optical disks, magnetic tape, and redundant array of independent disks (RAID), and compute the disk capacity and performance.

4. Become familiar with the functions provided by operating systems and programming tools. Understand the role played by each software component in maintaining the integrity of a computer system and its data.
5. Understand Flynn's taxonomy and describe models, structures, and techniques used for organizations of parallel and multiprocessor architectures and interconnection networks.
6. Describe the processes and practices of embedded hardware design and understand key concepts and tools for embedded software development.
7. Evaluate computer performance by using quantitative approaches, including Amdahl's law, and describe common benchmarks and their limitations.

Course Outline* (Major Topics and Weekly Schedule)

Date	Topics Covered	Chapters
Week 1: 08/21, 08/23, 08/25	Introduction of the class, syllabus, ISA Review: Instruction Formats, Instruction Types	Chapter 5
Week 2: 08/28, 08/30, 09/01	ISA Review: Addressing, Instruction Pipelining Real-World Examples of ISAs	Chapter 5
Week 3: 09/06, 09/08	Computer Simulators Programming Project 1: Using Simulators	
Week 4: 09/11, 09/13, 09/15	Memory: Types of Memory, The Memory Hierarchy	Chapter 6
Week 5: 09/18, 09/20, 09/22	Cache Memory: Placement, Replacement, effective access time, cache access policy	Chapter 6
Week 6: 09/25, 09/27, 09/29	Virtual Memory: address translation, page table, TLB, segmentation, fragmentation, A Real-World Example Test #1 (Chapter 5 and 6)	Chapter 6
Week 7: 10/02 10/04, 10/06	I/O and Performance, Amdahl's Law, I/O Architectures, Data Transmission Modes, Disk Technology: Rigid Disk Drives, Solid State Drives.	Chapter 7
Week 8: 10/09 10/11, 10/13	Optical Disks, Magnetic Tape, RAID, The Future of Data Storage.	Chapter 7
Week 9: 10/16, 10/18, 10/20	Operating Systems, Protected Environments, Programming Tools, Java: All of the Above Programing Project 2: Modifying Simulators	Chapter 8
Week 10: 10/23, 10/25, 10/27	RISC Machines, Flynn's Taxonomy, Parallel and Multiprocessor Architectures. Alternative Parallel Processing Approaches, Quantum Computing. Test #2 (Chapter 7, 8 and 9)	Chapter 9
Week 11: 10/30, 11/01, 11/03	Overview Embedded Hardware, Overview Embedded Software.	Chapter 10
Week 12: 11/06 11/08	Computer Performance Equations, Mathematical Preliminaries, Benchmarking.	Chapter 11
Week 13: 11/13, 11/15, 11/17	CPU Performance Optimization, User code optimization, Disk Performance	Chapter 11
	Thanksgiving	
Week 14: 11/27, 11/29, 12/01	Pipelining: Instruction-Level Parallelism, Basic Performance Issues in Pipelining, Pipeline Hazard, Minimizing Data Hazard Stalls by Forwarding. Branch Penalty, Delayed Branch, Scheduling the Branch Delay Slot, Dynamic Branch Prediction	

Week 15: 12/04, 12/06, 12/08	Test #3 (Chapter 10 and 11, and processor pipelining). Review for the final	
Week 16: 12/11, 12/13, 12/15	Final Examination Schedule https://www.csustan.edu/class-schedule/finals-schedule/	

* It is subject to change.

Grading Scale will be assigned on a standard scale as below

A	B	C	D	F
90-100	75-89	60-74	45-59	<45

Clustering of grades may cause the grading scale to be lowered (to your benefit), but it will not be raised.

Evaluation:

The overall course grade will be the weighted sum of the points earned in the following categories:

Homework	Projects	Tests	Final Exam
30%	10%	30%	30%

Other Polices:

1. I will accept the late homework assignments for maximum three days (including holidays) with the point deduction 20% per day.
2. There will be no makeup tests except in a verified emergency with immediate notification.

Academic Honesty:

The work you do for this course will be your own, unless otherwise specified. You are not to submit other people's or machine's work and represent it as your own. I consider academic honesty to be at the core of the University's activities in education and research. Academic honesty is expected at all times in this course.

Accommodations for Students with Disabilities

Students with disabilities seeking academic accommodations must first register with the Disability Resource Services (DRS) program, located in MSR 210, ph. (209) 667-3159. Students are encouraged to talk with the instructor regarding their accommodation needs after registering with DRS.