CSE 3421: Introduction to Computer Architecture

Course Description

Organization of hardware and software in modern computer systems, including instruction set design, processor control, ALU design, pipelining, multicores and accelerators, and memory subsystem design.

Prior Course Number: CSE 675.01, CSE 675.02
Transcript Abbreviation: Intr Comput Arch
Grading Plan: Letter Grade
Course Deliveries: Classroom
Course Levels: Undergrad
Student Ranks: Junior
Course Offerings: Autumn, Spring
Flex Scheduled Course: Never
Course Frequency: Every Year
Course Length: 14 Week
Credits: 3.0
Repeatable: No
Time Distribution: 3.0 hr Lec
Expected out-of-class hours per week: 6.0
Graded Component: Lecture
Credit by Examination: No
Admission Condition: No
Off Campus: Never
Campus Locations: Columbus
Prerequisites and Co-requisites: (CSE 2231 or CSE 321) and (CSE 2421 or CSE 360 or ECE 2560 or ECE 265) and (ECE 2000 or ECE 261)
Exclusions: Not open to students with credit for CSE 5421 or CSE 675.01 or CSE 675.02
Cross-Listings:

Course Rationale: Existing course.

The course is required for this unit's degrees, majors, and/or minors: No
The course is a GEC: No
The course is an elective (for this or other units) or is a service course for other units: Yes

Subject/CIP Code: 14.0901
Subsidy Level: Baccalaureate Course

Programs

Abbreviation	Description
BS CSE	BS Computer Science and Engineering

Course Goals

Be competent with performance tradeoffs in computer architecture, especially as they relate to processor and memory design.
Be competent with the architectural components of a computer, especially the memory hierarchy and processor.
Be familiar with the design principles underlying modern instruction sets.
Be familiar with the RISC/MIPS programming
Be exposed to the structure of a processor cache

Be exposed to multicores, multiprocessors, clusters/datacenters, and IO subsystems
Be exposed to the architectures underlying modern computer systems

Course Topics

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
State of the art in computer architecture, Moore's law, and the power wall	1.0							
Quantifying performance and power tradeoffs	2.0							
Design of instruction set architectures	6.0							
Digital logic and circuit design	3.0							
Architecture and design of memory, such as SRAM and DRAM	3.0							
Design of integer arithmetic logic unit (ALU)	3.0							
Floating point representation and arithmetic	3.0							
Processor design: non-pipelined and pipelined	9.0							
Advanced topics in memory hierarchy, such as cache lines, associativity, and cache coherence	4.0							
Multicores, multiprocessors, interconnects, I/O subsystems, and clusters/data centers	5.0							
Realization of architecture concepts in real systems	3.0							

Grades

Aspect	Percent
Homework	30%
Midterm	30%
Final	40%

Representative Textbooks and Other Course Materials

Title	Author
Computer Organization & Design: The Hardware/Software Interface	D.A. Patterson & J.L. Hennessy

ABET-EAC Criterion 3 Outcomes

Course Contribution		College Outcome
***	a	An ability to apply knowledge of mathematics, science, and engineering.
*	b	An ability to design and conduct experiments, as well as to analyze and interpret data.
**	c	An ability to design a system, component, or process to meet desired needs.
	d	An ability to function on multi-disciplinary teams.
**	e	An ability to identify, formulate, and solve engineering problems.
	f	An understanding of professional and ethical responsibility.
	g	An ability to communicate effectively.
	h	The broad education necessary to understand the impact of engineering solutions in a global and societal context.
*	i	A recognition of the need for, and an ability to engage in life-long learning.
**	j	A knowledge of contemporary issues.

Course Contribution		College Outcome
*	k	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

BS CSE Program Outcomes

Course Contribution		Program Outcome
***	a	an ability to apply knowledge of computing, mathematics including discrete mathematics as well as probability and statistics, science, and engineering;
*	b	an ability to design and conduct experiments, as well as to analyze and interpret data;
**	c	an ability to design, implement, and evaluate a software or a software/hardware system, component, or process to meet desired needs within realistic constraints such as memory, runtime efficiency, as well as appropriate constraints related to economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability considerations;
	d	an ability to function on multi-disciplinary teams;
**	e	an ability to identify, formulate, and solve engineering problems;
	f	an understanding of professional, ethical, legal, security and social issues and responsibilities;
	g	an ability to communicate effectively with a range of audiences;
	h	an ability to analyze the local and global impact of computing on individuals, organizations, and society;
*	i	a recognition of the need for, and an ability to engage in life-long learning and continuing professional development;
**	j	a knowledge of contemporary issues;
*	k	an ability to use the techniques, skills, and modern engineering tools necessary for practice as a CSE professional;
*	l	an ability to analyze a problem, and identify and define the computing requirements appropriate to its solution;
**	m	an ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices;
*	n	an ability to apply design and development principles in the construction of software systems of varying complexity.

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