CSE 2421 (Approved): Systems I: Introduction to Low-Level Programming and Computer Organization

Course Description

Introduction to computer architecture at machine and assembly language level; pointers and addressing; C programming at machine level; computer organization.

Prior Course Number: CSE 360 and CSE 459.21
Transcript Abbreviation: Sys I: Comput Org
Grading Plan: Letter Grade
Course Deliveries: Classroom
Course Levels: Undergrad
Student Ranks: Sophomore, Junior
Course Offerings: Autumn, Spring, Summer
Flex Scheduled Course: Never
Course Frequency: Every Year
Course Length: 14 Week
Credits: 4.0
Repeatable: No
Time Distribution: 3.0 hr Lec, 1.0 hr Lab
Expected out-of-class hours per week: 8.0
Graded Component: Lecture
Credit by Examination: No
Admission Condition: No
Off Campus: Never
Campus Locations: Columbus
Prerequisites and Co-requisites: (CSE 1232 or CSE 1233 or CSE 2231 or CSE 321) and (CSE 2321 or Math 2566 or Math 366)
Exclusions: Not open to students with credit for CSE 360
Cross-Listings:

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

Subject/CIP Code: 14.0901
Subsidy Level: Baccalaureate Course

Programs

Abbreviation	Description
BS CSE	BS Computer Science and Engineering

Course Goals

To master programming with pointers in C
To be competent with application development and debugging in Unix environments
To be competent in programming with dynamic data structures in C, and in using C string and I/O features, bit operations, and function pointers
To be familiar with overall organization and design of computer systems
To be competent with representation and manipulation of information in computer systems

To be familiar with machine encoding of instructions, and be competent with a particular real or hypothetical instruction set
To be familiar with programming in assembly language
To be familiar with Linking (static linking, relocatable object files, symbols and symbol tables, symbol resolution, relocation, loading executable object files)

Course Topics

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
Transitioning from Java to C, Basic C syntax, working in Unix Environments	6.0		2.0					
C pointers and memory allocation/deallocation. Programming dynamic data structures with C (linked lists, arrays, including multi-dimensional arrays accessed through pointers, trees), string manipulation, pointer casting, null/void pointers.	6.0		2.0					
Other misc C features: I/O operations, bit operations, function pointers, command line argument passing	3.0		1.0					
Debugging in Unix with gdb/xgdb, Use of Makefile, Other Unix features	3.0		2.0					
Introduction to Computer Systems Organization	3.0							
Representation and manipulation of information (information storage, integer representation, integer arithmetic, floating point)	6.0		2.0					
Machine level representation of programs (program encoding, data formats, accessing information, arithmetic and logical operations, control, procedures, array allocation and access, alignment)	9.0		2.0					
Programming with an assembly language: simple use of registers and arithmetic operations, conditionals and loops, accessing arrays in assembly, procedure calls in assembly.	3.0		3.0					
Linking (static linking, relocatable object files, symbols and symbol tables, symbol resolution, relocation, loading executable object files	3.0							

Representative Assignments

Introductory C programming (for students with 2 semesters of advanced programming)
Dynamic data structure based programming in C
Use of command line argument passing and function pointers, advanced string/buffer manipulation
Using bit operations in C to simulate hardware computer arithmatic algorithms
Introductory assembly programming

Grades

Aspect	Percent
Programming Assignments (6-7)	35%
Written Assignments	10%
Mid-term	20%
Final Exam	35%

Representative Textbooks and Other Course Materials

Title	Author
Computer Systems: A Programmer's Perspective	Bryant and O'Hallaron
Pointers with C	Kenneth Reek

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.
**	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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