



Lahore University of Management Sciences

CS-225 – Fundamentals of Computer Systems

Fall 2023

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Course URL (if any)	LMS will be used
Support Services	LUMS offers a range of academic and other services to support students. These are mentioned below, and you are encouraged to use these in addition to in-class assistance from course staff. For a complete list of campus support services available for you click here (https://advising.lums.edu.pk/#supportservices)

Course Basics				
Credit Hours	4			
Lecture(s)	Nbr of Lec(s) Per Week	2	Duration	100 min
Recitation/Lab (per week)	Nbr of Lec(s) Per Week		Duration	
Tutorial (per week)	Nbr of Lec(s) Per Week		Duration	

Course Distribution	
Core	BS CS (Equivalent to CS320+CS320L)
Elective	
Open for Student Category	All
Close for Student Category	

COURSE DESCRIPTION	
We discuss how computers operate at fairly low-level of abstraction and then discuss how computer systems build as layers and layers of abstraction. After taking this course, you will know the components of a computer and how do they fit together. How do computers do arithmetic and how does the code you write actually execute? How does a program in a high level language like C get translated into a form the machine can execute? How can you write code that is likely to execute efficiently? How is information stored and accessed? How does your program access existing "libraries"?	

COURSE PREREQUISITE(S)	
•	CS 100

COURSE OBJECTIVES	
•	Study the fundamental concepts of computer systems, including logic design, processor architecture, assembly language, and memory systems.
•	Understand how application programmers can use the knowledge of the underlying system to write better programs.

Grading Breakup and Policy	
Assignment(s) (4-5): 20% Homework: Quiz(s) (5-6): 20% Class Participation: Attendance: Midterm Examination: 25% Project: Final Examination: 35%	



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Examination Detail	
Midterm Exam	Yes/No: Yes Combine Separate: Combine Duration: 75 – 90 min Preferred Date: TBA Exam Specifications: TBA
Final Exam	Yes/No: Yes Combine Separate: Combine Duration: 150 – 180 min Exam Specifications: TBA

Assessed Course Learning Outcomes			
CLO	CLO Statement	Bloom's Cognitive Level	PLOs / Graduate Attributes (Seoul Accord)
CLO1	Describe how integers and floating-point numbers are stored in sign-magnitude and 2's-complement representations. [Familiarity]	C2	PLO2
CLO2	Describe the internal representation of non-numeric data, such as characters, strings, records, and arrays. [Familiarity]	C2	PLO2
CLO3	Explain different instruction formats and how to map high-level language constructs (For, Case, If Else, While, Procedure Calls, etc.) onto assembly/machine language snippets. [Familiarity]	C2	PLO3
CLO4	Write assembly language programs to solve small problems. [Usage]	C4	PLO4
CLO5	Build basic building blocks of a computer (ALU, Register File, Multiplexers, FSMs, etc.) [Usage]	C3	PLO4
CLO6	Design and implement a complete pipelined processor taking care of pipeline hazards. [Usage]	C4	PLO5
CLO7	Explain memory hierarchy and locality of reference and its impact on performance. [Familiarity]	C2	PLO2

Campus supports & Key university policies
<p><u>Campus Supports</u></p> <p>Students are strongly encouraged to meet course instructors and TA's during office hours for assistance in course-content, understand the course's expectations from enrolled students, etc. Beyond the course, students are also encouraged to use a variety of other resources. (Instructors are also encouraged to refer students to these resources when needed.) These resources include Counseling and Psychological Services/CAPS (for mental health), LUMS Medical Center/LMC (for physical health), Office of Accessibility & Inclusion/ OAI (for long-term disabilities), advising staff dedicated to supporting and guiding students in each school, online resources (https://advising.lums.edu.pk/advising-resources), etc. To view all support services, their specific role as well as contact information click here (https://advising.lums.edu.pk/#supportservices).</p> <p><u>Academic Honesty/Plagiarism</u></p> <p>LUMS has zero tolerance for academic dishonesty. Students are responsible for upholding academic integrity. If unsure, refer to the student handbook and consult with instructors/teaching assistants. To check for plagiarism before essay submission, use similarity@lums.edu.pk. Consult the following resources: 1) Academic and Intellectual Integrity (http://surl.li/gpvwb), and 2) Understanding and Avoiding Plagiarism (http://surl.li/gpvwo).</p> <p><u>LUMS Academic Accommodations/ Petitions policy</u></p> <p>Long-term medical conditions are accommodated through the Office of Accessibility & Inclusion (OAI). Short-term emergencies that impact studies are either handled by the course instructor or Student Support Services (SSS). For more information, please see Missed Instrument or 'Petition' FAQs for students and faculty (https://rb.gy/8sj1h)</p>



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LUMS Sexual Harassment Policy

LUMS and this class are a harassment-free zone. No behavior that makes someone uncomfortable or negatively impacts the class or individual's potential will be tolerated.

To report sexual harassment experienced or observed in class, please contact me. For further support or to file a complaint, contact OAI at oai@lums.edu.pk or harassment@lums.edu.pk. You may choose to file an informal or formal complaint to put an end to the offending behavior. You can also call their Anti-Harassment helpline at 042-35608877 for advice or concerns. *For more information: Harassment, Bullying & Other Interpersonal Misconduct: Presentation* (<http://surl.li/qpvwt>)

COURSE OVERVIEW			
Lecture	Topics	Related Book Chapters	Related CLO
1.	Introduction	(Ch 1)	CLO1, CLO2
2.	Information Storage	(Ch 2.1-2.2)	
3.			
4.	Integer operations	(Ch 2.3)	
5.			
6.	Floating point operations	(Ch 2.4)	
7.			
8.	Program encodings	(Ch 3.1-3.3)	CLO3, CLO4
9.	Data movement and arithmetic	(Ch 3.4-3.5)	
10.	Control flow	(Ch 3.6)	
11.	Procedures	(Ch 3.7)	
12.	Arrays and structures	(Ch 3.8-3.9)	
13.	Buffer overflow	(Ch 3.10)	
14.			
15.	Midterm Exam		
16.	Instruction set architecture	(Ch 4.1)	CLO5 – CLO6
17.	Logic Design	(Ch 4.2)	
18.			
19.	Sequential processor design	(Ch 4.3)	
20.			
21.	Pipelining	(Ch 4.4)	
22.			
23.	Pipelined processor design	(Ch 4.5)	
24.	Stalls and Bubbles	(Ch 4.5)	
25.			
26.	Memory Hierarchy and locality of reference	(Ch 6.1-6.3)	CLO7
27.	Introduction to cache design	(Ch 6.4)	
28.	Cache friendly code	(Ch 6.5-6.6)	
	Final Exam		

Textbook(s)/Supplementary Readings

Textbook:

“Computer Systems, A Programmer's Perspective” by Randal E. Bryant and David O'Hallaron, Prentice Hall, 2016 (3rd Edition)

Supplementary Reading:

Hand-outs and online links will be provided where needed

Prepared by:

Dr. Jahangir Ikram and Dr. Adeel Pasha (Instructors CS-225)

Date:

Updated: June 23, 2023