Lahore University of Management Sciences
CS300 – Advanced Programming
Spring 2024

Subject to Change

COURSE DESCRIPTION
This is the third course in a serious of undergraduate courses on programming. Compared to introductory programming courses, this course is concerned with systematically solving a complex problem, rather than learning to express a solution without ambiguity. Several programming languages are covered in the course so there is a lot of new syntax, however, the focus is on breaking down problems using abstraction and top-down design. Each language provides its own abstractions, and this provides additional vocabulary and shapes the thought process that is useful even in languages not taught in the course.

COURSE DISTRIBUTION	
Core	Yes
Elective	No
Open for Student Category	---
Closed for Student Category	---

COURSE PREREQUISITE(S)/CO-REQUISITE(S)
Pre-requisites: ---
Co-requisites: ---

COURSE OFFERING DETAILS				
Credit Hours	3			
Lecture(s)	Nbr of Lec(s) Per Week	2	Duration	75
Recitation/Lab (per week)	Nbr of Lec(s) Per Week	0	Duration	
Tutorial (per week)	Nbr of Lec(s) Per Week	0	Duration	

Instructor	Waqar Ahmad
Room No.	SBASSE 9-G22A
Office Hours	Mon and Wed 2:30 –3:30pm
Email	waqar.ahmad@lums.edu.pk
Telephone	---
Secretary/Coordinator/TA	---
TA Office Hours	---
Course URL (if any)	---

COURSE TEACHING METHODOLOGY
• Synchronous

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)	
PEO-01	Demonstrate excellence in profession through in-depth knowledge and skills in the field of Computing.
PEO-02	Engage in continuous professional development and exhibit quest for learning.
PEO-03	Show professional integrity and commitment to societal responsibilities.

COURSE LEARNING OUTCOMES (CLOs)

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CS300-	The students should be able to:
CLO1:	Understand and use various programming models including functional programming, even-driven programing, client-server programming distributed programming.
CLO2:	Design algorithm and implement the program code in an appropriate programming model.
CLO3:	Evaluate correctness of the proposed solution.
CLO4:	Apply relevant standard and ethical considerations to writing computing programs.

CLO	CLO Statement	Bloom's Cognitive Level	PLOs/Graduate Attributes (Seoul Accord)
CLO1	Understand and use various programming models including functional programming, even-driven programing, client-server programming distributed programming.	C2, C3	PLO2, PLO3, PLO4
CLO2	Design algorithm and implement the program code in an appropriate programming model.	C3, C4	PLO5
CLO3	Evaluate correctness of the proposed solution.	C5	PLO7, PLO8
CLO4	Apply relevant standard and ethical considerations to writing computing programs.	C6	PLO8, PLO9

Grading Breakup and Policy:

Assessment	Weight (%)	Related CLOs	ACM Recommended Disposition
Assignments: 40% (1x10+2x15)	40%	CLO2, CLO3, CLO4	D3, D4, D7, D9
Midterm Examinations (on campus): 30% (1 x 10 + 2 x 15)	40%	CLO1, CLO2, CLO3	D4, D7, D9
Final Examination (on campus): 15%	15%	CLO1, CLO2, CLO3	D4, D7, D9
Quizzes: 5%	5%		

EXAMINATION DETAIL

Midterm Exam	Yes/No: Yes Combine Separate: ---- Duration: ---- Preferred Date: ---- Exam Specifications: ----
Final Exam	Yes/No: Yes Combine Separate: ---- Duration: ---- Exam Specifications: ----

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COURSE OVERVIEW				
Week/ Module/ Lecture	**Topics**	**Book Chapters/ Recommended Reading**	**Related CLOs**	**ACM Computing Knowledge Landscape**
Week 1	**Programming Paradigms** Imperative paradigms: procedural, object-oriented Declarative paradigm: functional, logic programming	``		
Week 2-5	**Functional Programming with Haskell** Programming without loops Programming without variables Abstracting computation Self-restraint using types Abstracting parameterized computation Abstracting groups of computations Abstracting computation chains Top-down design and abstraction	• Haskell, The Craft of Functional Programming, 3rd Edition by Simon Thompson • Haskell Programming from first principles by Christopher Allen etc. • Haskell from the very beginning by John Whitington • http://www.happylearnhaskelltutorial.com/contents.html • https://en.wikibooks.org/wiki/Haskell	CLO1-CLO4	
Midterm Exam—1: Saturday, 11-Feb-2023 (Tentative date)				
Week 6-9	**Event-driven Programming with TypeScript** Event-driven programming Programming with asynchronous operations Abstracting asynchronous completion — Events/Callbacks Abstracting asynchronous completion — Promises/Futures Abstracting asynchronous completion — Async/Await	•	CLO1-CLO4	
Midterm Exam—2: Saturday, 11-Mar-2023 (Tentative date)				
Week 10-12	**Client-server Programming with TypeScript** Abstracting network communication Asynchronous client server programming Asynchronous web programming The model and view abstractions Designing responsive and interactive applications Overview of full stack development		CLO1-CLO4	
Midterm Exam—3: Saturday, 8-Apr-2023 (Tentative date)				
Week 13-14	**Introduction to design patterns (if time permits)** Introduction to key software design principles: modularity, separation of concerns, abstraction, anticipation of change. Selected design patterns and their implementation: Observer, Factory, Singleton, Composite	• Design Patterns: Elements of Reusable Object-Oriented Software by Erich Gamma etc. • Head First Design Patterns: A Brain Friendly Guide by Eric Freeman etc.	CLO1-CLO4	
Final Exam				

TEXTBOOK/ SUPPLEMENTARY READINGS

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1. ----

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Harassment Policy
SSE, LUMS and particularly this class, is a harassment free zone. There is absolutely zero tolerance for any behaviour that is intended or has the expected result of making anyone uncomfortable and negatively impacts the class environment, or any individual's ability to work to the best of their potential. In case a differently-abled student requires accommodations for fully participating in the course, students are advised to contact the instructor so that they can be facilitated accordingly. If you think that you may be a victim of harassment, or if you have observed any harassment occurring in the purview of this class, please reach out and speak to the instructor. If you are a victim, I strongly encourage you to reach out to the Office of Accessibility and Inclusion at oai@lums.edu.pk or the sexual harassment inquiry committee at harassment@lums.edu.pk for any queries, clarifications, or advice. You may choose to file an informal or a formal complaint to put an end of offending behavior. You can find more details regarding the LUMS sexual harassment policy at: https://mgshss.lums.edu.pk/lums-harassment-policy. To file a complaint, please write to harassment@lums.edu.pk.
In addition to LUMS resources, SBASSE's Council on Belonging and Equity is committed to devising ways to provide a safe, inclusive and respectful learning environment for students, faculty and staff. To seek counsel related to any issues, please feel free to approach either a member of the council or email at cbe.sse@lums.edu.pk
Rights and Code of Conduct for Online Teaching
A misuse of online modes of communication is unacceptable. TAs and Faculty will seek consent before the recording of live online lectures or tutorials. Please ensure if you do not wish to be recorded during a session to inform the faculty member. Please also ensure that you prioritize formal means of communication (email, lms) over informal means to communicate with course staff.

[Comment: Please fill column-III, with appropriate information.]
Assignment Details:

Assignment Title	**Topics Covered**	**Description of skills, tools, platform, etc. (e.g., Programming in C/C++, MS Visual Studio, Windows/Linux)**	**Duration in Weeks**

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Appendix A
Bloom's Taxonomy

BLOOM's TAXONOMY*	
1 - Remember 2 - Understand 3 - Apply 4 - Analyze 5 - Evaluate 6 - Create	• Recall facts and basic concepts • Explain ideas or concepts • Use information in new situations • Draw connection among ideas • Justify a stand or decision • Produce new or original work

https://cft.vanderbilt.edu/guides-sub-pages/blooms-taxonomy/

Appendix B
ACM Dispositions Table - I

ACM Dispositions			
Element	**Elaboration**	**Element**	**Elaboration**
D1 Adaptable:	Flexible; agile, adjust in response to change	D7 Professional:	Professionalism, discretion, ethical, astute
D2 Collaborative:	Team player; willing to work with others	D8 Purpose-driven:	Goal driven, achieve goals, business acumen
D3 Inventive:	Exploratory; Look beyond simple solutions	D9 Responsible:	Use judgment, discretion, act appropriately
D4 Meticulous:	Attentive to detail; thoroughness, accurate	D10 Responsive:	Respectful; react quickly and positively
D5 Passionate:	Conviction, strong commitment, compelling	D11 Self-directed:	Self-motivated, determination, independent
D6 Proactive:	With initiative, self-starter, independent		

ACM Dispositions Table - II

Class Assessments and Proposed Dispositions												
Assessment Type	**D1 Adaptable**	**D2 Collaborative**	**D3 Inventive**	**D4 Meticulous**	**D5 Passionate**	**D6 Proactive**	**D7 Professional**	**D8 Purpose-driven**	**D9 Responsible**	**D10 Responsive**	**D11 Self-directed**	**Included**
Quiz				✓			✓		✓			Yes
Assignment-Individual			✓	✓			✓		✓			Yes
Assignment-Group		✓	✓	✓			✓		✓	✓		Yes
Project-Individual	✓		✓	✓	✓	✓	✓	✓	✓		✓	Yes
Project- Group	✓	✓	✓	✓	✓	✓	✓	✓	✓			Yes
Presentation-Individual				✓			✓		✓	✓	✓	Yes
Presentation-Group		✓		✓			✓		✓	✓		Yes
Labs-Individual			✓	✓			✓		✓			Yes
Labs- Group		✓	✓	✓			✓		✓	✓		Yes
Exams				✓			✓		✓			Yes
Included	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	

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Appendix C
ACM Computing Knowledge Landscape Table

ACM Computing Knowledge Landscape (CK)			
1. Users and Organizations	CK1.1: Social Issues and Professional Practice CK1.2: Security Policy and Management CK1.3: IS Management and Leadership CK1.4: Enterprise Architecture CK1.5: Project Management CK1.6: User Experience Design	**4. Software Development**	CK4.1: Software Quality, Verification and Validation CK4.2: Software Process CK4.3: Software Modeling and Analysis CK4.4: Software Design CK4.5: Platform-Based Development
2. Systems Modeling	CK2.1: Security Issues and Principles CK2.2: Systems Analysis & Design CK2.3: Requirements Analysis and Specification CK2.4: Data and Information Management	**5. Software Fundamentals**	CK5.1: Graphics and Visualization CK5.2: Operating Systems CK5.3: Data Structures, Algorithms and Complexity CK5.4: Programming Languages CK5.5: Programming Fundamentals CK5.6: Computing Systems Fundamentals
3. Systems Architecture and Infrastructure	CK3.1: Virtual Systems and Services CK3.2: Intelligent Systems (AI) CK3.3: Internet of Things CK3.4: Parallel and Distributed Computing CK3.5: Computer Networks	**6. Hardware**	CK6.1: Architecture and Organization CK6.2: Digital Design CK6.3: Circuits and Electronics CK6.4: Signal Processing