



## Lahore University of Management Sciences

### CS 100 – Computational Problem Solving

Spring 2024

**Subject to Change**

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Course URL (if any)	<a href="https://lms.lums.edu.pk">lms.lums.edu.pk</a>
Lecture	SBASSE Programming Studio Lab
Lab	SBASSE Programming Studio Lab

#### Course Teaching Methodology

- **Teaching Methodology:** Synchronous. Students will be guided to supplementary reading material as well.
- **Lecture Details:** Although the teaching methodology is going to be synchronous, however, occasionally, there may be pre-recorded lectures. In addition, links to related reference material available online from different sources will be provided from time to time.

#### Class Discussion Forum

- This term we will be using Slack for class discussion.
- The system is highly catered to getting you help fast and efficiently from classmates, the TA, and myself.
- Rather than emailing questions to the teaching staff (TAs), I encourage you to post your questions on class discussion board.
- Link to the class discussion board page will be provided later.

#### Course Basics

Credit Hours	3			
Lecture(s)	Nbr of Lec(s)	28-30	Duration	50 min each, twice a week
Recitation/Lab	Nbr of Lec(s)	0/14	Duration	2 hrs 50 min each, once a week
Tutorial	Nbr of Lec(s)	As per need	Duration	

#### Course Distribution

Core	Yes (for SBASSE students, CS Majors, CS minors)
Elective	Yes, can be taken as an elective
Open for Student Category	Freshmen, Sophomore
Close for Student Category	None

#### COURSE DESCRIPTION

This course provides a conceptual and practical introduction to programming. The focus is on programming rather than a particular choice of programming language, with general principles being brought out through



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the study of 'C/C++'. This course will equip students with tools and techniques to analyze, solve, and implement a given problem programmatically.

### COURSE PREREQUISITE(S)

None

### 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 OBJECTIVES (COs)

CO-01	To teach programming fundamentals to students.
CO-02	To help students analyze and solve programming problems.
CO-03	To prepare students in programming for later courses with programming intensive content.

### COURSE LEARNING OUTCOMES (CLOs)

At the successful completion of the course students will be able to:

CLO	Statement	Bloom's Cognitive Level	Graduate Student Attributes Seoul Accord
1.	<b><u>use</u></b> C++ syntax and control structures to <b><u>code</u></b> algorithmic solutions using standard coding conventions.	C1 Remembering	Enabling Knowledge
2.	<b><u>explain</u></b> key concepts of algorithmic design in written form.	C2 Understanding	Communication
3.	<b><u>apply</u></b> relevant standards and ethical considerations to writing computer programs.	C3 Applying	Responsibility
4.	<b><u>analyze</u></b> the requirements for solving simple algorithmic problems.	C4 Analyzing	Critical Thinking and Analysis
5.	<b><u>evaluate</u></b> the correctness of the proposed solution.	C5 Evaluating	Critical Thinking and Analysis
6.	<b><u>design</u></b> and <b><u>implement</u></b> programs to solve simple algorithmic computing problems, based on the analysis of the requirements.	C6 Creating	Problem Solving



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Grading Breakup and Policy			
Assessment	Description	Weight (%)	CLO
<b>Quizzes</b>	There will be 8 to 10 quizzes. Two quizzes will be dropped. No petitions will be accepted.	20%	1 - 5
<b>Labs</b>	There are 14 lab sessions. Out of these first 2 to 3 labs will be conducted as guided labs. Next 11 to 12 labs will be evaluated. Two labs will be dropped No petitions will be accepted.	20%	6
<b>Project</b>	A programming project will be assigned in the last month of the semester. No petitions will be accepted.	10%	1 - 5
<b>Mid Term Exam</b>	One mid-term exam will be conducted. Exam will not be dropped. Petitions will be accepted only via OSA. Mode: In-class Duration: 50~90 mins (May vary) Preferred Date: Expected in the 7th week Exam Specifications: Closed book, Close notes, No calculator. No cell phones.	20%	1 - 5
<b>Final Exam</b>	Final exam will cover whole course content. Exam will not be dropped. Petitions will be accepted only via OSA. Duration: 120~180 mins (May vary) Exam Specifications: Closed book, Close notes, No calculator. No cell phones.	30%	1 - 5
<ul style="list-style-type: none"> <li>You are supposed to do labs alone. Any kind of collaboration, except for discussing what was taught in the class is strictly prohibited.</li> <li>Your labs, assignments, and projects may be checked for plagiarism via MOSS (<a href="https://theory.stanford.edu/~aiken/moss/">https://theory.stanford.edu/~aiken/moss/</a>).</li> <li>In case any work is found plagiarized you may be awarded a zero. In addition, your case of cheating will be reported to the Disciplinary Committee.</li> </ul>			

Examination Detail	
<b>Midterm Exam</b>	Yes/No: Yes Duration: 50~90 mins (May) Preferred Date: Expected in the 7 <sup>th</sup> week Exam Specifications: Closed Book, Closed Notes, No Calculator, No cell phones.
<b>Final Exam</b>	Yes/No: Yes Duration: 120~180 mins (May vary if taken online) Exam Specifications: Closed Book, No Calculator. No cell phones.



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### Makeup Policy

- Please refer to Student Handbook 2019-20, page 37, article 25, titled “Makeup Policy for Graded Instruments”.
- “In case N-X policy is implemented for an instrument having multiple sub instruments then petitions will not be accepted for that instrument”.

### Code of Conduct

1. Students are required show up in class fully prepared for the lecture, ensure their videos and mic’s are muted.
2. Quiz’s will be announced ahead of time, students must ensure their devices are charged and they have a stable internet connection (including smartphones).
3. All assessments including quizzes, labs and tests will be timed. Make sure that you are able to start them on time.

### COURSE OVERVIEW (TENTATIVE, THE ACTUAL SEQUENCE MAY BE DIFFERENT DURING THE COURSE OF THE SEMESTER)

Module	Recommended Readings - CFE	Topics	Objectives/(CLO )
1	1.5 2.1-2.2	<ul style="list-style-type: none"> <li>• Intro to the IDE. Edit-(preprocess)-compile-link-run cycle.</li> <li>• Tokens (keywords, identifiers, literals, operators, punctuation, and white-space).</li> <li>• Hello World program.</li> <li>• Statements, expressions, values and types.</li> </ul>	CLO1-CLO6
2	2.1-2.2	<ul style="list-style-type: none"> <li>• Variables, operators, assignment operator, precedence.</li> </ul>	CLO1-CLO6
3	2.5	<ul style="list-style-type: none"> <li>• Strings</li> </ul>	CLO1-CLO6
4	3.1, 3.3, 3.4, 3.7	<ul style="list-style-type: none"> <li>• Control: if, blocks. Program formatting, comments. Relational and Logic operators. Nesting ifs. Else.</li> <li>• Variable scoping</li> <li>• I/O, error messages, types of errors, debugging using print.</li> </ul>	CLO1-CLO6
5	4.1, 4.2	<ul style="list-style-type: none"> <li>• Repeating by using copy-paste (Code clones).</li> <li>• Programming to reduce redundancy</li> <li>• Loops: <i>While</i>. Counting using while.</li> <li>• Debugger: Stepping through a loop.</li> </ul>	CLO1-CLO6
	4.3-4.8	<ul style="list-style-type: none"> <li>• Loops: <i>For</i>. Converting <i>for</i> to <i>while</i> and back.</li> <li>• Unrolling loops to understand, and for speed.</li> <li>• Creating loops where there are differences in what is to be done using <i>if</i>.</li> <li>• Nesting loops. Nesting other control structures.</li> </ul>	CLO1-CLO6
	4.3-4.8	<ul style="list-style-type: none"> <li>• Loops: More practice.</li> <li>• <i>break, continue</i>.</li> </ul>	CLO1-CLO6
6	5.1-5.5	<ul style="list-style-type: none"> <li>• Functions. More types, <i>return, void</i></li> <li>• <i>Functions. Recursion</i></li> </ul>	CLO1-CLO6
7	6.1-6.3	<ul style="list-style-type: none"> <li>• Arrays, pointers</li> <li>• Pass by value, pass by reference, pass by address.</li> </ul>	CLO1-CLO6
8	7.7	<ul style="list-style-type: none"> <li>• <i>Structures (If time permits)</i> <ul style="list-style-type: none"> <li>○ <i>Struct</i></li> <li>○ <i>Class</i></li> </ul> </li> </ul>	CLO1-CLO6



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COURSE OVERVIEW (TENTATIVE, THE ACTUAL SEQUENCE MAY BE DIFFERENT DURING THE COURSE OF THE SEMESTER)				
Module	Week	Lecture	Topic	Recommended Readings - CFE
1.	1	1.	Introduction	Ch-01
		2.	ASCII Code	Ch-01
	2	3.	Programming Environment	Ch-01
		4.	Fundamental Data Types	Ch-02
2.	3	5.	Operators	Ch-03
		6.	Operators	Ch-03
	4	7.	Operators	Ch-03
3.		8.	Strings	Ch-02, 03, 07
	5	9.	Strings	Ch-02, 03, 07
4.		10.	Decision Statements	Ch-03
	6	11.	Decision Statements	Ch-03
		12.	Switch Statement	Ch-03
5.	7	13.	Loops – while, do..while	Ch-04
		14.	Loops – for	Ch-04
	8	15.	Loops – Nested for	Ch-04
		16.	Mid Term	
6.	9	17.	Functions	Ch-05
		18.	Functions	Ch-05
	10	19.	Functions – Reference Parameters	Ch-05
		20.	Functions – Recursion	Ch-05
7.	11	21.	Arrays	Ch-06
		22.	Arrays – 2D	Ch-06
	12	23.	Pointers	Ch-07
		24.	Pointers	Ch-07
	13	25.	Pointers	Ch-07
8.		26.	Structures (if time permits)	Ch-07
	14	27.	Structures (if time permits)	Ch-07
		28.	Recap	
	15	29.		
		30.		

### Textbook

The textbook using which we will be covering most of the topics will be:

- **[CFE] C++ for Everyone, (2nd Edition), Cay Horstmann, San Jose State University,**
- <http://bcs.wiley.com/he-bcs/Books?action=index&bcsId=6146&itemId=0470927135>
- [http://www.ebooksbucket.com/uploads/itprogramming/cplus/Cplusplus\\_for\\_Everyone\\_2nd\\_Edition.pdf](http://www.ebooksbucket.com/uploads/itprogramming/cplus/Cplusplus_for_Everyone_2nd_Edition.pdf)
- <http://horstmann.com/cpp4everyone.html>
- <http://www.chegg.com/homework-help/c-for-everyone-2nd-edition-solutions-9780470927137>
- [https://horstmann.com/cpp4everyone/CFE\\_CodingGuidelines.html](https://horstmann.com/cpp4everyone/CFE_CodingGuidelines.html)



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### Reference/Supplementary Readings

#### Reference Material:

- Problem Solving with C++, (6<sup>th</sup> – 9<sup>th</sup> Edition), Walter Savitch, Addison-Wesley ISBN 0321531345. ©2009.

These reference resources are available online and are free to download.

- C++ Language Tutorial, <http://www.cplusplus.com/doc/tutorial/>
- C++ Made Easy, <http://www.cprogramming.com/tutorial.html>
- Thinking in C++, <http://www.mindview.net/Books/TICPP/ThinkingInCPP2e.html>

Other supplemental readings will be provided by the instructor

- Learn to use online resources.
  - Books, Lectures, Courses, Videos, ...
  - <http://stackoverflow.com> (questions and answers about computers)
  - <http://coursera.org> (free online courses)
  - <http://ocw.mit.edu> (open courseware at MIT)
  - <http://google.com> (or just search for anything)
- You don't have to go at the slow pace of the class.  
Just take off on your own.  
Learn how to build web pages, or operating systems on your own.

### Academic Honesty

The principles of truth and honesty are recognized as fundamental to a community of teachers and students. This means that all academic work will be done by the student to whom it is assigned without unauthorized aid of any kind. Plagiarism, cheating and other forms of academic dishonesty are prohibited. Any instances of academic dishonesty in this course (intentional or unintentional) will be dealt with swiftly and severely. Potential penalties include receiving a failing grade on the assignment in question or in the course overall. For further information, students should make themselves familiar with the relevant section of the LUMS student handbook.

### 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](mailto:oai@lums.edu.pk) or the sexual harassment inquiry committee at [harassment@lums.edu.pk](mailto: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](mailto: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](mailto:cbe.sse@lums.edu.pk)



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### Appendix A Bloom's Taxonomy

\*(<https://cft.vanderbilt.edu/guides-sub-pages/blooms-taxonomy/>)

BLOOM'S TAXONOMY*		
<ul style="list-style-type: none"> <li>• (C1) Remember</li> <li>• (C2) Understand</li> </ul>	<ul style="list-style-type: none"> <li>• Recall facts and basic concepts</li> <li>• Explain ideas or concepts</li> </ul>	<ul style="list-style-type: none"> <li>• Recognizing, Recalling</li> <li>• Interpreting, Exemplifying, Classifying, Summarizing, Inferring, Comparing, Explaining</li> </ul>
<ul style="list-style-type: none"> <li>• (C3) Apply</li> <li>• (C4) Analyze</li> <li>• (C5) Evaluate</li> <li>• (C6) Create</li> </ul>	<ul style="list-style-type: none"> <li>• Use information in new situations</li> <li>• Draw connection among ideas</li> <li>• Justify a stand or decision</li> <li>• Produce new or original work</li> </ul>	<ul style="list-style-type: none"> <li>• Executing, Implementing</li> <li>• Differentiating, Organizing, Attributing</li> <li>• Checking, Critiquing</li> <li>• Generating, Planning, Producing</li> </ul>

### Appendix B Program Learning Outcomes / Student Outcomes / Graduate Attributes Seoul Accord

<https://www.seoulaccord.org/document.php?id=79>

1. Academic Education	1. Individual and Teamwork
2. Knowledge for Solving Computing Problems	2. Communication
3. Problem Analysis	3. Computing Professionalism and Society
4. Design/ Development of Solutions	4. Ethics
5. Modern Tool Usage	5. Life-long Learning

### Appendix C ACM C.2.2: Computer Science Draft Competencies Page 111, Computing Curricula 2020 (CC2020)

<https://www.acm.org/binaries/content/assets/education/curricula-recommendations/cc2020.pdf>

#### SDF-Software Development Fundamentals (page 113)

1. Create an appropriate algorithm to illustrate iterative, recursive functions, as well as divide-and-conquer techniques and use a programming language to implement, test, and debug the algorithm for solving a simple industry problem.
2. Decompose a program for a client that identifies the data components and behaviors of multiple abstract data types and implementing a coherent abstract data type, with loose coupling between components and behaviors.
3. Design, implement, test, and debug an industry program that uses fundamental programming constructs including basic computation, simple and file I/O, standard conditional and iterative structures, the definition of functions, and parameter passing.
4. Present the costs and benefits of dynamic and static data structure implementations, choosing the appropriate data structure for modeling a given engineering problem.
5. Apply consistent documentation and program style standards for a software engineering company that contribute to the readability and maintainability of software, conducting a personal and small-team code review on program component using a provided checklist.
6. Demonstrate common coding errors, constructing and debugging programs using the standard libraries available with a chosen programming language.
7. Refactor an industry program by identifying opportunities to apply procedural abstraction.



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### Appendix D

#### ACM Computing Knowledge Landscape Table

<https://www.acm.org/binaries/content/assets/education/curricula-recommendations/cc2020.pdf>

ACM Computing Knowledge Landscape (CK)			
<b>1. Users and Organizations</b>	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	<b>4. Software Development</b>	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
<b>2. Systems Modeling</b>	CK2.1: Security Issues and Principles CK2.2: Systems Analysis & Design CK2.3: Requirements Analysis and Specification CK2.4: Data and Information Management	<b>5. Software Fundamentals</b>	CK5.1: Graphics and Visualization CK5.2: Operating Systems CK5.3: Data Structures, Algorithms and Complexity CK5.4: Programming Languages <b>CK5.5: Programming Fundamentals</b> CK5.6: Computing Systems Fundamentals
<b>3. Systems Architecture and Infrastructure</b>	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	<b>6. Hardware</b>	CK6.1: Architecture and Organization CK6.2: Digital Design CK6.3: Circuits and Electronics CK6.4: Signal Processing

### Appendix E

#### ACM Dispositions Table

<https://www.acm.org/binaries/content/assets/education/curricula-recommendations/cc2020.pdf>

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		