COMSATS University Islamabad, Lahore Campus

Defence Road, Off Raiwind Road, Lahore

COURSE HANDBOOK

1	**Course Title**	Data Structure and Algorithm
2	**Course Code**	CSC211
3	**Credit Hours**	4(3,1)
4	**Semester**	Spring2024
5	**Resource Person**	Abdul Karim Shahid
6	**Supporting Team Members**	
7	**Contact Hours (Theory)**	3 hours per week
8	**Contact Hours (Lab)**	3 hours per week
9	**Office Hours**	

10 Course Introduction

This module will introduce students to the fundamental concepts of Data structures, and they will study how to write efficient algorithms. Students will learn theoretical concepts about different data structures, and the application of data structures to solve different problems. The theoretical background will let students to implement those concepts in the lab keeping in mind the real-world problems.

11 Learning Objectives

The aim of this course is to cover basic and in-depth concepts of Algorithms and Data Structures. Students will learn how data structures are helpful to solve different problems. It will provide foundation in learning advanced algorithm analysis course. Student can use C language for the purpose of implementation, and they will learn generic concepts which will be used for developing different software applications. The knowledge of C language is expected as strong background.

Students should be able to:

- Basic and in-depth concepts of Data Structures and Algorithms to solve different software problems.
- Selection of appropriate Data Structure and Algorithm for specified application.
- How appropriate Data Structures and algorithms impact performance of software?
- Solve different problems using Arrays, Stacks, Queues, Link Lists, Trees, Heaps, Hash Tables and Graphs.
- Use of different sorting techniques and their efficiency.
- Students will be able to translate Algorithm ideas into working practical applications.

12 Course Contents

The module consists of theory and practical portion. Theory part will consist of class lecture that will introduce theoretical concepts of Data Structures and Algorithms. The lab part will focus on the practical application of the concepts delivered in class to solve different problems. Exercises, assignments and projects assigned in lectures will be supervised in lab session. Students will be encouraged to come up with their own ideas and concepts to solve different problems.

13 Lecture Schedule

Weeks	Topic of Lecture	Reading Assignment
Week 1	● Course Overview, Introduction to Different Data Structures. Memory Management of basic data types.	Book+ Handouts
Week 2	● Algorithms, flow charts, pseudocodes	
Week 3	● Arrays, Insertion and Deletion in Arrays, row major order, column major order, Two-dimensional Arrays, Multi-dimensional Arrays.	Book + Handouts
Week 4	● Stacks, Operations on stacks, Infix, Postfix and Prefix notations, Infix to Postfix conversion, postfix evaluation, Tower of Hanoi	Book+ Handouts
Week 5	● Queues, Operation of Queue (Insertion & deletion), Types of Queues (Circular, Priority, Dequeue etc), Priority & Dequeue(Insertion & Deletion)	Book + Handouts
Week 6 & 7	● Basic concepts of pointers ● Link Lists, creation of link list, operations of link list(traversal, insertion, deletion)	Book+ Handouts
Week 7	● Circular & doubly link list, circular doubly link list (insertion, deletion)	Handouts
Week 8	● MedTerm Exam	
Week 9	● Concepts of Tree, Type of trees, Creation of tree using array, Traversal of Tree.	Handouts
Week 10	● Creation of tree using link list, Traversal of Tree.	Book+ Handouts
Week 11	● Binary search tree (creation, Insertion, Traversal), Height Balanced Trees	Handouts
Week 12	● , Heap (Min & Max heap), Heapify	
Week 13	● Searching (Linear, Binary), Introduction to Hashing, Algorithms, Hash Functions,	
Week 14	● Memory Organization of Hash, Collision in Hashing, Hash Function Techniques	
Week 15	● Sorting (Insertion, Bubble, Quick, Heap), Introduction to Graphs (Implementation using Array & Link List)	Book + Handouts
Week 16	● Graph operations, Memory representations of Graphs using Array & Link List, Traversal(Depth First and Breadth First Algorithms), Dijkstra Algorithm(Shortest Path)	Handouts

14 Lab Schedule

Sessions	Topics
Week 1 & 2	Exercise on Array Data structure.
Week 3	Practice on assignments of 2D Arrays,

Week 4	Stack Exercises, solving practical problems using Stack. Conversion & evolution of Infix to Postfix, Tower of Hanoi
Week 5	Queues practice assignments, Circular Queue, Application of priority queues.
Week 6 & 7	Implementation of link list and types of linked list
Week 8	Implementation of link list and types of linked list
Week 9	MidTerm Exam
Week 10	Circular and Doubly Link List
Week 11	Implementation of Tree, Transversal methods etc
Week 12	Implementation of BST, Transversal methods etc, Heap Creation
Week 13	Implementations of searching techniques, Hashing
Week 14	Hash Functions and its techniques
Week 15	Sorting (Insertion Sort, quick sort, bubble sort, Heap Sort)
Week 16	Implementation of Graphs

15 Course Assessment

The assessment of this module shall have followed breakdown structure

Theory Part

MidTerm Exam	25%
Final Exam	50%
Quiz (4 per semester)	10%
Assignments (4 per semester)	15%

Practical / Lab Part

Performance or experiments	25%
MidTerm Exam	25%
Final Exam	50%

The minimum pass marks for each course shall be 50%. Students obtaining less than 50% marks in any course shall be deemed to have failed in that course. The correspondence between letter grades credit points and percentage marks at CUI shall be as follows:

Grades	Letter Grade	Credit Points	Percentage Marks
A	(Excellent)	4.00	85 and above
A-		3.66	80-84
B+		3.33	75-79
B	(Good)	3.00	71-74
B-		2.66	68-70
C+		2.33	64-67
C	(Average)	2.00	61-63
C-		1.66	58-60
D+		1.30	54-57
D	(Minimum passing)	1.00	50-53
F	(Failing)	0.0	Below 50

Note: The marks to be assigned to students shall be in whole numbers and are not same as followed in the annual system of Lancaster University.

16	Assessment Schedule (Tentative)	
	Month 2 and 3	1st Assignment, 2nd Assignment and 2 Quizzes
	Month 4	3rd Assignment and Quiz
	Month 4 and 4.5	Assignment (Project) and Quiz

17 Format of Assignment

This course indoctrinates the following format for all assignments except code:

1. Paper Size: A4
2. Left Margin: 2 Inches
3. Right Margin: 1 Inch
4. Top Margin: 0.5 Inch
5. Bottom Margin: 0.5 Inch
6. Font: Times New Roman
7. Font Size:
    a. Main Heading 14
    b. Sub Heading 12
    c. Text 12
    d. Titles 16
8. Font Color: Black
9. Line Spacing: 1.5
10. Diagrams & Charts: Need not be colored
11. Title page must be designed as guided by resource person in class
12. Number of Pages: No Limit
13. Reference Style: APA (If applicable)

Code will be submitted in text files that can be compiled with specified programming language compiler.

18	Text Book	● "Classic Data Structures", by D. Samanta. ● "Data Structure—A Pseudocode Approach with C", by Richard F. Gilberg, Behrouz A. Forouzan ● "Data Structures using C and C++", by Yadidyah Langsam, Moshe J. Augenstein, Aaron M. Tenenbaum. ● A Common-Sense Guide to Data Structures and Algorithms, Jay Wengrow, Pragmatic Bookshelf, 2020.
19	Reference Books	● "Schaum's Outlines of Data Structures with C++", by John R. Hubbard. ● "Programming and Data Structures ", by Ashok N.Kamthane

20 Plagiarism

Plagiarism involves the unacknowledged use of someone else's work, usually in coursework, and passing it off as if it were one's own. Many students who submit apparently plagiarised work probably do so inadvertently without realising it because of poorly developed study skills, including note taking, referencing and citations; this is poor academic practice rather than malpractice. Some students, particularly those from different cultures and educational systems, find UK academic referencing/acknowledgement systems and conventions awkward, and proof-reading is not always easy for dyslexic students and some visually-impaired students. Study skills education within programmes of study should minimise the number of students submitting poorly referenced work. However, some students plagiarise deliberately, with the intent to deceive. This intentional malpractice is a conscious, pre-mediated form of cheating and is regarded as a particularly serious breach of the core values of academic integrity. **The Programme has zero tolerance for intentional plagiarism.**

Plagiarism can include the following:

1. Collusion, where a piece of work prepared by a group is represented as if it were the student's own;
2. Commission or use of work by the student which is not his/her own and representing it as if it were, e.g.:
    a. purchase of a paper from a commercial service, including internet sites, whether pre-written or specially prepared for the student concerned
    b. submission of a paper written by another person, either by a fellow student or a person who is not a member of the university;
3. Duplication (of one's own work) of the same or almost identical work for more than one module;
4. The act of copying or paraphrasing a paper from a source text, whether in manuscript, printed or electronic form, without appropriate acknowledgement (this includes quoting directly from another source with a reference but without quotation marks);
5. Submission of another student's work, whether with or without that student's knowledge or consent;
6. Directly quoting from model solutions/answers made available in previous years;
7. Cheating in class tests, e.g.
    a. when a candidate communicates, or attempts to communicate, with a fellow candidate or individual who is neither an invigilator or member of staff
    b. copies, or attempts to copy from a fellow candidate
    c. attempts to introduce or consult during the examination any unauthorised printed or written material, or electronic calculating, information storage device, mobile phones or other communication device
    d. Personates or allows him or her to be impersonated.
8. Fabrication of results occurs when a student claims to have carried out tests, experiments or observations that have not taken place or presents results not supported by the evidence with the object of obtaining an unfair advantage.

These definitions apply to work in whatever format it is presented, including written work, online submissions, group work and oral presentations.

21 Attendance Policy

Every student must attend 80% of the lectures/seminars delivered on this course.

2 Field Trips/Case Studies/Seminars/Workshop

Not Applicable