COMSATS University Islamabad – Abbottabad Campus
Department of Computer Science
Course Syllabus

Course Information			
Course Code:	**CSC211**	Course Title:	**Data Structures and Algorithms**
Credit Hours:	**4(3,1)**	Lecture Hours/Week:	**3**
Lab Hours/Week:	**3**	Pre-Requisites:	**CSC103-Programming Fundamentals**

Catalogue Description:

This course provides fundamental knowledge of data organization. The topics include: Overview of Data Structures; Time Complexity of an Algorithm; Static & Dynamic List; Stack; Queue; Tree & its Algorithms; Graph & its Algorithms; Sorting;Searching; and Hashing.

Text and Reference Books

Textbook:

1. "Data Structures and Algorithm Analysis in Java" by Mark Allen Weiss, Addison-Wesley.

Reference Book:

2. "Data Structures & Algorithm in Java" by Robert Lafore.

Week wise Plan:

Lecture #	CDF Unit #	Topics Covered	Reading Material
1.	1	**Introduction:** Course Overview, Data Structures, Data and Data Types, Data Structures, Abstract Data Types (ADTs). **Types of Data Structures:** Primitive and Non-Primitive, Linear and Nonlinear, Static and Dynamic, Sequential and Random Access, Persistent and Ephemeral.	Weiss: Ch1 Lafore: Ch1
2.	1	**Introduction:** Algorithms, Relation among Data, Data Structures, and Algorithms.	Weiss: Ch2
3.	1	**Complexity:** Complexity Analysis, Asymptotic Notations (O,Θ,Ω)	Weiss: Ch2
4.	2	**Array:** Organization, Creation, Memory Representation, Class Arrays, Array using Template, Two Dimensional Arrays, n-Dimensional Arrays, ArrayList.	Weiss: Ch3 Lafore: Ch2
5.	3	**Linked List:** Introduction, Organization, Dynamic Memory Management, ADT, Structure of Nodes, Insertion and Deletion of Nodes, Traversal of Nodes.	Weiss: Ch3 Lafore: Ch5
6.	3	**Variants of Linked List:** Doubly Linked List, Circular Linked List	Weiss: Ch3 Lafore: Ch5
7.	4	**Stack:** Primitive Operations, Stack-ADT, Representation of Stack using Arrays & Linked List.	Weiss: Ch3 Lafore: Ch4
8.	4	**Applications of Stack:** Expression Evaluation and Conversion (Infix Notation).	Weiss: Ch3 Lafore: Ch4
9.	4	**Applications of Stack:** Expression Evaluation and Conversion (Prefix & Postfix Notation).	Weiss: Ch3 Lafore: Ch4
10.	4	**Applications of Stack:** Solving Recursion, Types/Variant of Recursions.	Weiss: Ch3 Lafore: Ch6
11.	5	**Queue:** Queue-ADT, Queue Primitive Operations, Representation of Simple Queue Using Arrays & Linked List.	Weiss: Ch3 Lafore: Ch4
12.	5	**Queue:** Circular Queue, Representation using Arrays, Advantages of Circular Queue.	Weiss: Ch3 Lafore: Ch4
13.	5	**Queue:** DEque, Multiple Queues, Priority Queues.	Weiss: Ch3 Lafore: Ch4

14.	5	**Applications of Queue:** Job Scheduling, Routers/Switching Devices Queuing, Buffers.	Weiss: Ch3 Lafore: Ch5
15.	6	**Tree:** Introduction, Terminology, General Trees, Representation in Memory.	Weiss: Ch4 Lafore: Ch8
16.	6	**Binary Tree:** Binary Trees ADT (Properties, Realization), Binary Tree implementation using Array & Linked List.	Weiss: Ch4 Lafore: Ch8
17.	**Mid Term Exam**		
18.			
19.	6	**Binary Tree:** Traversal (Pre-order, In-order, Post-order).	Weiss: Ch4 Lafore: Ch8
20.	6	**Binary Search Tree:** Insertion, Searching, Deletion of Nodes.	Weiss: Ch4 Lafore: Ch8
21.	6	**AVL Tree:** Insertion and Deletion of Nodes.	Weiss: Ch4 Lafore: Ch8
22.	6	**Heap Data Structure**: Priority Queue	Weiss: Ch6 Lafore: Ch12
23.	6	**Applications of Binary Tree:** Expression Tree, Huffman Coding, Decision Tree.	Weiss: Ch4,Ch10 Lafore: Ch8
24.	7	**Graph:** Graph ADT, Basic Terminologies, Representation, Adjacency Matrix, Adjacency List, Types of Graphs.	Weiss: Ch9 Lafore: Ch13
25.	7	**Graph Traversal:** Depth First Search (DFS), Breadth First Search (BFS).	Weiss: Ch9 Lafore: Ch13
26.	7	**Shortest Path:** Dijkstra Algorithm	Weiss: Ch9 Lafore: Ch14
27.	7	**MST:** Kruskal and Prim's Algorithm	Weiss: Ch9 Lafore: Ch13
28.	8	**Searching Algorithms:** Linear Search, Binary Search.	Lafore: Ch3
29.	8	**Sorting Algorithms:** Introduction, Sorting Techniques, Bubble Sort Algorithm.	Weiss: Ch7 Lafore:Ch7
30.	8	**Sorting Algorithms:** Selection Sort Algorithm, Insertion Sort Algorithm.	Weiss: Ch7 Lafore:Ch7
31.	8	**Sorting Algorithms:** Quick Sort Algorithm, Merge Sort Algorithm.	Weiss: Ch7 Lafore:Ch7
32.	8	Hashing: Hash Function, Different Hashing Strategies & Techniques.	Weiss:Ch5 Lafore:Ch11
Final Term Exam			

Student Outcomes (SOs)

S.#	Description
1	Apply knowledge of computing fundamentals, knowledge of a computing specialization, and mathematics, science, and domain knowledge appropriate for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements.
2	Identify, formulate, research literature, and solve *complex* computing problems reaching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines.
3	Design and evaluate solutions for *complex* computing problems, and design and evaluate systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
4	Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to *complex* computing activities, with an understanding of the limitations.
5	Function effectively as an individual and as a member or leader in diverse teams and in multi-disciplinary settings.

Course Learning Outcomes (CLO)

Sr.#	Unit #	Course Learning Outcomes	Blooms Taxonomy Learning Level	SO
		CLO's for Theory		
CLO-1	1-4	Employ linear data structures to solve computing problems.	*Applying*	1,2
CLO-2	5-6	Use non-linear data structures to solve computing problems.	*Applying*	1,2
CLO-3	7-8	Analyze the time complexity of various algorithms.	*Analyzing*	2
		CLO's for Lab		
CLO-4	1-7	Implement data structures and algorithms.	*Applying*	2-4
CLO-5	1-8	Develop a project using appropriate data structures in a team environment.	*Creating*	2-5

Assessment Tools	CLO-1	CLO-2	CLO-3	CLO-4	CLO-5
Quizzes	Quiz 1&2	Quiz 3	Quiz 4	-	-
Assignments	Assignment 1&2	Assignment 3	Assignment 4	Lab Assignments	-
Mid Term Exam	Mid Term Exam	Mid Term Exam	-	-	-
Final Exam	Final Exam				
Project	-	-	-	-	Lab Project

Policy & Procedures

- **Attendance Policy:** Every student must attend 80% of the lectures delivered in this course and 80%of the practical/laboratory work prescribed for the respective courses. The students falling short of required percentage of attendance of lectures/seminars/practical/laboratory work, etc., shall not be allowed to appear in the terminal examination of this course and shall be treated as having failed this course.
- **Course Assessment:**

	Quizzes	Assignments	Mid Term Exam	Terminal Exam	Total
Theory (T)	15	10	25	50	100
Lab (L)	-	25	25	50	100
Final Marks (T+L)	**(T/100) *75 + (L/100)*25**				

- **Grading Policy:** 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:

Grade	**A**	**A-**	**B+**	**B**	**B-**	**C+**	**C**	**C-**	**D**	**F**
Marks	90 - 100	85 - 89	80 - 84	75 - 79	70 - 74	65 - 69	60 - 64	55 - 59	50 - 54	<50
Cr. Point	4.0	3.7	3.3	3.0	2.7	2.3	2.0	1.7	1.3	0.0

- **Missing Exam:** No makeup exam will be given for final exam under any circumstance. When a student misses the mid-term exam for a legitimate reason (such as medical emergencies), his grade forthis exam will be determined based on the Department policy. Further, the student must provide an official excuse within one week of the missed exam.
- **Academic Integrity:** All CUI policies regarding ethics apply to this course. The students are advised to discuss their grievances/problems with their counsellors or course instructor in a respectful manner.
- **Plagiarism Policy:** Plagiarism, copying and other anti-intellectual behavior are prohibited by the university regulations. Violators must face serious consequences.