

The Islamia University of Bahawalpur
Faculty Of Engineering
Course Outline: Data Structures and Algorithms

General Information:

Course:	Data structures and Algorithms	Instructor	Dr.Nadia Rasheed
Course Code	COMP-01417	Office	
Credit Hours	3 (Theory) + 1 (Lab)	Email	Nadia.rashid@iub.edu.pk
Contact Hours	3 (Theory) + 3 (Lab)	Contact No.	
Pre-Requisite(s)	OOP	Office Hours	

Course Description:

This course Covers the design, analysis, and implementation of data structures and algorithms to solve engineering problems using an object-oriented programming language. Topics include elementary data structures, (including arrays, stacks, queues, and lists), advanced data structures (including trees and graphs), the algorithms used to manipulate these structures, and their application to solving practical engineering problems.

Course Learning Outcomes (CLOs):

After completion of course, the student will be able to :

CLOs	Description	Domain	PLOs
CLO1	Formulate and apply object-oriented programming, using C++, as a modern tool to solve engineering problems.	C-3	PLO3
CLO2	Demonstrate an understanding of analysis of algorithms. Study an algorithm or program Code segment that contains iterative constructs and analyze the asymptotic time complexity of the algorithm or code segment	C-2	PLO4
CLO3	Demonstrate an understanding of design of data structures and algorithms to solve engineering problems and evaluate their solutions.	C-2	PLO3
CLO4	Demonstrate the ability to apply and use data structures and algorithms to solve engineering problems and evaluate their solutions.	C-3	PLO4

Relation of CLOs to the Program Learning Outcomes (PLOs):

	1	2	3	4	5	6	7	8	9	10	11	12
	Engineering Knowledge	Problem Analysis	Design & Development of Solutions	Investigation	Modern Tool Usage	The Engineer and Society	Environment and Sustainability	Ethics	Individual and Team Work	Communication	Project Management	Life Long Learning
CLO1			√									
CLO2				√								
CLO3			√									
CLO4				√								
Total			2	2								
Impact			High	High								

Justification of Program Learning Outcomes (PLO's) Coverage:

PLO1 - Engineering Knowledge:

The assignments, exams, and laboratory experiments require engineering knowledge to successfully complete the course. Students will have the knowledge of forward and inverse kinematics, AI techniques and the intelligent robot design paradigms.

PLO2 - Problem Analysis

The course shows the value of theory, by making it possible for the students examine the AI algorithms, perform kinematic and dynamics analysis. (High relevance to course).

PLO3 - Design & Development of Solutions

Through the basic to moderate level knowledge (theory plus hands-on practice) of OOP and data structure, The student will to understand different data structures.

PLO4-Investigation

Through the basic to moderate level knowledge (theory plus hands-on practice) of OOP and data structure, the student will to design different data structures and will do algorithmic analysis.

PLO5 - Modern Tool Usage

This objective is not directly addressed in this course.

PLO6 - The Engineer and Society

This objective is not directly addressed in this course.

PLO7 - Environment and Sustainability

This objective is not directly addressed in this course.

PLO8 - Ethics

This objective is not directly addressed in this course.

PLO9 - Individual and Team Work

This objective is not directly addressed in this course.

PLO10 – Communication

This objective is not directly addressed in this course.

PLO11- Project Management

This objective is not directly addressed in this course.

PLO12 - Life Long Learning

This objective is not directly addressed in this course.

Assessment of CLOs:

	CLO1	CLO2	CLO3	CLO4
Assignments	√	√	√	√
Quizes	√	√		√
Midterm Exam	√	√	√	
Finalterm Exam			√	√
Others (Projects/presentations)				

Textbook(s)/Reference Books:

1. Required Mark A. Weiss. Data Structures and Algorithm Analysis in C++. 4th Edition. Pearson 2014. ISBN-13: 978-0-13-284737-7
2. Schaum's Outline of Data Structures with C++.

Lecture Plan:

Topics	Hours	CLOs
Introductuion . Mathematics Review , Review :C++ Classes, Friend functions. Operator overloading. Exception handling. Memory allocation and Deallocation, Encapsulation. Inheritance. Polymorphism. Virtual Functions , Templates. Function and class templates. (Chapter 1)	Week 1-Week2	CLO1
Algorithm Analysis Mathematical Background Model , What to Analyze , Running-Time Calculations , A Simple Example ,General Rules , Solutions for the Maximum Subsequence Sum Problem , Logarithms in the Running Time , Limitations of Worst-Case Analysis	Week2-Week 4	CLO2

(Chapter 2)		
Basic Data structure Basic data structures. Arrays. Static arrays and Dynamic arrays. Explore how a generic Vector container is used to manipulate data. (Chapter 1 Sec. 1.8 ,Chapter 3 Sec 3.3)	Week 5	CLO3, CLO4
List ADT. Implementation using arrays (static and dynamic). (Basic operations on a List) (Chapter 3 Sec. 3.2.1)	Week 6	CLO3, CLO4
Linked-List. Singly linked-lists. Implementation using pointers. Basic Operations (Chapter 3 Sec. 3.2.2, 3.3, 3.5)	Week 7	CLO3, CLO4
Stacks and Queues. Behavior of a Stack. Basic operations on a Stack. Array-based stacks. Linked-list based implementation. Expression evaluation using a stack. Queues. Behavior of a queue. Basic queue operations Study implementations using an array and a linked-list. (Chapter 3 Secs. 3.6 and 3.7)	Week8-Week 10	CLO3, CLO4
Tree data structure. Binary and nonbinary trees. Structure of a binary tree. Definitions and properties. Traversing a binary tree. (Chapter 4 Secs. 4.1 and 4.2)	Week 12-Week 13	CLO3, CLO4
Binary Search Tree (BST). Organizing data in a BST. Inserting and deleting items in a BST. Traversing a BST. Non-binary (General) tree. General tree traversal. (Chapter 4 Sec. 4.3, 4.6)	Week 14	CLO3, CLO4
Searching and Hashing algorithms. Search algorithms – Sequential Search, Ordered lists, binary search. Searching using Hashing. Hash tables. Hash functions. Some examples of hash functions. Collision resolution. Review (Chapter 5,Chapter 9)	Week-15-Week16	CLO3, CLO4

Grading Policy vis-à-vis CLO Mapping

Assignments, Quizzes, Projects/presentations etc	20%	CLO1 to CLO4
Midterm	30%	CLO1 to CLO3
Final	50%	CLO3 to CLO4

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