CSC-222: Data Structures (Theory)

General Information

Course Number	**CSC-222**
Credit Hours	3+1 (Theory Credit Hour = 3, Lab Credit Hours = 1)
Prerequisite	CSC-102, Programming Fundamentals
Course Coordinator	Not Specified

The objective of this course is to make students familiar with the concepts of the way data is stored inside the computer and its manipulation using different algorithms. Students will learn different data structures such as an array, stack, queue, link list, trees, graphs, sorting algorithm, etc. Since Programming fundamentals is the pre-requisite of this course, therefore, in class we would be using java language to implement all the data structures. However, students may use any programming

Course Objectives

language

Catalog Description

CSC-222

Course Content

Week No	1. Topics	Chapters
1	• Introduction to the course • Elementary data structures • Arrays ○ Review of single-dimension arrays ○ Concept and implementation of 2D arrays ✦ Manipulating matrices using arrays ○ Basic concepts of Multi-dimensional arrays • What is the data structure? ○ Need for data structures ○ What are the limitations of Arrays?	

2	• Linked lists ○ Arrays vs. Linked list • Types of linked list ○ Singly-linked list ○ Circular singly linked list ○ Doubly linked list ○ Circular doubly linked list • Defining the Node class • Linked Lists Functions Printing linked list in reverse order using recursion	
3-4	• Applying dictionary operations on linked lists ○ Traversing a linked list ○ Inserting new node	
	✦ at the head ✦ at any location ○ Searching a node ○ Removing a node ✦ from the head ✦ from anywhere • Clearing a linked list	
5	• Introduction to Queues • The Queue data structure • Application of queues • Array Representation of Queue ○ Algorithm for the Addition of an Element to the Queue ○ Algorithm for Deletion of an Element to the Queue • Dynamic Representation of Queues Using Linked Lists • Circular Queue-Array Representation	

6	• The FIFO structure • Queue operations • Extended queue operations • Dictionary operations on queues • The priority queues • The LIFO structure • Introduction to the stack data structure • Applications of stack • Stack operations • Stack specifications ○ List and arrays ○ Stacks ○ Reversing a list • Stack implementation ○ Using arrays ○ Using linked list • Methods of stack ○ Push ○ Pop • Push down stack	
7	• What is algorithm? • Complexity of algorithm ○ Time complexity ○ Space complexity • Analysis of algorithms • Big O Notation ○ Best-case analysis ○ Worst-case analysis • Average-case analysis	
8-9	• Trees Introduction • Tree terminology • Tree Traversal • Concept of Binary Trees • Why use binary trees	
	• Basic Operations • Complete Binary Tree • Priority Queues: Heaps • Max-Heap	
First Mid Term Examination		
10-11	• Concept of Binary Search trees and how they work • Finding a node in a binary search tree • Inserting a node • Recursively traversing the tree in In order, Pre and Postorder	

	• Applications of tree traversing in sorting	
12	• Deleting a node in a Binary Tree with all three cases • The efficiency of Binary Trees • Handling duplicate nodes in BST • Applications of BST • Time complexity	
13	AVL Trees • Balance Factor • Cases(I,II,III, IV)	
14	• Simple sorting ○ Understanding why sorting is important ○ Bubble sort ○ Selection sort ○ Insertion sort ○ Merge Sort	
15	• Hashing • Applications of Hashing • Direct Address • Chain based Scheme • Hash Tables	
16	Introduction to Graph data structure • BFS • DFS • Spanning Tree	
	Project	**01-Dec-22**

Text Book

1. Data Structures & Algorithms in Java by Robert Lafore

Reference Material

1. C++ Plus Data Structures, 3rd edition, Nell Dale.
2. Think Data Structures: Algorithms and Information Retrieval in Java by Allen B. Downey

Course Learning Outcomes

	Course Learning Outcomes (CLO)

1	Demonstrate the knowledge of linear and non-linear data structures such as an array, list, queue, stack, trees, and graphs.
2	Implement algorithms for the efficient representation and manipulation of data.
3	Analyze different data structures to identify errors and predict the output.

CLO-SO Map

	SO IDs											
CLO ID	**GA1**	**GA2**	**GA3**	**GA4**	**GA5**	**GA6**	**GA7**	**GA8**	**GA9**	**GA10**	**GA11**	**GA12**
CLO 1	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	
CLO 2	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	
CLO 3	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	

Approvals

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Approved By	Not Specified
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