204184: Data Structures

204188: Data Structures Lab

SE (E&TC/Elex) - 2019 Course

Content-Book-Pages Mapping

Sr. No	Content	Duration	Reference Book	Page No.	Remark
UNIT 1: Introduction to C Programming					
1	C Fundamentals: Constants, Variables and Keywords in C, Operators, Bitwise Operations, Decision Control and Looping Statements.	3 Hrs.	R2	25-30, 52-61, 61-63, 114-174	--
2	Arrays & Pointers: Arrays, Functions, Recursive Functions, Pointers, String Manipulations, Structures, Union, Enumeration, MACROS.	4 Hrs.	R2	190-209, 262-295, 351-378, 229-250, 317-337, 445-449	Only single pointer is expected, String Manipulations using • user defined functions • with and without pointers
3	File Handling: File Operations- Open, Close, Read, Write and Append	1 Hrs.	R2	389-397	--
Unit II - Searching and Sorting Algorithms					
4	Algorithms: Analysis of Iterative and Recursive algorithms	2Hrs	T2	05-31, 45-69	It expected to cover algorithm definition, finding numbers of steps algorithm takes examples iterative and recursive Algorithms and their analysis
5	Space & Time complexity, Asymptotic notation- Big-O, Theta and Omega notations.		R4	54-63	Definition of notations with example, space and time trade-of

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6	Searching methods: Linear, Binary and Fibonacci Search.	2Hrs	R4	424-433	Searching algorithms and their analysis in best case worst case and average case with examples
7	Sorting methods: Bubble, Insertion, Selection, Merge, and Quick Sort.	2Hrs	T2 R4	533-570 433-450	Sorting algorithms and their analysis in best case worst case and average case with examples
Unit III- Stack and Queue					
8	**Stack:** Concept, Basic Stack operations, Array representation of stack, Stack as ADT, Stack Applications: Reversing data, Arithmetic expressions conversion and evaluation.	3 Hrs.	T2	79-82 95-101 102-121	For Applications: examples & algorithm
9	**Queue:** Concept, Queue operations, Array representation of queue, Queue as ADT, Circular queue, Priority Queue, Applications of queue: Categorizing data, Simulation of queue.	3 Hrs.	T2	147-150 159-166 119-120 168-178	For Applications: examples & algorithm
Unit IV - Linked List					
10	Concept of linked organization, Linked list as ADT, Comparison of sequential organization with linked organization,	1 Hr.	T1	193-195	-
11	Singly linked list,	1 Hr.	T1	195-227	Functions for Operations: Insertion, Deletion, Searching, Traversal

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12	Stack using linked list,	1 Hr.	T1	83-89	-
13	queue using linked list,	1 Hr.	T1	151-158	-
14	Doubly linked list, Circular linked list,	2 Hrs.	T1	239-244	DLL Operations: Creation, Traversal. Representation of Circular Linked List using SLL and DLL
15	Representation and manipulations of polynomials using linked lists,		T1	150-151,	Manipulation – Addition of polynomials using linked list (Discuss only algorithm in theory session)
Unit V: Trees					
16	Introduction to trees: Basic Tree Concepts Binary Trees: • Concept & Terminologies • Representation of Binary Tree in memory • Traversing a binary tree	2 Hrs.	T2 R1	265-282, 7.1-7.4	-
17	Binary Search Trees (BST): • Basic Concepts • BST operations • Concept of Threaded Binary Search Tree	3 Hrs	T2 R1	299-309, 334-335, 7.7-7.9	BST operations: create, insert, search, traversal Examples on BST and TBT
18	AVL Tree: Basic concepts and rotations of a Tree.	1 Hr.	T2 R1	341-375, 7.10-7.12	Only examples

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Unit VI- Graphs					
19	Basic Concepts & terminology Sequential representation of graphs: Adjacency matrix, Linked representation of a graph Operations on graph Traversing a graph	2 Hrs.	T2, R1	481-490, 8.1-8.7, 8.17-8.24	Examples also
20	Spanning trees: • Minimum Spanning tree • Kruskal's Algorithm • Prim's Algorithm Dijkstra's Shortest Path Algorithm	4 Hrs.	R1	8.30-8.48	Only examples

Text Books:

1. Ellis Horowitz, Sartaj Sahni, "Fundamentals of Data Structures", Galgotia Books Source, second edition.
2. Richard. F. Gilberg, Behrouz A. Forouzan, "Data Structures: A Pseudocode Approach with C," Cengage Learning, second edition.

Reference Books:

1. Seymour Lipschutz, "Data Structure with C, Schaum's Outlines", Tata McGrawHill, First Edition
2. E Balgurusamy, "Programming in ANSI C", Tata McGraw-Hill, Third Edition.
3. Yedidyah Langsam, Moshe J Augenstein, Aaron M Tenenbaum "Data structures using C and C++" PHI Publications, 2nd Edition.
4. Reema Thareja, "Data Structures using C", Second Edition, Oxford University Press, 2014

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Guidelines for Instructor's Manual The instructor's manual is to be developed as a hands-on resource and reference. The instructor's manual needs to include prologue (about University/program/ institute/ department/foreword/ preface etc), copy of curriculum, conduction & Assessment guidelines, topics under consideration-concept, objectives, outcomes, set of typical applications/assignments/ guidelines, and references.
Guidelines for Student's Laboratory Journal The laboratory assignments are to be submitted by student in the form of journal. Journal consists of prologue, Certificate, table of contents, and handwritten write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, software requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory-Concept in brief, features of Tool / framework / language used, Design, test cases, conclusions. Program codes with sample output of all performed assignments are to be submitted as softcopy. As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal may be avoided. Use of DVD containing students' programs maintained by instructor is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory.
Guidelines for Laboratory Assessment Continuous assessment of laboratory work is done based on overall performance and laboratory assignments performance of student. Each lab assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness.
Guidelines for Laboratory Conduction List of laboratory assignments is provided below for reference. The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The

assignment framing policy need to address the average students and inclusive of an element to attract and promote the intelligent students. The instructor may set multiple sets of assignments and distribute among batches of students. It is appreciated, if the assignments are based on real world problems/applications. Encourage students for appropriate use of coding style, proper indentation and comments.
Use of open source software and recent version is to be encouraged.

List of Laboratory Experiments

Group A

Write a C program to:

1.	Perform following String operations with and without pointers to arrays (without using the library functions): a. substring b. palindrome c. compare d. copy e. reverse	Compulsory
2.	Implement Database Management using array of structures with operations Create, Display, Modify, Append, Search and Sort. (For any database like Employee or Bank database with and without pointers to structures)	Compulsory
3.	Implement Stack and Queue using arrays.	Compulsory

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4.	Create a singly linked list with options: a. Insert (at front, at end, in the middle), b. Delete (at front, at end, in the middle), c. Display, d. Display Reverse, e. Revert the SLL	Compulsory
5.	Implement Binary search tree with operations Create, search, and recursive traversal.	Compulsory
6.	Implement Graph using adjacency Matrix with BFS & DFS traversal.	Compulsory
Group B: Perform (Any 3) **Write a C program to:**		
7.	Implement stack and queue using linked list.	**To cover all the experiments from this group, different laboratory experiments must be given to different batches.**
8.	Implement assignment 2 using files.	
9.	Add two polynomials using linked list.	
10.	Reverse a doubly linked list.	
11.	Evaluate postfix expression (input will be postfix expression)	
12.	Reverse and Sort stack using recursion.	
13.	Implement inorder tree traversal without recursion.	
14.	To find inorder predecessor and successor of a given key in BST.	
15.	Implement Quicksort.	

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Group C: Perform (Any 1) **Write a C program to:**		
16.	Implement merge sort for doubly linked list.	**To cover maximum experiments from this group, different laboratory experiments must be given to different batches.**
17.	Construct a tree from given inorder and preorder traversal.	
18.	Implement Dijkstra's Algorithm.	
19.	Implement Circular Linked List with various operations.	
20.	Represent graph using adjacency list or matrix and generate minimum spanning tree using Prim's algorithm.	

Virtual Lab based experiments

Virtual Lab based experiments: (Excluding the 10 experiments mentioned in Group A, B & C, Minimum 2 experiments must be performed on Virtual labs): –

1. Data Structures-I:
   https://ds1-iiith.vlabs.ac.in/data-structures-1/

2. Data Structures -II:
   https://ds2-iiith.vlabs.ac.in/data-structures-2/

3. Data Structures Lab:
   http://cse01-iiith.vlabs.ac.in/

4. Computer Programming Lab
   http://cse02-iiith.vlabs.ac.in/

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Group assignment **In addition to Group A, B & C, student group can select any one topic as group assignment or instructor may assign one real life application in the form of a group assignment based on the concepts learned. Instructor may also set one assignment or mini-project that is suitable to respective branch beyond the scope of syllabus.**

• Make Group of **4 students** in a batch (Batch of 20)
• Group will select any one topic as group assignment
• After completing the assignment, the respective group will present it during the practical slot.
  ➢ Distribution of work in a group during presentation may contain:
  ▪ Algorithm / Flowchart
  ▪ Program Explanation
  ▪ Applications