Program	Post Graduate Diploma in Data Science
Semester	1
Subject Code and Name	1618001 Data Structures and Algorithm
Credit	5

Objectives
- To learn about how to choose appropriate data structures, understand the ADT/libraries, and use it to design algorithms for a specific problem.
- To understand the necessary mathematical abstraction to solve problems.
- The student should be able to choose appropriate algorithms and use it for a specific problem.

Unit No.	Topic(s)	No. of Hours
1.	**Introduction to Data Structure** Data Management concepts, Data types – primitive and non-primitive, Performance Analysis and Measurement, Average, best and worst case analysis, Types of Data Structures- Linear & Non Linear Data Structures	2
2.	**Linear Data Structures** Array: Representation of arrays, Applications of arrays, sparse matrix and its representation Stack: Stack-Definitions & Concepts, Operations on Stacks, Applications of Stacks, Polish Expression, Reverse Polish Expression, Recursion, Tower of Hanoi Queue: Representation of Queue, Operations on Queue, Circular Queue, Priority Queue, Double Ended Queue, Applications of Queue Linked List: Singly Linked List, Doubly Linked list, Circular linked list, Applications of linked list	14
3.	**Nonlinear Data Structures** Tree-Definitions and Concepts, Representation of binary tree, Binary tree traversal, Binary search trees, Applications of Trees, AVL trees, 2-3 trees, Graph-Matrix Representation of Graphs, Graph Traversal Methods, Spanning Trees, Shortest path, Minimal spanning tree	10
4.	**Sorting & Searching** Bubble Sort, Selection Sort, Quick Sort, Merge Sort, Sequential Search, Binary Search	6
5.	**Greedy Algorithms** General Characteristics of greedy algorithms, Activity selection problem, The Knapsack Problem, Job Scheduling Problem, Huffman code	4
6.	**Dynamic Programming** Introduction, The Principle of Optimality, Knapsack problem, All Points Shortest path, Matrix chain multiplication.	4

Reference Books

1. Fundamentals of Data Structures in C++
   by Sartaj Sahani
   Galgotia Publications Pvt. Ltd., 2009
2. Introduction to Algorithms
   by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein
   PHI, Second edition
3. Fundamental of Algorithms
   by Gills Brassard, Paul Bratley
   PHI
4. Fundamentals of Computer Algorithms
   by Horowitz, Sahni
   Galgotia Publications Pvt. Ltd., 2001 ed.
5. An Introduction to Data Structures with Applications
   by Jean-Paul Tremblay & Paul G.
   Sorenson Publisher-Tata McGraw Hill

Outcomes

After completion of this subject, students would be able to:
- Differentiate primitive and non-primitive structures.
- Design and apply appropriate data structures for solving computing problems.
- Apply sorting and searching algorithms to the small and large data sets.
- Explain the major graph algorithms and their analyses. Employ graphs to model data science problems wherever appropriate.

Suggested list of Practical (at least 10 practical are to be performed by students. These practical should cover majority of all topics of syllabus.)
This is the suggested list of practical but it may not be limited only to this list.

1. Implement a program for stack that performs following operations using array.
   (a) PUSH (b) POP (c) PEEP (d) CHANGE (e) DISPLAY
2. Implement a program to convert infix notation to postfix notation using stack
3. Write a program to implement QUEUE using arrays that performs following operations (a) INSERT (b) DELETE (c) DISPLAY
4. Write a program to implement Circular Queue using arrays that performs following operations. (a) INSERT (b) DELETE (c) DISPLAY
5. Write a menu driven program to implement following operations on the singly linked list.
   (a) Insert a node at the front of the linked list.
   (b) Insert a node at the end of the linked list.
   (c) Insert a node such that linked list is in ascending order.(according to info. Field)
   (d) Delete a first node of the linked list.
   (e) Delete a node before specified position.
   (f) Delete a node after specified position.
6. Write a program to implement following operations on the doubly linked list.
   (a) Insert a node at the front of the linked list.
   (b) Insert a node at the end of the linked list.
   (c) Delete a last node of the linked list.
   (d) Delete a node before specified position
7. Write a program to implement following operations on the circular linked list.

(a) Insert a node at the end of the linked list.
(b) Insert a node before specified position.
(c) Delete a first node of the linked list.
(d) Delete a node after specified position.
8. Write a program which create binary search tree.
9. Write a program to implement Quick Sort, Merge Sort and Bubble Sort.
10. Write a program to implement binary knapsack problem with greedy and dynamic programming.
11. Write a program to implement activity selection problem with greedy method.
12. Write a program to implement matrix chain multiplication with dynamic programming.

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