ADVANCED DATA STRUCTURES AND ALGORITHMS

Course Code: 15IT2104

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Pre requisites:
1. Computer Programming through C
2. Data Structures
3. Design and Analysis of Algorithms

Course Outcomes:
At the end of the course, a student will be able to
CO1: Use abstract data type.
CO2: Implement priority queues and sorting algorithms.
CO3: Discover solutions for graph problems.
CO4: Devise solutions using algorithm design techniques.
CO5: Implement advanced data structures.

UNIT-I (10-Lectures)
Lists, Stacks, Queues and Trees: Lists, Stacks and Queues: Abstract Data Types (ADTs), The List ADT, Vector and list in the STI, Implementation of vector, Implementation of list, The Stack ADT, The Queue ADT.
Trees: The Search Tree ADT – Binary Search Trees, AVI. Trees, Splay Trees, B-Trees.
Hashing: Hashing: General idea, Hash Function, Separate Chaining, Hash Tables Without Linked Lists, Rehashing, Extendible Hashing.

UNIT-II (10-Lectures)
Priority Queues: Implementations, Binary Heap, Applications of Priority Queues, *d*-Heaps, Leftist Heaps, Skew Heaps, Binomial Queues.
Sorting: Sorting: A Lower Bound for Simple sorting Algorithms, Shellsort, Heapsort, Mergesort, Quicksort, Indirect Sorting, A General Lower Bound for sorting, Bucket Sort, External Sorting.

UNIT-III (10-Lectures)

The Disjoint Set Class: Equivalence Relations, The Dynamic Equivalence Problem, Basic Data Structure, Smart Union Algorithms, Path Compression, Worst Case of Union-by-Rank and Path Compression, An Application.

Graph Algorithms: Definitions, Topological sort, Shortest-Path Algorithms, Network Flow Problems, Minimum Spanning Tree, Applications of Depth-First Search, introduction to NP-Completeness.

UNIT –IV (10-Lectures)

Algorithm Design Techniques: Greedy Algorithms, Divide and Conquer, Dynamic Programming, Randomized Algorithms, Backtracking Algorithms.

Amortized Analysis: An Unrelated Puzzle, Binomial Queues, Skew Heaps, Fibonacci Heaps, Splay Trees.

UNIT-V (10-Lectures)

Advanced Data Structures and Implementation: Top-Down Splay Trees, Red-Black Trees, Deterministic Skip lists, AA-Trees, Treaps, *k*-d Trees, Pairing Heaps.

TEXT BOOKS:

1. Mark Allen Weiss: Data Structures and Algorithm Analysis in C++, 3rd Edition, Pearson Education, 2007.

REFERENCES:

1. Sartaj Sahni : Data Structures Algorithms and Applications in C++, 2nd Edition, Universities Press, 2007.
2. Ellis Horowitz, Sartaj Sahni, Rajasekharan: Fundamentals of Algorithms, 2nd Edition, Universities Press, 2009.
3. Aho V Alfred, Hapcroft E John, Ullman D Jeffry: Data Structures and Algorithms, 1st Edition, Pearson Education, 2002.
4. Adam Drozdek,Thomson: Data Structures and Algorithms in JAVA, 3rd Edition, Cengage Learning , 2008.

5. Horowitz, Sahni, Mehta: Fundamentals of Data Structures in C++, 2nd Edition, Universities Press, 2007.

Web References:

1. www.nptel.iitm.ac.in/video.php?subjectid=106102064.