

2/3 MCA First Semester

CA3T1

DESIGN AND ANALYSIS OF ALGORITHMS

Credits : 4

Lecture Hours : 4 periods / week

Internal assessment : 30 Marks
Semester and Examination: 70 Marks

Course Description:

Design and Analysis of Algorithms is a core course for the Computer Applications. This course provides an introduction to the modern study of computer algorithms and the classic algorithms in various domains, and techniques for designing efficient algorithms.

Course Objectives:

Through this course students should be able to:

- Analyze algorithm performance using complexity measurement.
- Master major algorithm design techniques such as Divide and Conquer, Greedy and Dynamic Programming.
- Apply above approaches to solve a variety of practical problems such as sorting and selection, graph problems, and other optimization problems such as Branch and Bound.

Unit I:

Introduction: Introduction to Algorithm. Algorithm specification. Performance analysis. Algorithm designing techniques. Review of data structures like Stacks, Queues, Trees, Dictionaries, Priority queues and Graphs.

Unit II:

Divide and Conquer: General Method. Applications: Binary search, Merge sort, Quick sort, strassen's matrix multiplication.

Unit III:

Greedy Method: General Method. Applications: Knapsack problem, Job sequencing with deadlines, Minimum cost spanning trees, optimal storage on tapes, Single source shortest paths.

Unit IV:

Dynamic Programming: General Method. Applications: Matrix chain multiplication, Multistage graphs, All-pairs shortest paths, Optimal binary search tree, 0/1 knapsack problem, Reliability design, The traveling sales person problem.

Unit V:

Travel and Search Techniques: Techniques for Binary Trees. Techniques for Graphs: BFS and DFS, Connected components, Spanning trees and Bi-connected components.

Unit VI:

Backtracking: General Method. Applications N-queen problem, Sum of subsets, Graph coloring, Hamiltonian cycles. Branch and Bound: General Method. Applications: LC search, FIFO search, Traveling sales persons problem, 0/1 knapsack problem.

Unit VII:

String Handling Algorithms: The Robin-Karp algorithm, The Knuth-Morris-Pratt algorithm, The Boyre-Moore algorithm.

Unit VIII:

NP-Hard and NP-Complete Problems: Basic concepts, Cooks' Theorem.

Learning Resources

Text Books:

1. Fundamentals of Computer Algorithms by Ellis Horowitz, Sartaj Sahni and Rajasekaran, 2008.
2. Introduction to Algorithms by T.H. Cormen, C.E. Leiserson, R.L. Rivest and C. Stein, Prentice-Hall of India, 2006.

References:

1. Design and Analysis of Algorithms by Aho, Ullman and Hopcroft, Pearson Education, Fourth Impression, 2009.
2. Introduction to the Design and Analysis of Algorithms by A.Levitin, Pearson Education, 2/e, 2007.
3. Data structures, Algorithms and Applications in C++ by S.Sahni, University press (India) Pvt. Limited, Orient Longman Pvt. Limited,2/e.