

Design & Analysis of Algorithm

Code: CS501

Contact: 3L + 1T

Credits: 4

Models of Computation: [2L]

Random Access Machine (RAM), Relationship between Turing Machine and RAM

Complexity Analysis: [2L]

Time and Space Complexity, Different Asymptotic notations – their mathematical significance

Algorithm Design Techniques: [2L]

Recursion – definition, use and limitations, Examples – Tower of Hanoi problem, Tail recursion

Divide and Conquer: [3L]

Basic method, use, Examples – Binary Search, Merge Sort, Quick Sort, Heap Sort and their complexity

Dynamic Programming: [3L]

Basic method, use, Examples – Matrix Chain Manipulation, All pair shortest paths, single source shortest path, Travelling Salesman Problem

Branch and Bound: [2L]

Basic method, use, Examples – The 15 puzzle problem

Backtracking: [3L]

Basic method, use, Examples – 8 queens problem, Graph coloring problem, Hamiltonian problem

Greedy Method: [3L]

Basic method, use, Examples – Knapsack problem, Job sequencing with deadlines, Minimum cost spanning tree by Prim's and Kruskal's algorithm

Lower Bound Theory: [2L]

Bounds on searching and sorting techniques using partial and total order

Disjoint set manipulation: [2L]

Set manipulation algorithm like UNION-FIND, union by rank, path compression

Graph traversal algorithm: [1L]

Breadth First Search (BFS) and Depth First Search (DFS) – complexity and comparison

String matching problem: [2L]

Different techniques including Knuth Morris and Pratt algorithm, complexities

Matrix Manipulation Algorithm: [4L]

Strassen's matrix manipulation algorithm and its application to solution of simultaneous linear equations using LUP decomposition, Inversion of matrix and Boolean matrix multiplication

Notion of NP-completeness: [3L]

P class, NP class, NP hard class, NP complete class – their interrelationship, Satisfiability problem, Cook's theorem (Statement only), Clique decision problem

Approximation Algorithms: [4L]

Necessity of approximation scheme, performance guarantee, polynomial time approximation schemes, 0/1 Knapsack problem, vertex cover problem, travelling salesman problem, set covering problem