

CS 501: ALGORITHMS AND COMPLEXITY (3-0-0 : 3)

Introduction of the notion of Algorithms, Introduction to Asymptotic Notations, Recurrence Relations and Master Theorem, Analysis of algorithms – Worst case, Best Case, Average Case, Basic Data Structure, Sorting Algorithms – Selection Sort, Bubble Sort, Mergesort, Quicksort, Heapsort, Fibonacci Heaps, AVL Trees, Hashing, Basic Algorithm Paradigms – Divide and Conquer, Greedy Algorithms, Dynamic Programming with examples.

Graph Algorithms, Algorithms for Shortest Paths, All-pair Shortest Paths, Algorithms for Minimum Spanning Trees, Algorithms for Maximum Flow, Capacity scaling Algorithms, Polynomial Multiplication, Fast Fourier Transform, Discrete Fourier Transform, Linear Programming.

Review of Turing Machine, Basics of Computational Complexity, Determinism and Non-Determinism, Important Time Complexity Classes like P, NP, #P, EXP, NEXP, Oracles, Alternation, Completeness of Complexity Classes, Polynomial Hierarchy, P vs NP Problem, Space Complexity, LOGSPACE, PSPACE, EXPSPACE, Relation between Time and Space Complexities. Problems whose exact Computational Complexity is unknown like Discrete Log, Factorization, Graph Isomorphism.

Text Books and References

1. H. Cormen, C. E. Leiserson, R. L. Rivest, C Stein, "Introduction to Algorithms", Prentice Hall India.
2. S. Arora, B. Barak, "Computational Complexity", Cambridge University Press.