

CSCS 407 - Complexity Analysis of Algorithms

UNIT I

Introduction to algorithms: Big-O notation, **Algorithms with numbers:** Basic arithmetic, Modular arithmetic, Primality testing, Cryptography, Universal hashing, Randomized algorithms, **Divide-and-conquer algorithms:** Multiplication, Recurrence relations, Mergesort **Decompositions of graphs:** The need of graphs, Depth-first search in undirected graphs, Depth-first search in directed graphs. (12 hours)

UNIT II

Paths in graphs: Distances, Breadth-first search, Lengths on edges, Dijkstra's algorithm **Greedy algorithms:** Minimum spanning trees, Huffman encoding **Dynamic programming:** Longest increasing subsequences, Knapsack, Chain matrix multiplication, Shortest paths, Independent sets in trees. (12 hours)

UNIT III

NP-complete problems: Search problems, Class NP, NP-hard problem, Reduction, NP-complete problems, **Coping with NP-completeness:** Intelligent exhaustive search, Approximation algorithms, Local search heuristics, P vs NP Problem, SAT solvers. (12 hours)

Textbooks:

- (1) Algorithms - Sanjoy Dasgupta, Christos Papadimitriou and Umesh Vazirani, TMH-2008
- (2) Introduction to Algorithms – Thomas H.Cormen, Charles E. Leiserson, Ronald L Rivest, Clifford Stein, 3rd edition, The MIT Press, 2009
- (3) Combinatorial Optimization : Algorithms and Complexity, Christos H. Papadimitriou, Kenneth Steiglitz