

MCPC2001 Design and Analysis of Algorithm (3-0-0)

Course Objectives:

The objective of the course is to:

- Design and analysis of algorithms and find complexity on them.
- Find the complexity of different sorting algorithm.
- Understand the dynamic programming and greedy algorithms
- Analyze and implementation of Graph Algorithms
- Demonstrate NP-Completeness and Approximation Algorithms

Module I

Introduction to design and analysis of algorithms, Growth of functions, Recurrences, Solution of recurrences by Substitution, Recursion tree and Master method, Worst case analysis of Merge sort, Quick sort and Binary search Heap sort: Heaps, Building a heap, The Heap sort algorithm, Priority Queue, Lower bounds for sorting

Module II

Dynamic Programming: Matrix-chain multiplication, Elements of dynamic programming, longest common subsequence Greedy Algorithms: An activity-selection problem, Elements of greedy strategy, Fractional knapsack problem, Huffman codes

Module III

Data structures for Disjoint Sets: Disjoint set operations, Linked-list representation of disjoint sets, Disjoint-set forests. Graph Algorithms: Elementary Graph Algorithms: Representations of graphs, Breadth-first search, Depth-first search, Minimum Spanning Trees: Kruskal and Prim's algorithms, Single-Source Shortest Paths: The Bellman-Ford and Dijkstra's algorithm, All-Pairs Shortest Paths: The Floyd-Warshall Algorithm

Module IV

Maximum Flow: Flow Networks, The Ford-Fulkerson method, Polynomials and the FFT: Representation of polynomials, The DFT and FFT, String Matching: The naïve string-matching algorithm, The Rabin-Karp algorithm. NP-Completeness: Polynomial time, Polynomial-time verification, NP-completeness and reducibility, NP-completeness proofs, NP-completeness problems, Approximation Algorithms: The vertex-cover problem, The travelling-salesman problem, The set-covering problem, The subset-sum problem.

Course Outcomes:

Upon successful completion of this course, the student shall be able to:

- CO 1. Identify the different design technique of algorithm.
- CO 2. Analyze the different sorting algorithm based on time and space.
- CO 3. Analyze the different approaches of designing algorithm like dynamic programming and greedy algorithms
- CO 4. Discuss different graph algorithm.

Books:

1. Introduction to Algorithms: T. H. Cormen, C. E. Leiserson, R. L. Rivest (PHI), Second Edition.
2. E. Horowitz, S. Sahani, S. Rajsekharan, " Fundamentals of Computer Algorithms", Second Edition, Universities Press, 2007

Reference Books:

1. Design and Analysis of Algorithm – M R Kabat, PHI Learning Pvt. Ltd.
2. Algorithm Design –Goodrich, Tamassia, WileyIndia.
3. Algorithms By Sanjay Dasgupta, Umesh Vazirani – McGraw-Hill Education