M.Sc. IT 1st Semester
1125
INFORMATION TECHNOLOGY
Paper : MS-41 : Analysis and Design of Algorithms

Time Allowed : Three Hours]   **[Maximum Marks : 80**

Note :– Attempt **five** questions in all, including Q. 9 in Section E, which is compulsory and taking **one** question each from Section–A to Section–D.

SECTION–A

1. (a) Discuss Asymptotic notations with the help of suitable examples.   8

   (b) What are recurrence relations ? How to solve them using substitution method ? Give an example.   8

2. (a) Discuss Divide and Conquer technique with the help of Control Abstraction and suitable example.   8

   (b) What is Selection Problem ? How to solve it using divide and conquer technique ? Explain with the help of an algorithm.   8

SECTION–B

3. (a) How to find minimum cost spanning tree of a graph using Kruskal's Algorithm. Give algorithm and discuss its complexity.

8

(b) Solve the following instance of Knapsack Problem using Greedy technique :

$n = 3$, $w_1 = 3$, $w_2 = 2$, $w_3 = 3$, $p_1 = 1$, $p_2 = 3$, $p_3 = 5$, $m = 6$ where n is number of items, w_i is weight of ith item, p_i is profit of ith item and m is capacity of knapsack. 8

4. (a) What is Optimal Binary Search Tree Problem ? How to solve it using dynamic programming technique ? Explain with the help of an example. 8

(b) How to solve All Pair Shortest Path Problem using Bellman Ford Algorithms ? Give algorithm and discuss its complexity.

8

SECTION–C

5. (a) Discuss general method of Backtracking with the help of a recursive algorithm. 8

(b) Discuss Hamiltonian Cycle Problem with the help of an algorithm and its complexity. 8

6. (a) What is a dynamic state space tree ? How to solve travelling salesman problem using Least Cost Branch and Bound with the help of dynamic state space tree ? Explain with the help of an example. 10

(b) Explain Least Cost Branch and Bound Technique with the help of an algorithm. 6

SECTION–D

7. (a) Discuss P, NP, NP-Hard and NP-Complete problems. What is the relationship between these classes of problems ? 8

   (b) Prove that Clique Decision Problem is NP-Hard. 8

8. (a) What is a Comparison Tree ? Draw comparison tree for searching an element in an array. What is the lower bound on the complexity of this technique ? 8

   (b) Discuss lower bound for the problem of polynomial evaluation. 8

SECTION–E

9. (a) What is breakeven point ? 2

   (b) Differentiate between feasible and optimal solution. 2

   (c) Give best, average and worst case complexity of Merge Sort. 2

   (d) Differentiate between forward and backward approaches for solving recurrence relations. 2

   (e) Give any two factors on which efficiency of backtracking algorithm depends. 2

   (f) Differentiate between implicit and explicit constraints with the help of an example. 2

   (g) Define Live node, E-node and Dead node. 2

   (h) Discuss the concept of upper (upper cost u) in Branch and Bound. 2