Time: 3 Hours   *Total Marks: 100*

Faculty Name: Mr. Rishabh Kamal

Note: Attempt all Sections. If you require any missing data, then choose suitably.

Section-A

1. Attempt all questions in brief.   **2x10 = 20**

(a) Discuss the basic steps in the complete development of an algorithm.

(b) Explain and compare best and worst time complexity of Quick Sort.

(c) Discuss Skip list and its operations.

(d) Discuss the properties of binomial trees.

(e) Illustrate the applications of Graph Coloring Problem.

(f) Define principle of optimality.

(g) Differentiate Backtracking and Branch and Bound Techniques.

(h) Discuss backtracking problem solving approach.

(i) Define NP, NP hard and NP complete. Give example of each.

(j) Explain Randomized algorithms.

Section -B

2. Attempt any three of the following: **10 x 3 = 30**

a. Solve the recurrence

   i) $T(n) = 3T(n/4) + cn^2$ using recursion tree method.

   ii) $T(n) = n + 2T(n/2)$ using Iteration method. (Given $T(1) = 1$)

b. What is Binomial Heap? Write down the algorithm for Decrease key operation

   in Binomial Heap also write its time complexity.

c. Write and explain the Kruskal algorithm to find the Minimum Spanning Tree of a graph with suitable example.

d. What is N queens' problem? Draw a state space tree for 4 queens problem using backtracking.

e. Write Rabin Karp string matching algorithm. Working modulo q=11, how many spurious hits does the Rabin karp matcher in the text T=3141592653589793, when looking for the pattern P=26

Section-C

3. Attempt any one part of the following: **10 x 1 = 10**

(a) Write Merge sort algorithm and sort the following sequence {23, 11, 5, 15, 68, 31, 4, 17} using merge sort.

(b) What do you understand by stable and unstable sorting? Sort the following sequence {25, 57, 48, 36, 12, 91, 86, 32} using heap sort.

4. Attempt any one part of the following: **10 x 1 = 10**

(a) Discuss the various cases for insertion of key in red-black tree for given sequence of key in an empty red-black tree- {15, 13, 12, 16, 19, 23, 5, 8}.

(b) What is skip list? Explain the Search operation in Skip list with suitable

5. Attempt any one part of the following: **10x1 = 10**

(a) Explain "greedy algorithm" Write its pseudo code to prove that fractional Knapsack problem has a greedy-choice property.

(b) What are single source shortest paths? Write down Dijkstra's algorithm for it.

6. Attempt any one part of the following: **10x1 = 10**

(a) What is the sum of subsets problem? Let w={5,7,10,12,15,18,20} and m=35. Find all possible subsets of w that sum to m using recursive backtracking algorithm for it. Draw the portion of the state-space tree that is generated.

(b) Illustrate n queen's problem. Examine 4 queen's problem using back tracking method.

7. Attempt any one part of the following: **10x1 = 10**

(a) What is string matching algorithm? Explain Rabin-Karp method with examples.

(b) Explain approximation algorithm. Explore set cover problem using approximation algorithm.