B TECH
(SEM V) THEORY EXAMINATION 2018-19
DESIGN AND ANALYSIS OF ALGORITHM

Time: 3 Hours   *Total Marks: 100*

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.
        2. Any special paper specific instruction.

SECTION A

1.   **Attempt *all* questions in brief.**   **2 x 10 = 20**

   a.   Explain various properties of Binomial Tree.

   b.   Show that the solution to $T(n) = 2T(\lfloor n/2 \rfloor + 17) + n$ is $O(n \lg n)$.

   c.   Write a recursive function to compute x^n

   d.   Quick sort is fastest comparison sorting algorithm in the average case. Are you agree with this statement? Justify your answer.

   e.   Compare dynamic and greedy programming strategies.

   f.   Explain application of graph coloring problem.

   g.   Prove that maximum degree of any node in an n node binomial tree is log n.

   h.   Explain Implicit and Explicit constraints of N-queen Problem.

   i.   Explain Randomized Algorithms.

   j.   Define NP, NP hard and NP Complete Problems. Give an example of each.

SECTION B

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

   a.   Solve the recurrence: $T(n) = 50\, T(n/49) + \log n!$

   b.   Insert the following element in an initially empty RB-Tree.
         12, 9, 81, 76, 23, 43, 65, 88, 76, 32, 54. Now Delete 23 and 81.

   c.   Prove that if the weights on the edge of the connected undirected graph are distinct then there is a unique Minimum Spanning Tree. Give an example in this regard. Also discuss Kruskal's Minimum Spanning Tree Algorithm in detail.

   d.   Find an optimal parenthesization of a matrix chain product whose sequence of dimensions is {10, 5, 3, 12, 6}.

   e.   Explain KMP algorithm. Find the prefix function for the pattern
         P: ababaaca and apply KMP algorithm on Text T: aabbababaacaab

SECTION C

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

   (a)   Illustrate the operation of Quick sort on the array, A= (9, 14, 87, 4, 32, 86, 67)

   (b)   Solve the recurrence using recursion tree method:
         T (n) = T (n/2) + T (n/4) + T (n/8) + n

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

    (a)   Discuss the advantages of using B-Tree. Insert the following Information 86, 23, 91, 4, 67, 18, 32, 54, 46, 96, 45 into an empty B-Tree with degree t=2 and delete 18, 23 from it.

    (b)   Explain the algorithm to extract the minimum elements in a binomial Heap. Give an example for the same.

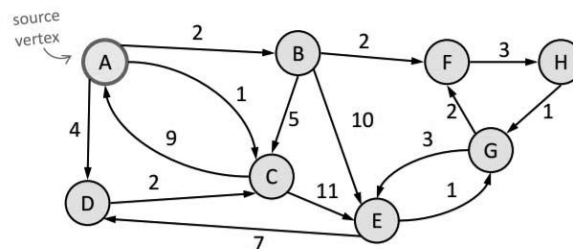5. **Attempt any *one* part of the following:**   **10 x 1 = 10**

    (a)   Consider the following instance for knapsack problem. Find the solution using Greedy method:
N= 10, W=130
P [] = {21, 31, 43, 53, 41, 63, 65, 75}
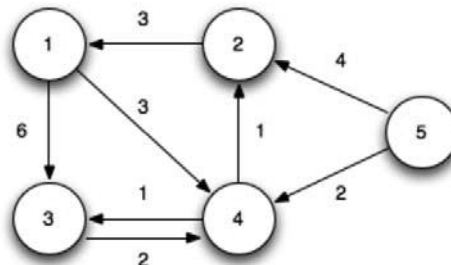V [] = {11, 21, 31, 33, 43, 53, 65, 65}

    (b)   Apply the greedy single source shortest path algorithm on the following graph:

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

    (a)   Define Floyd Warshall Algorithm for all pair shortest path and apply the same on following graph:

    (b)   What is the difference between Backtracking and Branch & Bound? Write Pseudo code for Subset Sum Problem using Backtracking. Give example for the same.

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

    (a)   What are approximation algorithms? What is meant by P (n) approximation algorithms. Discuss approximation algorithm for Vertex cover Problem.

    (b)   Prove that the Travelling Salesman Problem is NP-Complete.