Printed Pages: 02 **Sub Code:KCS-503**

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B.TECH.
(SEM V) THEORY EXAMINATION 2022-23
DESIGN & ANALYSIS OF ALGORITHM

Time: 3 Hours ***Total Marks: 100***

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: 10x3 = 30

(a) Explain Merge sort algorithm and sort the following sequence {23, 11, 5, 15, 68,31, 4, 17} using merge sort.
(b) What are the various differences in Binomial and Fibonacci Heap? Explain.
(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 in detail.
(d) Discuss LCS algorithm to compute Longest Common Subsequence of two givenstrings and time complexity analysis.
(e) Explain and Write the Naïve-String string matching algorithm:
Suppose the given pattern p= aa b and given text T = a c a a b c.
Apply Naïve-String Matching algorithm on above Pattern (P) and Text (T) to find the number of occurrences of P in T.

SECTION C

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

(a) Examine the following recurrence relation:
(i) $T(n) = T(n-1) + n^4$
(ii) $T(n) = T(n/4) + T(n/2) + n^2$
(b) Explain algorithm for counting sort. Illustrate the operation of counting sort on the following array: A={0,1,3,0,3,2,4,5,2,4,6,2,2,3}.

4. Attempt any *one* part of the following: 10 *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}. Also show that a red-black tree with **n** internal nodes has height at most **2lg(n+1).**

(b) Explain and write an algorithm for union of two binomial heaps and write its time complexity.

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

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

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