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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 given strings 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 $2\lg(n+1)$.
- (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.

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