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Roll No.

## 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

- Discuss the various cases for insertion of key in red-black tree for given (a) 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  $\mathbf{n}$  internal nodes has height at most  $2\lg(\mathbf{n}+1)$ .
- Explain and write an algorithm for union of two binomial heaps and write its (b) time complexity.

#### 5. Attempt any one part of the following:

10\*1 = 10

- Explain "greedy algorithm" Write its pseudo code to prove that fractional Knapsack problem has a greedy-choice property.
- What are single source shortest paths? Write down Dijkstra's algorithm for it.

#### 6. Attempt any *one* part of the following:

10\*1 = 10

- What is the sum of subsets problem? Let  $\mathbf{w} = \{5,7,10,12,15,18,20\}$  and  $\mathbf{m} = 35$ . 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

- What is string matching algorithm? Explain Rabin-Karp method with examples. (a)
- 19 No. 01.2023 No. 12.03 No. 12.023 No. 02.023 No. 02.0 Explain approximation algorithm. Explore set cover problem using (b) approximation algorithm.

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