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B. TECH.
(SEM V) THEORY EXAMINATION 2021-22
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. How analyze the performance of an algorithm in different cases?
- b. Derive the time complexity of Merge sort.
- c. Explain left rotation in RB tree.
- d. Write down the properties of Fibonacci Heap.
- e. Explain Greedy programming in brief.
- f. What do you mean by convex hull?
- g. Write down the Floyd Warshal algorithm.
- h. Explain Branch and Bound method in brief.
- i. Explain Randomized algorithm in brief.
- j. Explain NP-complete and NP-Hard.

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



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example also write its algorithm.

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

10 x 1 = 10

- (a) What is Knapsack problem? Solve Fractional knapsack problem using greedy programming for the following four items with their weights $w = \{3, 5, 9, 5\}$ and values $P = \{45, 30, 45, 10\}$ with knapsack capacity is 16.
- (b) Write down the Bellman Ford algorithm to solve the single source shortest path problem also write its time complexity.

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

10 x 1 = 10

- (a) What is travelling salesman problem (TSP)? Find the solution of following TSP using Branch & Bound method

0	20	30	10	11
15	0	16	4	2
3	5	0	2	4
19	6	18	0	3
16	4	7	16	0

- (b) Explain the method of finding Hamiltonian cycles in a graph using backtracking method with suitable example.

7. Attempt any *one* part of the following:

10 x 1 = 10

- (a) Write and explain the algorithm to solve vertex cover problem using approximation algorithm.
- (b) Explain and Write the Knuth-Morris-Pratt algorithm for pattern matching also write its time complexity.