Roll No. | | | | | | | | | | | | **Total No. of Pages : 03**

Total No. of Questions : 09

MCA (Sem–2)

DESIGN AND ANALYSIS OF ALGORITHMS

Subject Code : PGCA-1920

M.Code : 79616

Date of Examination : 14-12-2024

Time : 3 Hrs. **Max. Marks : 70**

INSTRUCTIONS TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION - B & C. have FOUR questions each.**
3. **Attempt any FIVE questions from SECTION B & C carrying TEN marks each.**
4. **Select atleast TWO questions from SECTION - B & C.**

SECTION-A

1. Write briefly :

a. What is randomization?

b. Explain space complexity.

c. What is TSP? Give example.

d. Suppose that a selection sort of 50 items has completed 35 iterations of the main loop. How many items are now guaranteed to be in their final position i.e. never need to be moved again during rest part sort?

e. An array of 16 elements is already sorted. We always pick the first element of the array at each iteration of the sorting process as the pivot. How many recursions (layers) will it take for quicksort to terminate?

f. Kruskal's algorithm uses _____ and prim's algorithm uses_____ in determining the MST. Elaborate.

g. In what manner is a state-space tree for a backtracking algorithm constructed?

h. Write the complexity of the recurrence relation $T(n)=4T(4n/5)+\theta(n)$.

i. What is the complexity of running merge sort on an array of size n which is already sorted?

j. Explain Randomized algorithm with applications.

SECTION-B

2. Explain in brief characteristics of greedy algorithms. Compare Greedy Method with Dynamic Programming Method in terms of complexity with the help of example.

3. a. Solve following recurrence using master method $T(n) = 9T(n/3) + n$.

   b. For parameters a and b, both of which are $\omega(1)$, $T(n) = T(n^{1/a})+1$, and $T(b) = 1$. Find the value of $T(n)$ in terms of θ.

4. Explain analyzing algorithm in detail and analyze its different order of growth with the help of recurrence relations and tree. Analyze recursive and no-recursive algorithms

5. *The 4-Queens Problem* consists in placing four queens on a 4×4 chessboard so that no two queens can capture each other. That is, no two queens are allowed to be placed on the same row, the same column or the same diagonal.

   a. Translate this real problem into a *mathematical model* with *variables* and *constraints* using backtracking approach.

   b. Explain step by step approach to solve 4 queen problem with the help of its pseudo code.

SECTION-C

6. Given a sorted array of n integers that has been rotated an unknown number of times, write pseudocode (based on binary search) to find an element in the array. You may assume that the array was originally sorted in increasing order.

   EXAMPLE:

   Input: find 5 in {15, 16, 19, 20, 25, 1, 3,4,5,7,10, 14}

   Output: 8 (the index of 5 in the array)

7. a. Write short note on NP hardness and NP completeness.

   b. Apply merge sort algorithm to sort given input sequence. Input: 14, 90, 27, 15, 15, 19, 42, 44.

8. Write a program naïve string matcher algorithm. Also analyse the complexity of the algorithm.

9. Write Pseudocode for Partition in Quicksort. Run it on the given array once and show how the array looks after running Partition over it. (Take last element as Pivot element)

9	6	5	0	8	2	4	7

Show how quick sort can be made to run in O(n lg n) time in the worst case.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.