MCA (Sem–2)
DESIGN AND ANALYSIS OF ALGORITHMS
Subject Code : PGCA-1920
M.Code : 79616
Date of Examination : 21-06-2023

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. Define algorithm. List the criteria that an algorithm should follow.

   b. Define time complexity and space complexity of an algorithm.

   c. What are asymptotic notations? List various asymptotic notations used in the analysis of algorithms.

   d. Prove that if $f_1(n)=O(g_1(n))$ and $f_2(n)=O(g_2(n))$ then $f_1(n) + f_2(n) = O(g_1(n) + g_2(n))$.

   e. Give the recurrence relation for worst case behavior of quick sort algorithm.

   f. What is the difference between backtracking and branch-and-bound algorithm design techniques?

   g. What are the applications of BFS and DFS?

   h. What are NP-hard and NP-complete problems?

   i. In context of backtracking, define the following terms: implicit constraints, explicit constraints, e-node and live node.

   j. In context of dynamic programming, define principle of optimality.

SECTION-B

2. What is all-pairs shortest path problem? Write an algorithm that makes use of dynamic programming to solve all-pairs shortest path problem. Analyze its time complexity.

3. What do you mean by control abstraction? Using the control abstraction, describe in detail divide- and-conquer algorithm design strategy.

4. What is 8-queens problem? Describe and write an algorithm that makes use of backtracking for solving 8-queens problem.

5. What is 0/1 Knapsack problem? How it is different from fractional knapsack problem? Describe how 0/1 knapsack problem can be solved using Branch-and-Bound technique of algorithm design?

SECTION-C

6. Describe how an array of elements can be sorted using Quicksort algorithm. Show that the running time of Quicksort is $O(n^2)$ when the array A contains distinct elements and is sorted in decreasing order.

7. What is the basic assumption in binary search algorithm? Write binary search algorithm. Using binary search algorithm, find the number of comparisons required to find key value 9 in the given list: -15,-6, 0,7,9,23,54,82,101,112,125,131,142,151.

8. Describe bubble sort algorithm for sorting. Why is it named "Bubble sort"? Analyze its time complexity.

9. Define and describe NP, P, NP-hard and NP-complete problems. Give an example of each class of problem.

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.