

Roll No.

Total No. of Pages : 02

Total No. of Questions : 09

MCA (Sem-2)
DESIGN AND ANALYSIS OF ALGORITHMS

Subject Code : PGCA-1920

M.Code : 79616

Date of Examination : 05-05-2025

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. Are the sub solutions overlapping in dynamic programming approach?
 - b. What is asymptotic analysis? Why are asymptotic notations important?
 - c. Draw a graph with a cycle but with no Hamiltonian cycle.
 - d. What are P and NP problems?
 - e. What is the basic principle of divide-and-conquer?
 - f. State the general principle of greedy algorithm.
 - g. What are the two classes of non-polynomial algorithms?
 - h. What do you mean by the running time of an algorithm?
 - i. What are the deterministic algorithms?
 - j. How is the time complexity measured?

SECTION - B

2. Order the following functions by growth rate: N , $N^{1.5}$, N^2 , $N \log \log N$, $N \log^2 N$, $N \log(N^2)$, $2/N$, 2^N , $2^{N/2}$, 37 , $N^2 \log N$, N^3 . Indicate which functions grow at the same rate.
3. Prove that $f(n) = a_m n^m + a_{m-1} n^{m-1} + \dots + a_1 n + a_0$ then $f(n) = O(n^m)$.
4. Consider 5 items along with their respective values and weights: $I = \langle I_1, I_2, I_3, I_4, I_5 \rangle$, $w = \langle 5, 10, 20, 30, 40 \rangle$, $v = \langle 30, 20, 100, 90, 160 \rangle$

The capacity of the knapsack $W = 60$. Find the solution for the fractional knapsack problem.

5. Explain the Big -Oh computation for each of the following control structures:
 - a) Sequencing
 - b) If-then-else
 - c) "for" loop
 - d) "While" loop
 - e) Recursion.

SECTION - C

6. What is the working principle of Quicksort? What is the significance of the Pivot element? Explain the implementation of the Quicksort algorithm step-by-step using a suitable illustrative example.
7. What is NP Completeness? Is $P = NP$? Explain.
8. If we are given a directed graph G with n vertices. Explain how you will find out the length of the shortest path between any pair of vertices in G ? Justify your answer with an example.
9. Define depth-first search. Write algorithm for DFS, discussing its time complexity. Also, illustrate with some example.

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.