**Seat No: _____** **Enrollment No: _____**

# PARUL UNIVERSITY

## FACULTY OF ENGINEERING & TECHNOLOGY

**B.Tech. Summer 2023-24 Examination**

**Semester: 4/5** **Date: 10/05/2024**

**Subject Code: 203105301** **Time: 02:00 pm to 04:30 pm**

**Subject Name: Design and Analysis of Algorithms** **Total Marks: 60**

Instructions:

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start a new question on the new page.

| Q.1 | Objective Type Questions - | (15) | CO | PO | BT |
|---|---|---|---|---|---|
| | 1) The Master Theorem can solve all types of equations<br>a. True b. False c. None of the above d. Can't say | | 1 | 2 | 1 |
| | 2) A Bellman-Ford algorithm provides solution for _____ Problems.<br>a. All Pair Shortest Path b. Sorting<br>c. Network flow d. Single Source Shortest Path | | 1 | 2 | 2 |
| | 3) Which data structure is used for implementing a LIFO branch and bound strategy?<br>a. Stack<br>b. Queue<br>c. Array<br>d. Linked list | | 2 | 1 | 1 |
| | 4) Problems that can be solved in polynomial time are known as?<br>a. Intractable<br>b. Tractable<br>c. Decision<br>d. Complete | | 1 | 2 | 2 |
| | 5) f(n) = Θ(g(n)) implies that?<br>a. f(n) >= c.(g(n)) and f(n) <= c.(g(n))<br>b. f(n) >= c.(g(n))<br>c. f(n) <= c.(g(n))<br>d. D) None of the above | | 2 | 1 | 2 |
| | 6) _____ algorithm is one that always makes the locally optimal choice at each step. | | 1 | 1 | 1 |
| | 7) n the _____ problem, the goal is to find the most valuable combination of items that can be carried in a knapsack of limited capacity. | | 2 | 2 | 1 |
| | 8) In the dynamic programming approach, the subproblems are _____. | | 1 | 2 | 2 |
| | 9) The time complexity of the bubble sort algorithm is _____. | | 1 | 1 | 2 |
| | 10) In the divide and conquer paradigm, the problem is broken down into _____ subproblems, each of which is solved independently. | | 2 | 2 | 1 |
| | 11) Define Backtracking. | | 1 | 2 | 1 |
| | 12) What is the time complexity of performing a topological sort on a graph with V vertices and E edges? | | 2 | 1 | 2 |
| | 13) Describe the behavior of the divide and conquer algorithm? | | 2 | 1 | 1 |
| | 14) List down the greedy techniques? | | 1 | 1 | 1 |
| | 15) What are asymptotic notations? | | 2 | 2 | 2 |
| **Q.2** | **Answer the following questions.** | (15) | | | |
| | A) What is the relationship between P, NP, and NP-complete problems? Show with the help of a Diagram. | | 1 | 3 | 1 |
| | B) What is the Traveling Salesman problem and how is it formulated as a branch and bound problem? | | 1 | 3 | 2 |
| | C) Write an algorithm based on a divide-and-conquer strategy to search an element in a given list. Assume that the elements of the list are in sorted order | | 2 | 2 | 3 |
| | D) (i) Solve the following recurrence relation using the Substitution method. | | 3 | 1 | 3 |

| | | | | | |
|---|---|---|---|---|---|
| | T(n) = 8T(n/2) + n^2 if n > 2<br>1 if n = 2<br>(ii) Solve the following recurrence relation using the Recursive tree method.<br>T(n) = T(n/2) + T(n/2) + n. | | | | |
| **Q.3** | A) Describe the Dijkstra's algorithm Explain with the example. | (07) | | 3 | 4 |
| | B) What is the traveling salesman problem? Explain how it can be solved using an approximation algorithm. | (08) | 1 | 3 | 2 |
| | OR | | | | |
| | B) What is the difference between a BFS (breadth-first search) and a DFS (depth-first search) algorithm? In what situations would you use one over the other? | (08) | 1 | 2 | 2 |
| **Q.4** | A) Define the spanning tree. Write Kruskal's algorithm for finding a minimum cost-spanning tree. Describe how Kruskal's algorithm is different from Prim's algorithm for finding a minimum cost-spanning tree | (07) | 2 | 1 | 4 |
| | OR | | | | |
| | A) Explain in detail the quick sort method. Provide a complete analysis of quick sort. | (07) | 2 | 3 | 1 |
| | B) Give the solution for the knapsack with branch and bound. The capacity of knapsack is m=12 . There are 5 objects with profit (p1,p2,p3,p4,p5)=(10,15,6,8,4) and weights (w1,w2,w3,w4,w5)=(4,6,3,4,2). | (08) | 3 | 2 | 3 |