DHARMSINH DESAI UNIVERSITY, NADIAD
FACULTY OF TECHNOLOGY
SECOND SESSIONAL
SUBJECT: (CE-423) DESIGN & ANALYSIS OF ALGORITHMS

Examination	**: B.Tech Semester-IV**	**Seat No**	**: _____**
Date	**: 05/02/2024**	**Day**	**: Monday**
Time	**: 01:00 P.M.-02:15 P.M.**	**Max. Marks**	**: 36**

INSTRUCTIONS:

1. Figures to the right indicate maximum marks for that question.
2. The symbols used carry their usual meanings.
3. Assume suitable data, if required & mention them clearly.
4. Draw neat sketches wherever necessary.

Q.1 Do as directed. **[12]**

CO1 R (a) Which of the following describes key idea behind Dynamic Programming most accurately: **[2]**

i. Breaking down a complex problem into simpler overlapping subproblems and solving each subproblem only once.
ii. Solving problems in a recursive manner.
iii. Storing all solutions in a table for quick access
iv. Applying brute force to explore all possible solutions.

CO1 U (b) The problem is suitable for DP solution, when it possesses _____ and _____ key properties. **[2]**

CO2 N (c) Compare top-down and bottom-up approaches of Dynamic Programming on the following criteria : 1) Memory Usage 2)Time Complexity **[2]**

CO1 E (d) State true or false and justify using suitable example: Strongly connected components of Directed Graph G and its transpose Graph G^T are same. **[2]**

CO2 N (e) Assume that you are doing Depth First Traversal over undirected graph. If current node being explored is u, which has some neighbor w. When does the edge (u, w) qualify to be the Back Edge and when not? **[2]**

CO2 N (f) If Adjacency List is used for Graph, what is the complexity of Level order search? Justify the answer. **[2]**

Q.2 Attempt *Any Two* of the following questions. **[12]**

CO3 C (a) Given number of stairs, starting from the 0th stair, you need to climb to the n^{th} stair. At a time, you can climb either one or two steps. You need to return the total number of distinct ways to reach from 0th to n^{th} stair. Give the solution of the above-mentioned problem using Memoization approach of Dynamic Programming. Show the recurrence tree and DP array generated using your solution for the problem where **n=5.** **[6]**

CO3 A (b) Solve the problem of finding optimal BST by minimizing expected search cost for successful and unsuccessful searches for the below given data using bottom-up dynamic programming. Show the values of each cell of cost, weight and root tables. Also draw the OBST based on your solution. **p_i = { 0.19, 0.19, 0.06, 0.06 } q_i = { 0.13, 0.19, 0.06, 0.06, 0.06 }** **[6]**

CO3 C (c) You are a professional robber planning to rob houses along a street. Each house has a certain amount of money stashed, the only constraint stopping you from robbing each of them is that adjacent houses have security systems connected and it will automatically contact the police if two adjacent houses were broken into on the same night. Write a solution which takes an integer array **nums** representing the amount of money of each house, and returns the **maximum amount** of money you can rob tonight without alerting the police. **Provide your solution using tabulation approach.** **[6]**

Q.3 Attempt the following questions. **[12]**

CO1 A (a) i. Which of the following statement(s) is/are correct regarding Bellman-Ford shortest path algorithm? Justify. **[2]**

P: Always finds a negative weighted cycle, if one exists.

Q: Finds whether any negative weighted cycle is reachable from the source.

ii. Apply Bell-Man ford Algorithm over graph **G1**. **Consider 0 as Source.** **[4]**

CO4 A (b) Solve the following recurrence using method of Homogeneous/Non-Homogeneous Method. Show every necessary step of Computation. **[6]**

$$T(n)= 3T(n-1) + n.3^n, n>1$$
$$= 1, \text{otherwise}$$

OR

CO1 A (a) i. Which of the following statement(s) is/are correct, considering Tarjan's algorithm? Justify. **[2]**

P: It has Complexity n times that of DFS.

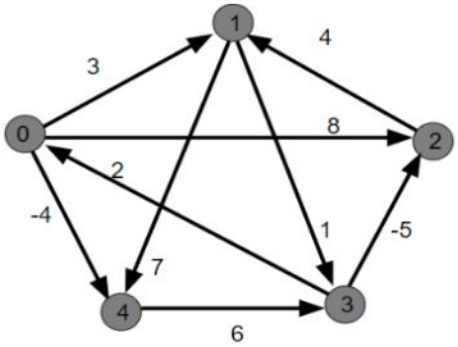
Q: Leaves of the Depth First Tree are always Articulation Points.

R: Root of the Depth First Tree is always Articulation Point.

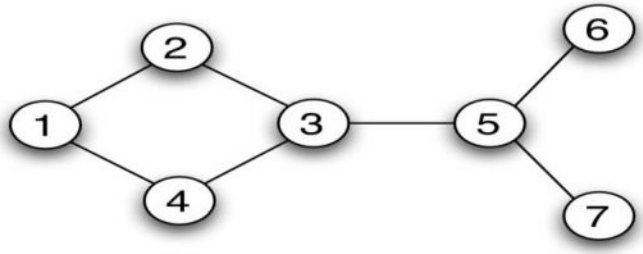
ii. Execute Tarjan's algorithm over Graph **G2** and obtain Articulation Points. **[4]**
Start the Depth First Spanning Tree from node 3.

CO4 A (b) Use change of variable method and convert the following recurrence to the Homogeneous/Non-Homogeneous recurrence. Solve the obtained recurrence and change the solution back to original. Show every necessary step of Computation. Do not obtain values for constants. **[6]**

$$T(n)= 3T(n/2) + n.\log(n), n>1 \text{ and } n \text{ is power of } 2$$
$$= 1, \text{otherwise}$$



G1



G2