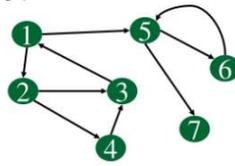


GUJARAT TECHNOLOGICAL UNIVERSITY**BE- SEMESTER-III EXAMINATION – WINTER 2025****Subject Code:3134201****Date:12-12-2025****Subject Name: Data Structures and Algorithms****Time:10:30 AM TO 01:00 PM****Total Marks:70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

- | | | Marks | | | | | | | | | | |
|------------|---|--------------|---|---|---|---|---|--|--|--|--|--|
| Q.1 | (a) Define Stack. Differentiate between Stack and Queue. | 03 | | | | | | | | | | |
| | (b) Compare various asymptotic notations. Mention properties of properties of an algorithm. | 04 | | | | | | | | | | |
| | (c) Define data structures. Draw classification diagram of various data structures. Mention the operations that can be performed over data structures. Show that $4n^2 = O(n^3)$, using concept of asymptotic notations. | 07 | | | | | | | | | | |
| Q.2 | (a) Evaluate given prefix expression + - 9 2 7 * 8 / 4 12 | 03 | | | | | | | | | | |
| | (b) Show how the given expression can be converted from Infix to Postfix notation using Stack: $((A - B) + D / ((E + F) * G))$ | 04 | | | | | | | | | | |
| | (c) Write the algorithm for insertion of a new node at the beginning of singly linked list.
Consider the Queue given below which has FRONT =1 and REAR=5 | 07 | | | | | | | | | | |
| | <table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <tr> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;">A</td> <td style="width: 20px; height: 20px;">B</td> <td style="width: 20px; height: 20px;">C</td> <td style="width: 20px; height: 20px;">D</td> <td style="width: 20px; height: 20px;">E</td> <td style="width: 20px; height: 20px;"></td> </tr> </table> | | A | B | C | D | E | | | | | |
| | A | B | C | D | E | | | | | | | |
| | Now perform the following operations on the queue: | | | | | | | | | | | |
| | 1. Add F
2. Delete two letters 3. Add G
4. Add H 5. Delete four letters 6. Add I | | | | | | | | | | | |
| | OR | | | | | | | | | | | |
| | (c) Write a program to perform insert and delete operations in a doubly linked list. | 07 | | | | | | | | | | |
| Q.3 | (a) Solve the following recurrence relation $T(n) = T(n-1) + 5$ for $n > 1$, and $T(1) = 0$ as initial condition. | 03 | | | | | | | | | | |
| | (b) Apply a quick sort algorithm to sort the following data. Justify the steps. 41,27,74,10,64,53 | 04 | | | | | | | | | | |
| | (c) Construct AVL tree for following sequence: 45,36,27,63,39. After the creation of AVL tree insert 72, 18 and delete 72. (Show each iteration) | 07 | | | | | | | | | | |
| | OR | | | | | | | | | | | |
| Q.3 | (a) Find the order of growth for solutions of following recurrences using master's theorem:
i) $T(n) = 4T(n/2) + n, T(1) = 1$
ii) $T(n) = 4T(n/2) + \log n$ | 03 | | | | | | | | | | |
| | (b) Apply a merge sort algorithm to sort the following data. Justify the steps. 41,27,74,10,64,53 | 04 | | | | | | | | | | |
| | (c) Create a Binary Search Tree for given elements 84, 25, 36, 15, 48, 09, 17, 55, 92, 11, 15, 7, 1, 12. Find in order and preorder traversal for the same. | 07 | | | | | | | | | | |

- Q.4 (a)** What is principal of optimality? Explain its use in Dynamic Programming Method. **03**
- (b)** Perform Depth First Search on below given undirected graph starting at node 1 Show the resultant stack. **04**

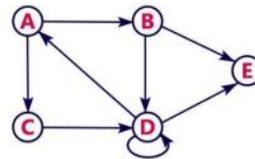


- (c)** Solve the following making change problem using dynamic programming method: Amount = Rs. 8 and Denominations: (Rs. 1, Rs. 3, Rs. 5 and Rs. 6) **07**

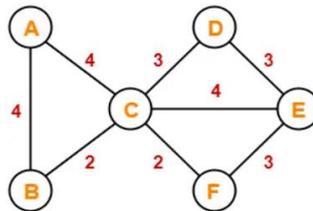
OR

- Q.4 (a)** Differentiate between greedy method and dynamic programming. **03**
- (b)** Perform Breadth First Search on previously mentioned graph of Q.4(c) starting at node 1. Show the resultant queue. **04**
- (c)** Describe longest common subsequence problem. Find longest common subsequence of following two strings X and Y using dynamic programming. X=<MLNOM>, Y=<MNOM> **07**

- Q.5 (a)** Consider the graph given below: **03**
- Write the adjacency matrix of G.
 - Write the path matrix of G.
 - Is the graph complete? Justify.



- (b)** Find out the Minimum Spanning Tree using Kruskal algorithm for given Graph: **04**



- (c)** Find a minimum number of multiplications required to multiply: A $[1 \times 5]$, B $[5 \times 4]$, C $[4 \times 3]$, D $[3 \times 2]$, and E $[2 \times 1]$. Also, give optimal parenthesization. **07**

OR

- Q.5 (a)** Identify mutually compatible activities and the feasible solution set for below given activity selection problem: **03**

i	1	2	3	4	5	6	7	8	9	10	11
s_i	1	3	0	5	3	5	6	8	8	2	12
f_i	4	5	6	7	8	9	10	11	12	13	14

- (b)** Find out the Minimum Spanning Tree using Prim's algorithm for given Graph; for previously mentioned graph of Q.5(b). **04**
- (c)** Find the optimal solution of the knapsack instance $n=4, W=5$ (capacity), $w=(2,1,3,2)$ and $v=(12,10,20,15)$ **07**
