Printed Page:- 04 Subject Code:- AMICA0302 Roll. No: NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA (An Autonomous Institute Affiliated to AKTU, Lucknow) MCA Int. SEM: III - THEORY EXAMINATION (2024 - 2025) **Subject: Data Structures Time: 3 Hours** Max. Marks: 100 **General Instructions: IMP:** *Verify that you have received the question paper with the correct course, code, branch etc.* 1. This Question paper comprises of three Sections -A, B, & C. It consists of Multiple Choice *Questions (MCQ's) & Subjective type questions.* 2. Maximum marks for each question are indicated on right -hand side of each question. 3. Illustrate your answers with neat sketches wherever necessary. 4. Assume suitable data if necessary. 5. Preferably, write the answers in sequential order. 6. No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked. **SECTION-A** 20 1. Attempt all parts:-1-a. What is the relation between Sparsity and Density of a matrix?(CO1, K1) 1 Sparsity = 1 + Density(a) Sparsity = 1 - Density(b) Sparsity = Density*Total number of elements (c) Sparsity = Density/Total number of elements (d) What is the best case for linear search? (CO1, K1) 1-b. 1 O(nlogn) (a) O(logn) (b) O(n)(c) O(1)(d) 1-c. adds a new element at the TOP of the stack. (CO2, K1) 1 PUSH (a) POP (b) (c) **INSERT** (d) PUSH and INSERT 1-d. Insertion in queue happens at the ______ end and Deletion happens at the 1 ____.(CO2, K1) (a) rear, front

(b) front, rear

- (c) both, front
- (d) rear, both
- 1-e. A variant of the linked list in which none of the node contains NULL pointer is? 1 (CO3, K1)
 - (a) Singly linked list
 - (b) Doubly linked list
 - (c) Circular linked list
 - (d) None

1-f. Linked list data structure offers considerable saving in _____(CO3, K1) 1

- (a) Space Utilization and Computational Time
- (b) Computational Time
- (c) Space Utilization
- (d) Speed Utilization
- 1-g. The number of external nodes in a full binary tree with n internal nodes is?(CO4, 1 K1)
 - (a) n
 - (b) n+1
 - (c) 2n
 - (d) 2n+1

1-h. How many arrays are required to perform deletion operation in a heap? (CO4, K1) 1

- (a) 1
- (b) 2
- (c) 3
- (d) 4
- 1-i. Consider a undirected graph G with vertices { A, B, C, D, E}. In graph G, every 1 edge has distinct weight. Edge CD is edge with minimum weight and edge AB is edge with maximum weight. Then, which of the following is false? (CO5, K1)
 - (a) Every minimum spanning tree of G must contain CD
 - (b) If AB is in a minimum spanning tree, then its removal must disconnect G
 - (c) No minimum spanning tree contains AB
 - (d) G has a unique minimum spanning tree
- 1-j. The travelling salesman problem can be solved using (CO5, K1)
 - (a) A spanning tree
 - (b) A minimum spanning tree
 - (c) Bellman Ford algorithm
 - (d) DFS Traversal
- 2. Attempt all parts:-
- 2.a. Given a 2D list A [-100:100] [-5:50]. Find the address of element A [99, 49] in 2

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	row major order considering base address 10 and each element requires 4 bytes for storage. (CO1, K3)	
2.b.	What are the operations of a queue? (CO2, K2)	2
2.c.	Construct a code to represent Linked list in python? (CO3, K3)	2
2.d.	What is the Depth of root node in a tree? (CO4, K2)	2
2.e.	Which types of problems will be solved using Dijkstra's Algorithm?(CO5, K2)	2
<u>SECT</u>	ION-B	30
3. Ans	wer any <u>five</u> of the following:-	
3-a.	How is an array is different from Linked List?(CO1, K2)	6
3-b.	Explain Linear probing Collision resolution technique with example.(CO1, K2)	6
3-c.	How the queue is implemented by linked list?(CO2, K2)	6
3-d.	Define stack and explain PUSH and POP operation on stack. (CO2, K3)	6
3.e.	Define linked list. Explain the representation of linked lists in memory.(CO3, K2)	6
3.f.	Explain RR rotation in AVL tree with example. (CO4, K2)	6
3.g.	Write a function in Python for DFS traversal. (CO5, K3)	6
<u>SECT</u>	ION-C	50
4. Ans	wer any <u>one</u> of the following:-	
4-a.	What are Asymptotic Notations in Complexity Analysis of Algorithms? Explain each one with example.(CO1, K2)	10
4-b.	Calculate the address of integer element A [1, 2] and A[4,2] in a matrix of 10*10 order with base address 200 using a) Row major representation and b) Column major representation. (CO1, K3)	10
5. Ans	wer any <u>one</u> of the following:-	
5-a.	Explain the addition and deletion operations performed on a circular queue with necessary algorithms.(CO2, K2)	10
5-b.	Write the algorithm for converting infix expression to postfix (reverse polish) expression. (CO2, K2)	10
6. Ans	wer any <u>one</u> of the following:-	
6-a.	Differentiate Circular linked List and Linear Linked list. (CO3, K4)	10
6-b.	With the Python program explain how the elements are inserted and deleted from a doubly linked list. (CO3, K3)	10
7. Ans	wer any <u>one</u> of the following:-	
7-a.	Explain AVL tree with example. (CO4, K2)	10
7-b.	Construct a B-tree of order 5 created by inserting the following elements 3, 14, 7, 1, 8, 5, 11, 17, 13, 6, 23, 12, 20, 26, 4, 16, 18, 24, 25, 19 Also delete elements 6, 23 and 3 from the constructed tree (CO4, K3)	10
8. Ans	wer any <u>one</u> of the following:-	

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8-a. Explain the working of Dijkstra Algorithm with an example. (CO5, K2)
8-b. Explain the various representation of graph in detail with example?(CO5, K2)
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