

MCA
(SEM II) THEORY EXAMINATION 2022-23
DATA STRUCTURES & ANALYSIS OF ALGORITHMS

Time: 3 Hours**Total Marks: 100****Note:** Attempt all Sections. If require any missing data; then choose suitably.**SECTION A****1. Attempt all questions in brief.****2 x 10 = 20**

- (a) Describe the *Big Oh* notation.
- (b) Differentiate between array and linked list.
- (c) Let J and K be integers and suppose Q(J,K) is recursively defined as

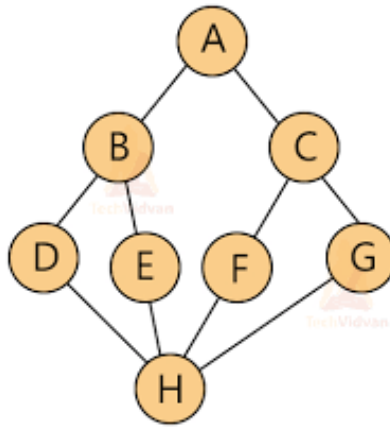
$$Q(J,K) = \begin{cases} 5 & \text{if } J < K \\ Q(J-K, K+3) + J & \text{if } J \geq K \end{cases}$$

Find Q(4,7).

- (d) Consider the following linear queue capable of accommodating maximum five elements. Front = 2 Rear = 4 Queue _ L, M, N, _
Compute following operations
(i) Add O (ii) Add P (iii) Delete two letters (iv) Add Q, R
- (e) What do you mean by non-comparison sort? List two non-comparison sort algorithms.
- (f) Apply selection sort algorithm on given data to sort in ascending order:-
5, 8, 6, 2, 1, 3
- (g) Discuss the concept of inorder "successor" and inorder "predecessor" in Binary Search Tree.
- (h) Give static and dynamic memory representation of binary tree
- (i) How dynamic programming approach is better from recursive programming approach
- (j) What is the role of a negative cycle, while you are computing the shortest path in the graph

SECTION B**2. Attempt any three of the following:****10x3=30**

- (a) Discuss how two-dimensional array can be stored in the memory and **compute** the following. An array Arr[50][100] is stored in the memory along the row major with each element occupying 4 bytes of memory. **Estimate** the address of the location Arr[20][50], if the base address 1000.
- (b) Write down algorithm to evaluate postfix expression and also evaluate given postfix expression using the algorithm
10, 7 + 30, 6 / * 8 -
- (c) Discuss various methods to represent graph in the memory, Also write down algorithm to do DFS in the graph. Apply that algorithm on given graph to compute DFS Tree



- (d) What is AVL tree? What is balancing factor? Explain balancing method of AVL tree with all possible cases with suitable example
- (e) How Strassen's matrix multiplication provide better time complexity over classical matrix multiplication algorithm. Apply the Strassen's algorithm method on the following matrix $\begin{bmatrix} 1 & 5 \\ 7 & 3 \end{bmatrix}$ and $\begin{bmatrix} 8 & 2 \\ 6 & 4 \end{bmatrix}$.

SECTION C

3. Attempt any *one* part of the following: **10x1=10**

- (a) How to represent followings linked lists in memory provide their self-referential structure and proper diagram
- Single linear Linked List
 - Doubly linear Linked list
 - Circular Doubly Linked List
 - Header Linked List
- (b) Give an algorithm or C function to perform following operations on single linear linked list
- Insert a node after a given node
 - Delete a node from end

4. Attempt any *one* part of the following: **10x1=10**

- (a) What do you understand by hashing? What are the different hashing techniques? Discuss different techniques to resolve collision once it is occurred during hashing.
- (b) Write a 'C' program to implement two stacks in a single array. One stack will grow from one end of the array and second stack will grow from the other end of the array. User need to implement following functions
- Push in specific stack
 - Pop from Specific stack
 - Handling overflow and underflow cases

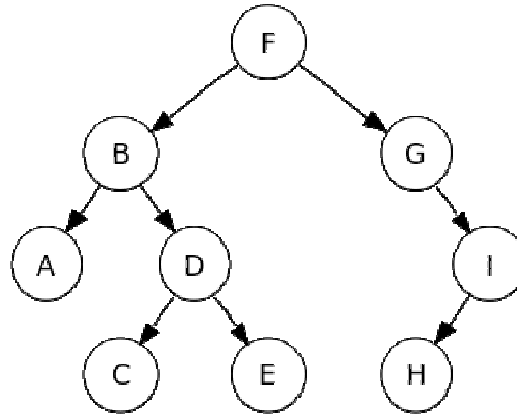
5. Attempt any *one* part of the following: **10x1=10**

- (a) Write heap sort algorithm and draw the max-heap only for following data
1,2,3,4,5,6,7,8,9,10
- (b) Write down Quick Sort Algorithm and apply it on following data to sort it.
5,8,7,6,3,4,1,9,2,10

6. Attempt any *one* part of the following:

10x1=10

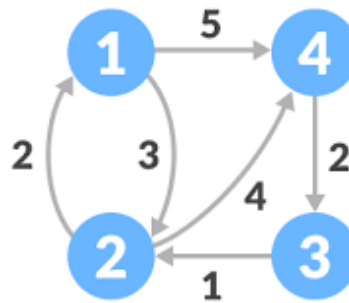
- (a) Write down recursive algorithm to insert a node in binary search tree. And apply that algorithm to construct BST with given data.
8,5,12,67,43,23,6,3,2,8,24,21,20
- (b) Demonstrate the traversal of the following tree in Pre-Order, Post-Order and In-Order. Also write recursive algorithms of three traversals.



7. Attempt any *one* part of the following:

10x1=10

- (a) Write down algorithm of Floyd-Warshall to compute all pair shortest path within the graph. Also apply it on following graph



- (b) Discuss the applications of longest common subsequence (LCS). Determine the LCS of $\langle 1,0,0,1,0,1,0,1 \rangle$ and $\langle 0,1,0,1,1,0,1,1,0 \rangle$