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BRAINWARE UNIVERSITY

Term End Examination 2025-2026

Programme – MCA-2025

Course Name – Data Structure and Algorithm

Course Code - MCA27500 (T)

(Semester II)

Full Marks : 40

Time : 2:0 Hours

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A

(Multiple Choice Type Question)

1 x 10=10

1. Choose the correct alternative from the following :

(i) What will be the worst case time complexity of linear search if the elements are already sorted?

- | | |
|-----------|------------------|
| a) $O(n)$ | b) $O(\log n)$ |
| c) $O(1)$ | d) $O(n \log n)$ |

(ii) Identify the purpose of a data structure.

- | | |
|-------------------|------------------|
| a) Store programs | b) Organize data |
| c) Compile code | d) Delete files |

(iii) What is the time complexity of the following code snippet -

```
for(i=0; i<=n; i )  
{  
    if (i==100) break;  
    printf ("Hello");  
}
```

- | | |
|-----------|----------------|
| a) $O(n)$ | b) $O(100n)$ |
| c) $O(1)$ | d) $O(\log n)$ |

(iv) Which of the following is the working principle of a stack?

- | | |
|-----------------|-------------------|
| a) FIFO order | b) LIFO order |
| c) Random order | d) Priority order |

(v) Choose the condition for stack overflow.

- | | |
|---------------------|---------------------|
| a) Deleting element | b) Stack empty |
| c) Stack full | d) Traversing stack |

(vi) Interpret circular queue full condition.

- a) Front = Rear
c) Front = 0
- b) Rear+1 = Front
d) Rear = 0
- (vii) Identify the advantage of linked list over array.
- a) Fixed size
c) Dynamic size
- b) Random access
d) Faster sort
- (viii) Evaluate the memory representation of a complete binary tree in an array. If a node is at index j , where are its children?
- a) $j+1$ and $j+2$.
c) $2j+1$ (left child) and $2j+2$ (right child), assuming 0-based indexing.
- b) $j-1$ and $j-2$.
d) $j/2$ for both children.
- (ix) Evaluate the risk of using Quick Sort on a dataset that is already sorted in ascending order when the algorithm consistently chooses the leftmost element as the pivot.
- a) The performance improves to $O(n)$.
c) The performance degrades to $O(n^2)$ because the partitions become highly unbalanced.
- b) The algorithm remains at $O(n \log n)$ due to the divide-and-conquer strategy.
d) The algorithm fails and results in a "Stack Overflow" error immediately.
- (x) When inserting a node into the middle of a Doubly Linked List at a specific position, how many total pointer fields across all involved nodes must be updated?
- a) 2
c) 4
- b) 1
d) 6

Group-B

(Short Answer Type Questions)

3 x 5=15

2. Convert the given infix expression into its prefix equivalent using a stack: $(A-B)*C/(F-G)$. (3)
3. Suppose one 2-D array is initialized as `int a[5][7]`. Base address is 4000. Find the location of element `a[2][4]` in row-major form and column-major form. (3)
4. Define Big-O notation. (3)
5. Compare the efficiency of "Quadratic Probing" and "Double Hashing" regarding implementation and performance. (3)
6. Draw a binary search tree with the following key values: 100, 20, 34, 40, 12, 40, 50, 110, 60, 20 (3)

OR

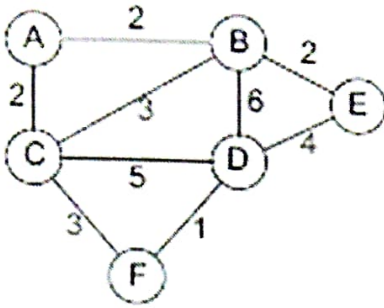
Draw a binary tree with the following informations: Preorder traversal: A,D,B,K,C,T Inorder traversal: A,K,B,C,T,D (3)

Group-C

(Long Answer Type Questions)

5 x 3=15

7. Develop an algorithm to count the total number of nodes in a singly linked list. (5)
8. Deduce the worst case time complexity of Quicksort algorithm. (5)
9. Consider the graph given below. Find the minimum spanning tree of this graph using Prim's algorithm. (5)



OR

Insert the following keys in the order given below to build them into an AVL Tree:

(5)

12, 11, 13, 10, 9, 15, 14, 18

Clearly mention different rotations used and balance factor of each node.

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