



BRAINWARE UNIVERSITY

Term End Examination 2025-2026

Programme – BCA(MAWT)-Hons-2024

Course Name – Data Structure and Algorithm

Course Code - BMT40106

(Semester IV)

Full Marks : 60

Time : 2:30 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 15=15

1. Choose the correct alternative from the following :

- (i) What will be the evaluated result of the following post fix expression: 3,5,7,*,+,12,% ?
 - a) 2
 - b) 3
 - c) 0
 - d) 3.17
- (ii) Given an array arr={12,13,35,56,78}. Determine the number of comparisons needed to search 56 using Binary search algorithm.
 - a) 3
 - b) 2
 - c) 1
 - d) 5
- (iii) Select the correct option on an array of the void data type.
 - a) It can store any data-type
 - b) It only stores element of similar data type to first element
 - c) It acquires the data type with the highest precision in it
 - d) You cannot have an array of void data type
- (iv) Which one is appropriate for the Big Theta notation?
 - a) An asymptotic upper bound on the growth rate of a function.
 - b) An asymptotic lower bound on the growth rate of a function.
 - c) An asymptotic tight bound on the growth rate of a function.
 - d) None of these.
- (v) Identify the primary advantage of using a linked list over an array as an underlying structure for an ADT?
 - a) Faster random access
 - b) Constant time complexity for insertion
 - c) Dynamic resizing
 - d) Reduced memory usage
- (vi) In a binary search tree, if the number of nodes of a tree is 9 then select the minimum height of the tree.
 - a) 9
 - b) 5

- 398, Radhakrishnapur Road, Baranagar,
Kolkata, West Bengal-700125
- c) 4 d) None of these
- (vii) Identify the characteristic of elements obtained from the inorder traversal of a BST.
- a) Sorted order b) Unsorted order
- c) Random order d) None of these
- (viii) Identify the term used to describe the number of edges from the root to a specific node in a tree structure.
- a) Height b) Depth
- c) Length d) Width
- (ix) Determine the purpose of an adjacency matrix in graph representation.
- a) Store vertices b) To represent the edges between vertices
- c) Perform graph traversal d) Store edge weights
- (x) Calculate the number of elements in the adjacency matrix of a graph having 7 vertices and 10 edges.
- a) 7 b) 14
- c) 36 d) 49
- (xi) Choose the worst case running time for the selection sort algorithm.
- a) $\Theta(n \log n)$ b) Θ
- c) $\Theta(\log n)$ d) $\Theta(n^2)$
- (xii) The time complexity for inserting at beginning of an array of size n is.
- a) $O(1)$ b) $O(\log n)$
- c) O d) $O(n \log n)$
- (xiii) Employ stacks in infix to postfix conversion. Which of the following is always pushed when encountered?
- a) Operand b) Left parenthesis
- c) Right parenthesis d) Postfix operator
- (xiv) Identify the correct structure of a B-tree.
- a) Only two children per node b) Fixed size node
- c) Multi-way balanced tree d) Height is always 1
- (xv) Predict the time complexity of the following code: `for(i=1;i<=N;i++){ printf("%d",i); }`
- a) $O(1)$ b) $O(\log N)$
- c) O d) none of these

Group-B

(Short Answer Type Questions)

$$3 \times 5 = 15$$

2. Analyze the structural differences and use-cases between an AVL tree and a B-tree in data management systems? (3)
3. Convert the following infix expression into postfix:- $((a*b)^c)+(x*y+z)$ (3)
4. Determine the contents of the array [4, 9, 0, 3, 1, -6, 2, 8, -2] after the fourth pass of the selection sort algorithm. (3)
5. Apply the Insertion Sort algorithm to sort the list [5, 3, 8, 6, 1, 4, 9]. Show the state of the list after each iteration of the sorting process. (3)
6. Illustrate the process of detecting imbalance in an AVL tree during insertion operations? (3)

OR

Identify the optimal scenario to use a B-tree instead of a binary search tree in database indexing? (3)

Group-C

(Long Answer Type Questions)

$$5 \times 6 = 30$$

7. State a recursive function to calculate the sum of first n natural numbers. Trace the function when $n = 4$. (5)
8. Given a circular queue with size 5 and initial state: FRONT = 2, REAR = 4, Q = [_, 10, 20, 30, _], perform one insertion and one deletion. Show step-by-step changes in FRONT, REAR, and the queue. (5)
9. Can you implement an AVL tree and show how it maintains balance during insertion? (5)
10. Consider a hash table of size 11, that uses open addressing with linear probing. Let $h(k) = k \text{ mod } 11$ be the hash function used. A sequence of records with keys: 43, 36, 92, 87, 11, 4, 71, 13, 14 are inserted into an initially empty hash table, the bins of which are indexed from zero to ten. What is the index of the bin into which the last record is inserted? (5)
11. Construct a Binary Search Tree (BST) by inserting the following values: 45, 20, 50, 10, 30, 60. Show the final structure and analyze its properties. (5)
12. Given the array [170, 45, 75, 90, 802, 24, 2, 66], apply Radix Sort and explain each step. Conclude why it works better for fixed-width numbers. (5)

OR

Trace binary search on the sorted array [3, 6, 8, 11, 15, 18, 21] to find the number 11. Explain how binary search minimizes comparisons. (5)

Library
Brainware University
398, Ramkrishnapur Road, Barasat
Kolkata, West Bengal-700125