



**Avinashilingam Institute for Home science and Higher Education for Women**  
(Deemed to be University under Category 'A' by MHRD, Estd. u/s 3 of UGC Act 1956)  
Re-accredited with A++ Grade by NAAC. Recognised by UGC Under Section 12B  
Coimbatore - 641 043, Tamil Nadu, India  
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**Continuous Internal Assessment Test I – Aug 2025**  
**SEMESTER III**

**Class : II UG**  
**Major : Information Technology**

**Time : 2 hours**  
**Max.marks: 60**

**23BITC05 Data Structures and Algorithms**

**CO1:** Write and analyze efficient algorithm for a given problem and to analyze its time complexity.

**CO2:** Apply the suitable data structure to a given problem.

**CO3:** Utilize data structure techniques in problem solving.

**CO4:** Gain Knowledge on Memory management, Tree and its implementation.

**CO5:** Apply data structures and algorithms for different type of searching and sorting.

**Part A**

**6 X1 =6**

**Choose the correct answer**

- In a 1D array, the elements are stored in ----- CO1 K2
  - Random memory locations
  - Continuous memory locations
  - Stack memory only
  - Non-contiguous blocks
- Which of the following best describes the purpose of analyzing a program? CO1 K2
  - To compile the program faster
  - To find syntax errors
  - To evaluate time and space complexity
  - To optimize keyboard input
- Which of the following data structures is best suited for implementing function call management in a program? CO2 K2
  - Queue
  - Priority Queue
  - Stack
  - Circular queue
- Which of the following operations requires traversal of the entire singly linked list in the worst case? CO2 K2
  - Insertion at the beginning
  - Insertion at the end
  - Deletion from the beginning
  - Accessing the head node
- What is the key advantage of a doubly linked list over a singly linked list? CO2 K2
  - Uses less memory
  - Allows traversal only in one direction
  - Allows traversal in both forward and backward directions
  - Easier to implement
- Which traversal of a binary tree visits the left subtree, then the root, and finally the right subtree? CO3 K2
  - Preorder
  - Inorder
  - Postorder
  - Level Order

**Part B**

**3 x 6 = 18**

**Answer the following**

**Each answer should not exceed 400 words or two pages**

- a. Analyze the time complexity of the following code segment using Big O notation. Explain each step of your analysis and justify your final answer. CO1 K5

```
for (int i = 0; i < n; i++) {  
    for (int j = 0; j < n; j++) {  
        sum += 1; // constant time operation  
    }  
}
```

(Or)

- b. Explain the memory representation of one-dimensional and two-dimensional arrays in programming. CO1 K4
8. a. Convert the expression to postfix notation using stack-based infix-to-postfix conversion.  
 $(a + b) * (c - d) / (e + f)$  (Or) CO2 K6
- b. What is a storage pool in linked lists? Explain how it is used for efficient memory allocation and deallocation during node insertion and deletion. CO2 K4
9. a. Explain how a stack can be implemented using a singly linked list. Write the algorithms for PUSH and POP operations. CO2 K4
- (Or)
- b. Explain the concepts of garbage collection and memory compaction in dynamic memory management. Why are they essential in managing free storage space? CO3 K4

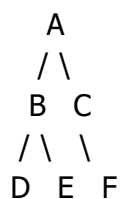
### Part C

**3 x 12 = 36**

#### Answer ALL questions

**Each answer should not exceed 800 words or four pages**

10. a. (i) Define an Algorithm. Explain the important characteristics of a good algorithm. CO1 K2  
 (ii) Define Ordered List. Describe how ordered lists differ from unordered lists with examples. CO1 K3
- (or)
- b. Explain the algorithm to insert an element at a given position in a one-dimensional array. What challenges arise during insertion and deletion operations? Analyze the time complexity of both operations. CO1 K5
11. a. Explain the concept of a linear queue. Describe its array-based implementation along with algorithms for enqueue, dequeue, overflow, and underflow operations. Illustrate your answer with a suitable example. CO2 K5
- (or)
- b. (i) Explain the concept of sparse matrices. How are sparse matrices represented using linked lists? CO2 K4  
 (ii) Describe how polynomial addition is performed using linked lists. Write the algorithm or explain with an example. CO2 K4
12. a. Define a binary tree. Explain array and linked representations of a binary tree with examples. CO3 K4
- (or)
- b. Explain the different types of binary tree traversals: Inorder, Preorder, and Postorder. Write the algorithms and trace the traversals for the following binary tree: CO3 K5



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