

**MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL**

Paper Code : PC-ECS301/PCC- CS301/PCC- CSBS301/PCC-CS301/PCCCS301 Data Structure &amp; Algorithms

UPID : 003443

Time Allotted : 3 Hours

Full Marks : 70

*The Figures in the margin indicate full marks.**Candidate are required to give their answers in their own words as far as practicable***Group-A (Very Short Answer Type Question)**

1. Answer any ten of the following :

[ 1 x 10 = 10 ]

- (I) What is the disadvantage of array data structure?
  - a) The amount of memory to be allocated should be known beforehand.
  - b) Elements of an array can be accessed in constant time.
  - c) Elements are stored in contiguous memory blocks.
  - d) Multiple other data structures can be implemented using arrays.
- (II) Which of the following data structures allow insertion and deletion from both ends?
  - a) Stack b) Deque c) Queue d) Strings
- (III) Which of the following sorting algorithms provide the best time complexity in the worst-case scenario?
  - a) Merge Sort
  - b) Quick Sort
  - c) Bubble Sort
  - d) Selection Sort
- (IV) Worst case time complexity to access an element in a BST can be?
  - a)  $O(n)$  b)  $O(n * \log n)$  c)  $O(1)$  d)  $O(\log n)$
- (V) How are String represented in memory in C?
  - a) An array of characters.
  - b) The object of some class.
  - c) Same as other primitive data types.
  - d) LinkedList of characters.
- (VI) Which of the following data structures can be used to implement queues?
  - a) Stack b) Arrays c) Linked List d) Both b and c
- (VII) Which of the following is a Divide and Conquer algorithm?
  - a) Bubble Sort b) Selection Sort c) Heap Sort d) Merge Sort
- (VIII) What is the best case time complexity of the binary search algorithm?
  - a)  $O(1)$  b)  $O(n)$  c)  $O(\log 2n)$  d)  $O(n^2)$
- (IX) What is the time complexity to insert an element to the front of a LinkedList (head pointer given)?
  - a)  $O(n)$  b)  $O(1)$  c)  $O(\log n)$  d)  $O(n * \log n)$
- (X) In a B+ tree, both the internal nodes and the leaves have keys.
  - a) True b) False
- (XI) What is the time complexity of an infix to postfix conversion algorithm?
  - a)  $O(N \log N)$  b)  $O(N)$  c)  $O(N^2)$  d)  $O(M \log N)$
- (XII) What is a hash table?
  - a) A structure that maps values to keys.
  - b) A structure that maps keys to values.
  - c) A structure used for storage.
  - d) A structure used to implement stack and queue.

**Group-B (Short Answer Type Question)**

Answer any three of the following :

[ 5 x 3 = 15 ]

2. Write an algorithm to create linear linked list with n nodes. [5]
3. Write an algorithm to insert an element in Circular Queue. [5]
4. Justify the statement with proper example: All Binary Search Trees are Binary Tree but All Binary Trees are not Binary Search Tree. [5]
5. Find the time complexity of recursive algorithm of Tower of Hanoi. [5]

6. Convert the given infix expression to postfix expression  
 $A+B \times C-D \div F/H$

[5]

**Group-C (Long Answer Type Question)**

Answer *any three* of the following :

[ 15 x 3 = 45 ]

7. Create a AVL tree by inserting the following numbers in the order in which they are given:  
17, 25, 19, 23, 75, 6. Explain it step wise with suitable diagram.  
What is Threaded Binary Tree? What are its advantages? [ 8+3+4 ]
8. Define queue and its applications. Write an algorithm for insertion and deletion from queue. [ 5+5+5 ]
9. a) Define Circular Linked List and Double Linked List. [ 3+4+4+4 ]  
b) Write an algorithm to delete an element from Double Linked List.  
[Consider three cases: 1st node deletion, last node deletion and any intermediate node deletion]
10. a) Write a quick sort algorithm to sort a list. Explain with an example. [ 9+6 ]  
b) Prove that the best case time complexity for quick sort is  $O(n \log n)$  for input size of  $n$ .
11. Write short notes on any three from following: [ 15 ]  
a) AVL Tree  
b) Dequeue and Priority Queue  
c) Collision Resolution Techniques in Hashing  
d) BFS

\*\*\* END OF PAPER \*\*\*