MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

EC-504B

DATA STRUCTURE AND

Time Allotted: 3 Hours | Full Marks: 70

The questions are of equal value.
The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.
All symbols are of usual significance.

GROUP A
(Multiple Choice Type Questions)

1. Answer *all* questions. 10×1 = 10

(i) In traversing non-empty binary tree, visit to the root is made at last in
(A) preorder traversal (B) postorder traversal
(C) inorder traversal (D) none of these

(ii) A linear list that allows elements to enter at either end but not in the middle is called
(A) Stack (B) Queue
(C) Deque (D) None of these

(iii) Which of the following sorting methods need extra space for storing data?
(A) Selection sort (B) Bubble sort
(C) Heap sort (D) None of these

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(iv) Number of possible binary trees with three nodes are
(A) 3 (B) 2
(C) 4 (D) none of these

(v) Total nodes in a 2-tree (Strictly binary tree) with 30 leaves will be
(A) 60 (B) 58
(C) 59 (D) 57

(vi) The adjacency matrix of an undirected graph is
(A) unit matrix (B) asymmetric matrix
(C) symmetric matrix (D) none of these

(vii) The best case complexity of insertion sort is
(A) $O(n^2)$ (B) $O(n \log n)$
(C) $O(n^3)$ (D) $O(n)$

(viii) If a binary tree is threaded for inorder traversal, a right NULL link of any node is replaced by the address of its
(A) successor (B) predecessor
(C) root (D) own

(ix) The method of linear probing for collision resolution can lead to
(A) clustering (B) efficient storage utilization
(C) overflow (D) underflow

(x) A full Binary tree with n leaves contains
(A) n nodes (B) $\log_2 n$ nodes
(C) $2n-1$ nodes (D) 2^n nodes

GROUP B
(Short Answer Type Questions)

Answer any *three* questions. 3×5 = 15

2. Prove that, for any non empty binary tree T, if n_0 is the number of leaves and n_2 be the number of nodes of degree 2, then $n_0 = n_2 + 1$. 5

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3. How sparse matrices are represented using linked list? 5

4. What are the differences between Stack and Queue? 5

5. Convert the following infix expressions to their postfix equivalent
   (i) (A+B)*D+E/(F+A*D)+C
   (ii) A–B/(C*D^E)

6. What is meant by time complexity? Find the time complexity of the fowling code snippet.

```
for (i=0; i<n; i++)
{
    for (j=0; j<n; j++)
    {
        c[i][j]=0;
        for(k=0;k<n;k++)
         c[i][k]+=a[i][k]*b[k][j];
    }
}
```

3+2

GROUP C
(Long Answer Type Questions)

Answer any *three* questions. 3×15 = 45

7. (a) Define level and depth of a tree. 2
   (b) What is a complete binary tree? 1
   (c) Construct a binary tree whose nodes are given as follows: 9+3
   In-order: 3, 5, 6, 7, 10, 12, 13, 15, 16, 18, 20, 23
   Pre-order: 15, 5, 3, 12, 10, 6, 7, 13, 16, 20, 18, 23
   Now find the post-order traversal sequence.

8. (a) Explain Djkstra's algorithm for finding the shortest distance between two given nodes. 5
   (b) What is priority queue? 1
   (c) How can the polynomial $4x^6 + 7x^3 + 2$ be represented using a linked list and an array? Also explain why arrays should not be used in this regard. (3+3)+1
   (d) What is the necessity for having a circular queue? 2

9. (a) Write the algorithm to perform insert operation on a circular queue represented in the form of an array. 5
   (b) Write a recursive function to calculate factorial of a number. 4
   (c) Write an algorithm to reverse all elements of a singly linked list. 6

10. (a) What is the need for AVL trees? 2
    (b) Insert the following keys in the order given below to build them into an AVL tree. 5
    8, 12, 9, 11, 7, 6, 9, 15, 20, 26.
    (c) Explain merge sort algorithm. Find its worst case time complexity. 4+4

11. Write short notes on any *three* of the following: 3×5
    (a) Heap sort
    (b) Binary search
    (c) Tail recursion
    (d) Time Complexity
    (e) B Tree.