MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

CS-302

DATA STRUCTURE AND ALGORITHMS

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) Which of the following traversal techniques lists the nodes of a binary search tree in ascending order?

(A) Post-order (B) In-order
(C) Pre-order (D) None of these

(ii) The number of possible distinct binary trees with 12 nodes is

(A) 4082 (B) 4084
(C) 3082 (D) 3084

(iii) Which of the following expressions accesses the $(i, j)^{th}$ entry of a $(m \times n)$ matrix stored in column major order?

(A) $n \times (i - 1) + j$ (B) $m \times (j - 1) + i$
(C) $m \times (n - j) + j$ (D) $n \times (m - i) + j$

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(iv) Stack cannot be used to

(A) evaluate an arithmetic expression in postfix form
(B) implement recursion
(C) allocate resources (like CPU) by the operating system
(D) convert infix expression to its equivalent postfix expression

(v) The postfix equivalent of the prefix * + ab – cd is

(A) ab + cd – * (B) abcd + – *
(C) ab + cd* – (D) ab + – cd*

(vi) Merge sort uses

(A) divide and conquer strategy (B) backtracking approach
(C) heuristic search (D) greedy approach

(vii) The following sequence of operations is performed on a stack
push(1), push(2), pop( ), push(1), push(2), pop( ), pop( ), pop( ), push(2), pop( ).
The sequence of popped out values are

(A) 2, 2, 1, 2, 1 (B) 2, 2, 1, 1, 2
(C) 2, 1, 2, 2, 2 (D) 2, 1, 2, 2, 1

(viii) Which of the following is not a requirement of good hashing function?

(A) Avoid collision (B) Reduce the storage space
(C) Make faster retrieval (D) None of these

(ix) Self-referential pointer is used in defining

(A) an array (B) a node of linked-list
(C) a queue (D) all of these

(x) A binary tree has n leaf nodes. The number of nodes of degree 2 in this tree is

(A) $\log n$ (B) $n - 1$
(C) n (D) cannot be said

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GROUP B
(Short Answer Type Questions)

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

2. What is the difference between array and linked-list? What is the primary criterion of performing binary search technique on a list of data?

3. Write a recursive algorithm to solve tower of Hanoi problem.

4. Deduce the average time complexity of Quicksort algorithm.

5. Suppose a queue is implemented by an array. Write an algorithm to insert a new element at the k^{th} position of the array.

6. Write an algorithm to delete the last node of a linked-list.

GROUP C
(Long Answer Type Questions)

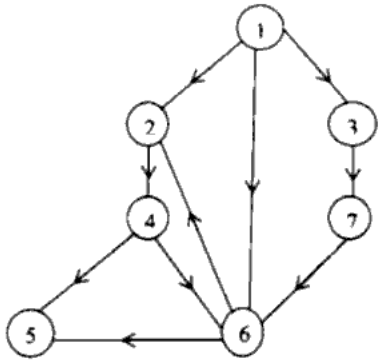
Answer any *three* questions. 3×15 = 45

7. (a) The in-order and pre-order traversal sequence of nodes in a binary tree are given below: 7
   Post-order: I E J F C G K L H D B A
   In-order: E I C F J B G D K H L A
   Construct the tree.
   (b) Define Hashing. 1
   (c) Describe a String reversal Algorithm. 3
   (d) Write an algorithm for inserting an element into a Binary tree with example. 4

8. (a) Convert the following infix expression into equivalent postfix expression using stack. 3
   (A + B) * C – (D – E)/(F + G)
   (b) What is dequeue? 1
   (c) How can a polynomial such as $6x^6 + 4x^3 - 2x + 10$ be represented by a linked list? 3

(d) For the following expression draw the corresponding expression tree: 3
$a + b * c - d/e$.
(e) Write an algorithm to insert an element in the middle of a linked list. 5

9. (a) For the following graph find the BFS and DFS traversal with proper algorithm. 6



(b) Insert the following keys in the order given below to build them into an AVL-tree. 12, 11, 13, 10, 09, 15, 14, 18, 7, 6, 5, 4. Clearly mention different rotations used and balance factor of each node. 9

10. (a) What is hashing? Describe any three methods of defining a hash function. 2+6
(b) Discuss different collision resolution techniques. 7

11. Write short notes on any *three* of the following: 3×5
(a) ADT
(b) AVL Tree
(c) Circular link list
(d) Threaded binary trees
(e) Heap