



[This question paper contains 4 printed pages.]

Sr. No. of Question Paper : 7802

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Your Roll No.....

Unique Paper Code : 2341202

Name of the Course : B.Tech. Computer Science

Name of the Paper : Data Structures [DC-1.4]

Semester : II

Duration : 3 Hours

Maximum Marks : 75

**Instructions for Candidates**

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Question 1 is compulsory.
3. Attempt any **four** questions out of the remaining Q2-Q7.
4. Parts of a question must be answered together.

1. (a) A tridiagonal matrix  $D$  of dimension  $n \times n$  has all non-zero entries on the three central diagonals. Suppose this matrix is mapped to a one dimensional array  $A$  by diagonals, starting with the lowest diagonal. Obtain the formula for the location of an element  $D(i, j)$  in  $A$ . (3)

- (b) Differentiate between arrays and linked lists. (3)

- (c) How many exchanges will occur during the first pass, if the following array is sorted using bubble sort ?

23, 43, 56, 12, 87, 14, 86 (3)

- (d) Give the prefix form for the following infix expression

$((A + B) * C - (D - E)) ^ (F + G)$  (3)

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- (c) Draw possible binary trees with three nodes A, B, and C such that their post-order traversal is B-A-C. (3)

- (f) Consider the following recursive function :

```
int func(int m, int n)
{
    if (m < n) return 0;
    else
        return 1 + func(m-n, n); }
```

What is the value of func(6, 3) based on the code above ? (3)

- (g) Take an initially empty hash table with eight slots, with hash function  $h(x) = x \bmod 8$ , and with collisions resolved by linear probing, put the following data into the correct slot :

16, 36, 28, 72, 34, 50 (3)

- (h) Draw a binary search tree for the following sequence :

50, 20, 30, 60, 65, 55, 80, 15, 8, 35, 70 (3)

- (i) Write a C++ function for binary search. (3)

- (j) What is a B-tree ? How is it different from a B+ tree ? (3)

- (k) Write a C++ function to reverse a singly linked list of integers in one pass of the list. (5)

2. (a) Write a C++ program to reverse the order of elements in a stack using one additional queue. (6)

- (b) Show the contents of the stack while evaluating the following postfix expression :-

$B A C + \times C A B - + \times$  where  $B=5$ ,  $A=6$ ,  $C=4$ . (4)

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3. (a) Give template class definition for a doubly linked list. Write a member function to delete all odd numbered nodes from this linked list. (2+4)
- (b) Give the formula and calculate the address of the element  $A[3][6]$  of the 2D Array defined as  $\text{int } A[7][7]$ , if the elements are stored in
- (i) row major order
- (ii) column major order
- The beginning address of the array is 200. Every element requires 4 bytes of storage. (4)
4. (a) What are self-organizing lists ? For a given sequence ABCDBBCADD, show the list after each step using (i) Move to Front and (ii) Count method. (1+5)
- (b) Write a recursive function to calculate the length of a linked list. (4)
5. (a) Write C++ functions to perform the following on a binary tree (3+3)
- Counting the no. of right children
  - Calculating height of the tree
- (b) Draw the tree corresponding to the following traversals
- Preorder traversal : J C A E G F M R
- Inorder traversal : A C E F G J M R (4)
6. (a) Write an algorithm that determines whether a binary tree is complete or not. (6)
- (b) Briefly explain any two methods for hash function. (4)

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7. (a) Build a B tree of order 5 by inserting the following keys :-

9, 14, 3, 16, 4, 1, 17, 6, 5, 28

Show the B tree diagrammatically after each key insertion. (6)

- (b) Sort the following array using insertion sort :-

12, 14, 11, 16, 7, 8

Show the contents of the array at every step. (4)

(2000)