

[This question paper contains 7 printed pages]

Your Roll No. :

Sl. No. of Q. Paper : **7403** **J**

Unique Paper Code : 32341301

Name of the Course : **B.Sc.(Hons.) Computer Science**

Name of the Paper : Data Structures

Semester : III

Time : 3 Hours **Maximum Marks : 75**

Instructions for Candidates :

- (a) Write your Roll No. on the top immediately on receipt of this question paper.
- (b) Question No. 1 is compulsory.
- (c) Attempt any **four** questions out of the remaining Question No. 2 to 7.
- (d) Parts of a question must be answered together.

1. (a) Convert the following infix expression to postfix form using a stack : 5

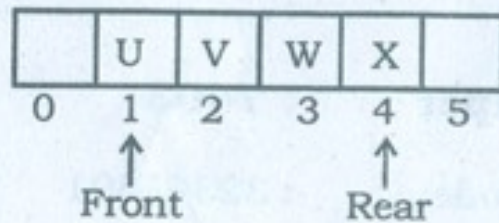
$$(A - B / C) * (D * E - F)$$

Show the contents of the stack at every step.

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7403

- (b) Consider the following Queue of characters of size 6 : 5



This Queue is implemented as a circular array. Show the contents of the Queue with the positions of Front and Rear after each of the following operations :

(i) Y is added to the Queue

(ii) One element is deleted

(iii) Z, A and B are added

(iv) Three elements are deleted

(v) C is added

- (c) Given a single linked list of characters, write a function to check whether this list is a palindrome or not. You may use any one additional data structure. 5

- (d) Consider the intermediate configurations of an array being sorted. Which sorting algorithm is being used in each case ? Justify your answer. $2.5+2.5=5$

(i) (4, 5, 8, 1) (1, 5, 8, 4) (1, 4, 8, 5) (1, 4, 5, 8)

(ii) (4, 5, 8, 1) (4, 5, 1, 8) (4, 1, 5, 8) (1, 4, 5, 8)

- (e) Create a binary search tree using the following sequence of data :

$$2+2+1=5$$

25, 28, 40, 15, 10, 17, 20, 26

Delete 25 using (i) deletion by merging (ii) deletion by copying.

Which of the two methods of deletion is better and why ?

- (f) What is a hashing ?

Insert the keys 35, 44, 61, 72, 56, 51 into a hash table of size $m=7$ using linear probing with hash function as the Division Method.

$$2+3=5$$

7403

- (g) Give the recursive version of the following function : 4+1=5

```
void cubes (int n)
{ for (int i =1; i<= n; i++)
    cout << i*i*i << ' ';
}
```

How will this recursive function be initially invoked for $n = 5$?

2. (a) Give template class definition for an ordered singly linked list of integers. Write a member function to insert a node in this linked list such that the list remains in order. 2+4=6

- (b) Calculate the address of the element $X[3][4]$ of the 2D array defined as $\text{int } X[7][10]$, if the elements are stored in :

2+2=4

- (i) row major order
- (ii) column major order

The beginning address of the array is 100. Every element requires 4 bytes of storage.

3. (a) Write an algorithm that determines whether a given binary tree is complete. 5

- (b) A binary tree has 10 nodes. The preorder and inorder traversals of the tree are shown below. Construct the tree. 5

I. Preorder : JCBADefIGH

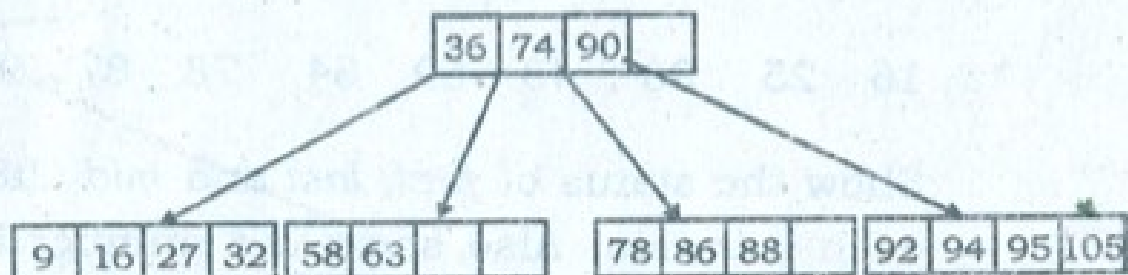
II. Inorder : ABCEDfJGIH

Also give the Postorder Traversal of the constructed tree.

4. (a) Insert the given keys one by one in the following B tree of order 5 : 5

55, 80, 40, 42, 99

Show the status of the tree after each insertion.



7403

(b) Consider the following array of integers :

$$1+4=5$$

12, 14, 9, 18, 120, 30, 40, 35, 60

Which sorting algorithm will be best suited to sort this array ? Use this algorithm to sort it and show the contents of the array after every step.

5. (a) Given a queue of integers, write an algorithm that deletes all negative integers without changing the order of the remaining elements of the queue. 6

(b) Give an algorithm to display the minimum value in a Binary Search Tree. 4

6. (a) Apply binary search algorithm to search for 25 and 91, in the following array of integers :

$$3+3=6$$

16 25 33 43 59 64 78 87 99

Show the status of *first*, *last* and *mid* after each iteration. Also show the number of comparisons made in both the cases.

- (b) A Tridiagonal matrix T of dimension $n \times n$ that has all non-zero entries on the three central diagonals is mapped to a one-dimensional array D by diagonals, starting with the lowest diagonal. Obtain the formula for the location of an element $T(i, j)$ in D . 4
7. (a) Given a doubly linked list, write an algorithm to swap the k th node from the beginning of this list with the k th node from the end of the same list. The nodes have to be swapped and not their contents. 6
- (b) Write a recursive function to find the sum of the elements of an array. 4