[This question paper contains 4 printed pages.]

Sr. No. of Question Paper : 2046 **GC-3** **Your Roll No.....**

Unique Paper Code : 32341301

Name of the Paper : Data Structures

Name of the Course : **B.Sc. (H) Computer Sc. CBCS**

Semester : III

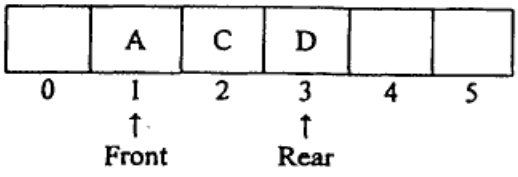
Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on the 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) Give template class definition for a doubly linked list of integers. Write a member function to insert a node at the end of this linked list. (5)

(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) F is added to the Queue

P.T.O.

(ii) Two letters are deleted

(iii) K, L and M are added

(iv) Three letters are deleted

(v) S is added

(c) Write a recursive function for Linear Search on an array of integers. The function should return the index of the element if it is found else it should return –1. (5)

(d) Evaluating the following postfix expression :– (5)

BA + CD – × CB – AD – + / where, B=5, A=9, C=8, D=4

Show the contents of the stack at every step.

(e) Construct a binary search tree for the following keys in the given order :

75 70 44 48 98 108 91 145

Show :

(i) Inorder Traversal

(ii) Postorder Traversal

(iii) The tree after deleting key 98. Use deletion by merging.

(2+1+1+1=5)

(f) Define a class to implement a Diagonal matrix as a 1-D array. Write the member functions to store and retrieve its elements. (5)

(g) What is a hashing function ? Explain the Division Method.

Insert the keys 28, 37, 55, 72, 63, 89 into a hash table of size m=7 using linear probing with hash function as the Division Method. (1+1+3=5)

2. (a) Give the formula and calculate the address of the element A[2][4] of the 2D array defined as :

int A [6] [6], if the elements are stored in :

(i) row major order

(ii) column major order

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

(b) Let a and b be positive integers. Suppose a function F is defined recursively as follows :

$$F(a,b) = \begin{cases} 0 & \text{if } a < b \\ F(a-b,b)+1 & \text{if } b \le a \end{cases}$$

Find the value of :

(i) F(2,3)

(ii) F(14,3)

(iii) F(5861,7) (2+2+2=6)

3. Write member functions to perform the following operations on a Binary Search Tree :–

(i) Creation

(ii) Traversing Preorder (Iterative)

(iii) Calculating height (4+3+3=10)

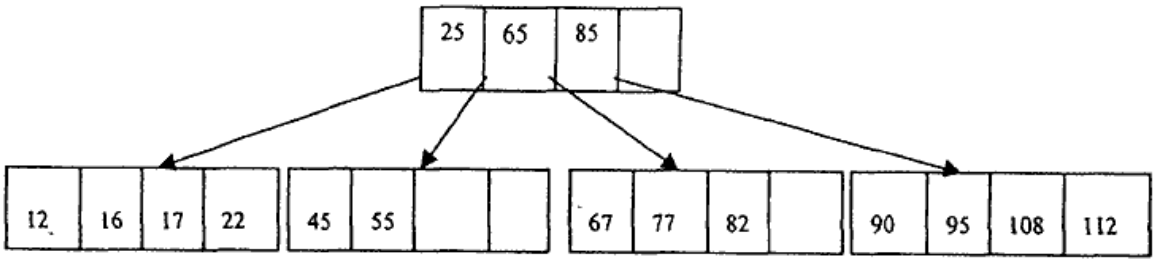
4. (a) Write a function to perform Merge Sort on an array of integers. (4)

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

58, 78, 40, 42, 99, 64

Show the status of the tree after each insertion. (6)

P.T.O.



5. (a) Explain Priority Queue. (2)

(b) Write a C++ program to add two large integers using a stack. (8)

6. Write functions for the following : (4+4+2=10)

(i) Creating an ordered linked list of integers.

(ii) Merging two ordered singly linked lists of integers into one ordered list.

(iii) Displaying the linked list.

7. (a) Explain any two methods used to self-organize lists. (2+2=4)

(b) Apply Bubble Sort on the following array of integers :

26, 45, 13, 23, 12, 7, 38, 42

Show the contents of the array after every pass. (6)