

[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

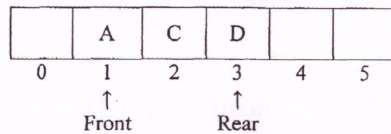
Maximum Marks : 75

**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)  
 $BA + CD - \times CB - AD - + /$  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 :

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

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)

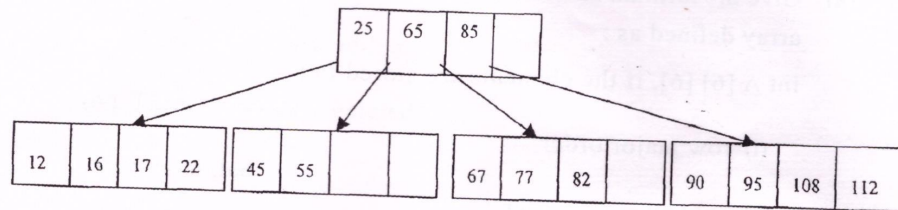
- (b) Insert the given keys one by one in the following B tree of order 5 :

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)
- Creating an ordered linked list of integers.
  - Merging two ordered singly linked lists of integers into one ordered list.
  - 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)