

**Group - E**

8. (a) Trace the action of heap sort on the given list  
26, 33, 35, 29, 19, 12, 22.
- (b) Apply merge sort to the list of seven numbers, 26, 33, 35, 29, 19, 12, 22. Draw the tree of recursive calls.
- (c) What is hashing? Why is it used?
- 6 + 4 + 2 = 12**
9. (a) Trace the action of insertion sort on the following list of numbers.  
26, 33, 35, 29, 19, 12, 22
- (b) When does a collision occur in hashing? Explain any two methods for collision resolution.
- (c) Write an algorithm for selection sort.
- 4 + 4 + 4 = 12**

**DATA STRUCTURES  
(MCAP 1202)****Time Allotted : 3 hrs****Full Marks : 70***Figures out of the right margin indicate full marks.**Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.**Candidates are required to give answer in their own words as far as practicable.***Group - A  
(Multiple Choice Type Questions)**

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) Given two sorted list of size 'm' and 'n' respectively, the number of comparison needed in the worst case by the merge method of merge sort will be
- (a)  $m \times n$  (b)  $\max(m, n)$   
(c)  $\min(m, n)$  (d)  $m + n - 1$ .
- (ii) Leaves of which of the following trees are at the same level?
- (a) Binary tree (b) B-tree  
(c) AVL-tree (d) Expression tree.
- (iii) Given an empty stack, after performing push (1), push (2), pop, push (3), push(4), pop, pop,push (5), pop, what is the value at the top of the stack?
- (a) 4 (b) 3  
(c) 2 (d) 1.
- (iv) What is the time complexity of the function given below?
- ```
void fun(int n, int a[])
{
    int i = 0, j = 0;
    for(; i < n; ++i)
        while(j < n && a[i] < a[j])
            j++;
}
```
- (a)  $O(n^2)$  (b)  $O(n)$   
(c)  $O(n \log n)$  (d)  $O(n(\log n)^2)$ .

- (v) The best data structure to check whether an arithmetic expression has balanced parenthesis is  
(a) Queue (b) Stack (c) Tree (d) Array.
- (vi) Time complexity of binary search is  
(a)  $O(n)$  (b)  $O(\log n)$  (c)  $O(n \log n)$  (d)  $O(n^2)$ .
- (vii) The inorder traversal of which of the following tree will yield a sorted listing of elements?  
(a) Min Heap (b) Binary search tree  
(c) Max Heaps (d) None of the above.
- (viii) Which of the following is not a stable sorting algorithm?  
(a) Insertion sort (b) Selection sort  
(c) Bubble sort (d) Merge sort.
- (ix) Consider the following declaration for a two-dimensional array in C:  
**char a[100][100];**  
Assuming that the main memory is byte addressable and that the array is stored starting from memory address 0, the address of **a[40][50]** is  
(a) 4040 (b) 4050 (c) 5040 (d) 5050.
- (x) The postfix form of  $A*B+C/D$  is  
(a)  $*AB/CD+$  (b)  $AB*CD/+$  (c)  $A*BC+/D$  (d)  $ABCD+/*$ .

**Group - B**

2. (a) Write algorithms/C-like pseudo code to implement the following on a doubly linked list:  
i. insert an element at the end of the list.  
ii. delete an element from the beginning of the list.
- (b) Define Big-Oh notation in relation to growth rate of a function. Work out the computational complexity of the following piece of code:  

```

for( i = n; i > 0; i-- ) {
    for( j = 1; j < n; j *= 2 ) {
        for( k = 0; k < j; k++ ) {
            ... /* constant number of operations */
        }
    }
}

```

$$(4 + 4) + (2 + 2) = 12$$

3. (a) Write algorithms/C-like pseudo code to implement the following on a circular linked list:  
i. Count the number of nodes  
ii. Concatenate two lists.
- (b) How can you represent the following polynomial  $5x^5 + 4x^2 - 25x + 10$  with array(s)? Write an algorithm to read such a polynomial, take derivative of the polynomial and print the result.

$$(3 + 4) + 5 = 12$$

**Group - C**

4. (a) Write the push and pop function for a stack after describing the data structure clearly. State three applications of a stack.
- (b) What is tail recursion? How is it different from ordinary recursion?
5. (a) With the help of stack convert the following infix expression to corresponding postfix expression: (assume  $^$  is the exponentiation operator)  
 $a / (b + d * (e - f) ^ f ^ g$
- (b) Write recursive function to find factorial of a non-negative integer and derive the time complexity.

$$6 + (3 + 3) = 12$$

**Group - D**

6. (a) Given a binary tree whose inorder and preorder traversal are given by  
Inorder: G D H B E I A C J F K  
Preorder: A B D G H E I C F J K  
Draw the tree. What will be the post order traversal of the binary tree?
- (b) Write an algorithm to find the inorder traversal of a threaded binary tree.
7. (a) Insert the following keys in the following order to build an AVL tree. Clearly show the various rotations when required.  
6, 3, 1, 2, 4, 5, 9, 7, 8, 11, 10, 12
- (b) Explain how a binary tree may be converted into a linear data structure.

$$(6 + 2) + 4 = 12$$

$$9 + 3 = 12$$