Q.1 Choose the correct or the best alternative in the following: (2×10)

a. ________ is the logical or mathematical model of a particular organization of data.
   (A) Structure             (B) Variable
   (C) Function             (D) Data Structures

b. The data structure that is known as a non-linear data structure?
   (A) Array              (B) Stack
   (C) Linked List        (D) Graph

c. ______ operation accesses each record exactly once so that certain items may be processed.
   (A) Inserting            (B) Deleting
   (C) Traversing          (D) Searching

d. ________ function of C is used to allocate a block of memory.
   (A) malloc()             (B) calloc()
   (C) free()               (D) realloc()

e. Which of the following linked list below have last node of the list pointing to the first node?
   (A) Circular Doubly Linked List (B) Doubly Linked List
   (C) Circular Linked List     (D) Circular Singly Linked List

f. Which of the following approach is used by Merge Sort?
   (A) Divide and conquer      (B) Backtracking
   (C) Heuristic search        (D) Greedy approach
g. A Binary tree is said to be a BST (Binary Search tree) if every node $N$ in a tree is such that

(A) $\text{Left Subtree} < N < \text{Right Subtree}$
(B) $N < \text{Left Subtree} < \text{Right Subtree}$
(C) $\text{Left Subtree} < \text{Right Subtree} < N$
(D) $\text{Right Subtree} < \text{Left Subtree} < N$

h. Which of the following way follows in Inorder traversal?

(A) Root $\rightarrow$ Left subtree $\rightarrow$ Right subtree
(B) Root $\rightarrow$ Right subtree $\rightarrow$ Left subtree
(C) Left subtree $\rightarrow$ Root $\rightarrow$ Right subtree
(D) Left subtree $\rightarrow$ Right subtree $\rightarrow$ Root

i. The worst case and average case complexity of Bubble Sort algorithm is given by

(A) Both $O(n^2)$
(B) $O(n^2)$ and $O(n \log n)$
(C) $O(\log n)$ and $O(n^2)$
(D) Both $O(n \log n)$

j. A complete graph with $N$ nodes will have _______ edges.

(A) $[n(n-1)/2]$
(B) $[(n-1)(n+1)/2]$
(C) $[n(n+1)/2]$
(D) $[(n-1)/2]$

**Answer any FIVE Questions out of EIGHT Questions.**
Each question carries 16 marks.

**Q.2**

a. Discuss the procedure of writing a Recursive function. Also write C programs for the following with the explanation in support of your answer:  

(i) To find the sum of $n$ numbers by recursion.
(ii) To reverse a given number.

b. Explain the memory Allocation in C and distinguish between compile time (static) and run time (dynamic) memory allocation.

**Q.3**

a. How a pointer can be used to access the members of a structure? Explain by C programs as examples.

b. Describe Major File operations with examples as C programs.

**Q.4**

a. Describe linear and binary search with their algorithms.

b. Write a C Program code for binary search using recursion.
Q.5  

a. Discuss the concept of Stack and Queues and write the C programs that demonstrate the following:  

(2+3+3)

(i) Push and Pop operations in a stack  
(ii) Insert and Delete operations in a Queue.

b. Briefly describe the Circular Queue. Show the procedure of adding and deleting an element from a circular queue by a C programming function.  

(8)

Q.6  

a. Define a singly Linked List. Write a C Program for appending a new node in the end as well as deleting the beginning or first node of the created linked list.  

(8)

b. Give a C program module that shows the Insert, find, delete and print operations in a Singly Linked list.  

(8)

Q.7  

a. Write short notes on the following:  

(4+4)

(i) Circular linked lists  
(ii) Doubly linked lists

b. Write a C program which demonstrates the merging of two circular lists.  

(8)

Q.8  

a. Express the non recursive algorithms for the Inorder and Preorder traversal of a binary tree.  

(8)

b. Write the following algorithms:  

(8)

(i) Write the algorithm for testing that a given binary tree is BST (Binary Search tree) or not.  
(ii) Express the algorithm of inserting a node k in a BST (binary search tree) with a brief analysis.

Q.9  

a. Distinguish between the Breadth first search (BFS) and Depth first search (DFS) traversal techniques of a graph in detail.  

(8)

b. Discuss the Kruskal’s Algorithm with its analysis and apply it to find the minimum cost spanning tree for the following undirected graph:  

(4+4)