Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/MCA/SEM-2/MCA-203/2010

2010

DATA STRUCTURES WITH C

Time Allotted : 3 Hours Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following : 10 × 1 = 10

   i) The complexity of binary search algorithm is

      a) $O(n)$ b) $O(\log n)$

      c) $O(n^2)$ d) $O(n \log n)$.

   ii) The operation of processing each element in the list is known as

      a) Sorting b) Merging

      c) Inserting d) Traversal.

   iii) Finding and removing an element (by copying succeeding elements down one index) from an array (sorted in ascending order) of length n that is full requires how many copy operations and how many comparisons between elements in the worst case ? (Assume that the element appears in the array .)

      a) $O(\log n)$ copy operations and $O(n)$ comparisons between elements

b) $O(n)$ copy operations and $O(1)$ comparisons between elements

c) $O(1)$ copy operations and $O(\log n)$ comparisons between elements

d) $O(n)$ copy operations and $O(n)$ comparisons between elements.

iv) To implement recursion, we require

a) Stack b) Queue

c) Both (a) & (b) d) None of these.

v) The Worst case occurs in linear search algorithm when

a) Item is somewhere in the middle of the array

b) Item is not in the array at all

c) Item is the last element in the array

d) Item is the last element in the array or is not there at all.

vi) Tail recursive function means

a) A function where last statement is a recursive call

b) A nested function

c) A function with an infinite loop

d) None of these.

vii) Sparse matrix is

a) All 0 element matrix

b) A unit matrix

c) Mostly 0 element matrix

d) A few 0 element matrix.

viii) Which of the following is a linear data-structure ?

a) Graph b) Binary Search Tree

c) Double Linked-List d) None of these.

ix) Prerequisite of Binary Search is

a) Array must be sorted in ascending order

b) Array must be sorted in descending order

c) Either (a) or (b)

d) None of these.

x) Circular Queue uses which of the following strategy ?

a) FIFO b) LIFO

c) None of these d) Both (a) and (b).

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. Compare linked list with array in respect of both advantages and disadvantages.
3. Prove that for any non-empty binary tree T, if n_0 be the number of leaves and n_1 be the number of nodes of degree 2, then $n_0 = n_1 + 1$.
4. Construct a Binary tree with the help of the following preorder and inorder traversal and also find the postorder traversal.

   Preorder : A B C D F H J M K E G I L N

   Inorder : A D J M H K F C I N L G E B.
5. Define circular queue. What are the advantages of circular queue over linear queue ? Define priority queue.
6. Write a C function to delete a node from the end of a singly linked list.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. a) How can a polynomial such as $5x^4 - 3x^2 + 9x - 11$ be represented by a linked list ?

   b) Write an algorithm to delete a node from a doubly linked list.

   c) Explain the advantages of binary search over sequential search.

   d) Are recursive routines more efficient than non-recursive routines ? Justify your answer with example.

   4 + 5 + 3 + 3

8. a) Convert the following infix expression into equivalent postfix expression using stack :
A ^ B * (C + D) + (E – F) + G / (H + W).
b) Can a queue be represented by a circular linked list with only one pointer pointing to the tail of the queue ? Write C functions for the Add and Delete operations on such a queue.
c) Compare the advantages and disadvantages of implementing a stack as an array with implementing a stack as a linked list.
d) Define Deque and its types. Write some of the applications of stacks and queues. 4 + 5 + 3 + 3

9. a) Draw a binary search tree whose elements are inserted in the following order :
50, 70, 90, 93, 100, 20, 10, 12, 9, 25, 51, 15, 95.
b) Explain the algorithm to search a node in a binary search tree.
c) What is height balanced tree ? Explain what you mean by balance factor. Construct a height balanced tree from the following sequence of integers :
50, 72, 96, 94, 107, 26, 12, 11, 9, 2. 5 + 5 + 5

10. a) Sort the following list in ascending order using merge sort. Show the step by step process :
80, 75, 45, 90, 30, 40, 12, 15, 93, 8, 50, 10.
b) What do you mean by Hashing and Hash functions ? Describe any three Hash functions with suitable examples. Explain any two methods of dealing with hash collision.
c) Write the algorithm of Binary search. 4 + (2 + 3 + 2) + 4

11. Write short notes on any *three* of the following : 3 × 5
a) Tail Recursion
b) Threaded binary tree
c) Importance of Garbage collection and compaction
d) Sparse matrix and its representation
e) Dequeue-operation and application.