ROLL NO. _____

Code: CT11 **Subject: DATA STRUCTURE THROUGH C**

ALCCS – NEW SCHEME

Time: 3 Hours **FEBRUARY 2013** **Max. Marks: 100**

PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.

NOTE:

- **Question 1 is compulsory and carries 28 marks. Answer any FOUR questions from the rest. Marks are indicated against each question.**
- **Parts of a question should be answered at the same place.**

Q.1 a. How do you implement dynamic memory allocation in C? Give a suitable example to illustrate your answer.

b. Show that $n * \log_2 n$ is the highest performance any sorting algorithm can achieve.

c. A link list has 10 nodes and TOP is the pointer pointing to its first node. Reverse the list in such a way that TOP now points to 10^{th} node and 9^{th} node is second, 8^{th} is third and so on and first becomes tenth node.

d. Give the output of the function call foo (5) when foo() is defined as:

```
int foo (int n)
{
        if (n == 10) return n;
        else return (n + foo(n+1));
}
```

What will happen when foo(11) is invoked?

e. Differentiate between Stack and Queue. How are they related to LIFO and FIFO concept?

f. Define a structure for binary tree. Use this structure to represent the expression

3 + 5 * (7 – 9) – 6 + 9
in infix notation.

g. Describe boundary tag method. **(7×4)**

Q.2 a. Write basic characteristics of C programming language. What is the function of main()? **(4)**

b. With the help of an example explain the sparse matrix. How the sparse matrix is represented in memory? **(10)**

c. Write a program to multiply two matrices A and B. Your program should check whether matrices A and B are conformal for matrix multiplication **(4)**

Q.3 a. Arbitrarily large integer cannot be stored in a computer because of its limitation. Size of an integer grows exponentially while computing factorial of an integer, therefore, simple multiplication does not help us in computing factorial of a large positive integer. Write an algorithm using linked list to compute factorial of any arbitrarily large positive integer. **(12)**

b. How will you implement unbounded buffer with overwrite facility using cyclic queue. Explain your answer with a suitable example. **(6)**

Q.4 a. Write a recursive algorithm to sort a list of following 10 integers using quick sort.

10, 23, 11, 55, 32, 5, 67, 53, 4, 98

Trace the working of your algorithm. **(10)**

b. Why recursive algorithm is slower compared to its corresponding iterative algorithm? **(4)**

c. Explain the AVL trees. **(4)**

Q.5 a. How the binary trees are represented in the memory? **(9)**

b. What is collision in Hash search? Give two methods to resolve the collision. **(9)**

Q.6 a. Write any two data structures that are suitable for representing a graph. Write an algorithm for Depth First Traversal of a graph using one of your two data structures. **(10)**

b. Write Dijkstra's shortest path algorithm to compute all pair shortest path in a weighted directed graph **(8)**

Q.7 a. What is garbage collection and how is it useful for managing external fragmentation in main memory? Give an example to show that best fit allocation of memory leads to external fragmentation. **(9)**

b. How multi-way search tree is different from binary search tree? Write a condition to select one of the branches from an internal node (or root) of the 3-way search tree depending upon the possibility of getting the item in the tree, if the item is in the tree. No backtracking should be allowed. **(9)**