ROLL NO. _____

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

ALCCS – NEW SCHEME

Time: 3 Hours **AUGUST 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. Write an algorithm to evaluate a postfix expression using the stack.

b. Assuming a pointer P is given to the node P which is not a head node or tail node in a singly linked list. Write the pseudo code to delete this node from the list.

c. Create a Heap when the values 100,200,-10,-30,-60, 80, 90,300 are entered.

d. Write the algorithm for BFS traversal of a graph.

e. Sort the following numbers using Radix sort:
100,300,95,60,10,900,800 showing positions of various buckets.

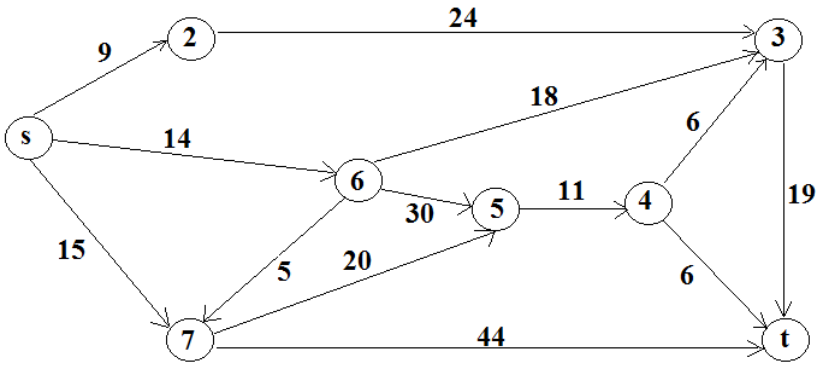
f. Define the terms
(i) General tree (ii) Forest
(iii) Graph (iv) Game Tree

g. What is the difference between binary trees and B-trees. **(7×4)**

Q.2 a. Derive an expression to find the memory address of any general element in n dimensional array where address of the first element is α. Assume that all the elements are stored in column major order. If the length of each word is w then how would this expression change? **(6)**

b. An Ackerman function is defined as follows:
$A(m,n) = n + 1$ if $m=0$
$= A(m-1,1)$ if $m \neq 0$ and $n = 0$
$= A(m-1, A(m,n-1))$ if $m \neq 0$ and $n \neq 0$
Write the recursive function for A(m,n). Can we find manually that how many times this function is called for A(3,5)? **(4)**

c. Apply the Dijkshtra's algorithm to find the shortest path between s and t in the following graph. **(8)**



Q.3 a. Write a function to reverse a singly linked list in place i.e. without creating a second linked list. **(7)**

b. Write a function to merge two doubly linked lists X=(a1,a2,a3, ….an) and Y=(b1,b2,b3, ….bm) giving Z=(a1,b1,a2,b2, …..) ending in an or bm depending upon whether n >m or m>n. **(7)**

c. Given that a polynomial $f(x) = a_n x^n + a_{n-1}x^{n-1} + a_{n-2}x^{n-2} + \ldots + a_1 x + a_0$ write a function evaluate(x) to return the value of this function for passed value of x. **(4)**

Q.4 a. Given an array A(1:n) of n elements. Suggest a scheme to divide it into n equal parts except possibly the last. Each part will be treated as a stack. State all boundary conditions. Write the functions to pop and push any element over any general stack. No overlapping is allowed in the adjacent stacks even if neighbouring stack is empty. **(7)**

b. Explain Buddy systems. **(5)**

c. Assuming that priority queue is implemented using the linked lists where a master list contains a pointer to the corresponding priority list. Write a function to insert an element x of priority p into this queue. **(6)**

Q.5 a. Explain firstfit and bestfit approaches of dynamic memory management. **(6)**

b. Prove that a linked binary tree with $n \geq 0$ nodes has exactly n+1 NULL links. **(6)**

c. Write the code for inorder traversal of a right-threaded binary search tree. **(6)**

Q.6 a. Show various stages of AVL tree on inserting the items MAR, MAY, NOV, AUG, APR, JAN, DEC, JUL and FEB. **(8)**

b. Draw the figures for performing the single and double rotations in AVL tree. **(4)**

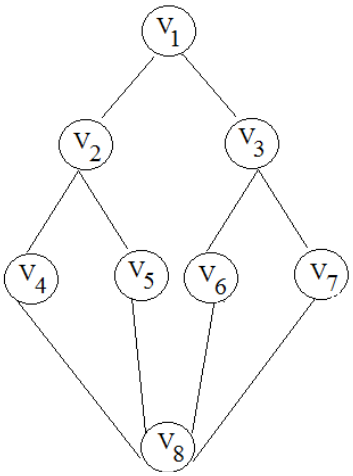
c. Following skeleton code readjusts a Heap on inserting a new item into it. Given that *low* contains the index of the root and *high* contains the index of the last item in the list. Fill the blanks of the following algorithm: **(6)**

```
int largeIndex = 2*low + 1;
while ( _____)   /* Blank A  */
```

```
{
        if ( largeIndex< high )
                if ( _____)   /* Blank B */
                        largeIndex = largeIndex +1;
                if(_____)              /* Blank C */
                        break;
        else {
                swap(_____);   /* Blank D   */
                low = largeIndex;
                largeIndex = _____; /* Blank E */
                }
}
```

Q.7 a. Construct the binary tree whose following traversals are given:
inorder : DFEIHBAJCNOMK
postorder: FIHEDBJONMKCA **(6)**

b. Define connected components of a Graph. For the given graph give the adjacency list.



Write the BFS algorithm and traverse it starting from the vertex v6 showing various stages. How the connected components of a graph can be determined? **(6)**

c. Find the BFS Topological sorting of the following graph. **(6)**