ROLL NO. _____

Code: CS21 Subject: DATA STRUCTURES & ALGORITHM DESIGN

ALCCS – OLD 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. What is the output of the following program? Give reason.

```
#include <stdio.h>
main(){
        struct point {
            int x, y;
} polygon[]={{1, 2},{1, 4},{2, 4},{2, 2}};

struct point *ptr;
ptr = polygon;

ptr++;
ptr -> x++;
printf("\n %d", ptr -> x);
}
```

b. Compute the time complexity of the following relation:
$T(n) = 5*N^3 + N^2 + 2*N$

c. Write the disadvantages of linear representation of binary tree.

d. Describe various elements of the greedy strategy.

e. Define Graph and list any three application area of graph.

f. Describe any two Hash functions using suitable examples.

g. Which sorting algorithm is easily adaptable to singly linked lists? Explain your answer. **(7×4)**

Q.2 a. What are the parameters on the basis of which an algorithm can be analyzed? **(4)**

b. Explain Dijkstra's algorithm for finding the shortest path in a given graph. **(8)**

c. Assume the declaration of multidimensional arrays A and B to be,
A (-2:2, 2:22) and B (1:8, -5:5, -10:5)
(i) Find the length of each dimension and the number of elements in A and B.
(ii) Consider the element B[3,3,3] in B. Find the effective indices E_1, E_2, E_3 and the address of the element, assuming Base (B) = 400 and there are W = 4 words per memory location. **(6)**

Q.3 a. A nasty number is defined as a number which has at least two pairs of integer factors such that the difference of one pair equals to sum of the other pair.
For instance, the factors of '6' are 1, 2, 3 and 6. The difference of factor pair (6, 1) is equal to the sum of factor pair (2, 3), i.e, 5. Hence, '6' is a nasty number.
Choose appropriate data structure and write a program that displays all the nasty numbers present in a list of numbers. **(10)**

b. Use a stack to evaluate the following postfix arithmetic expression. Show the changing status of the stack in tabular form:
X Y Z ^ * + A B / C + - for X=1, Y=5, Z=2, P=3, A=15, B=3, and C=8 **(8)**

Q.4 a. Write a program that creates a linked list consisting of nodes of following struct type and searches the record of a student whose roll number is given by the user.

```
struct student{
  char name[15];
  int roll;
  struct student *next;
};
```

(9)

b. What is merge sort? Write an algorithm for merge sort and derive its run time complexity. **(9)**

Q.5 a. Suppose the following list of numbers is inserted in order into an empty binary search tree:
45, 32, 90, 34, 68, 72, 15, 24, 30, 66, 11, 50, 10

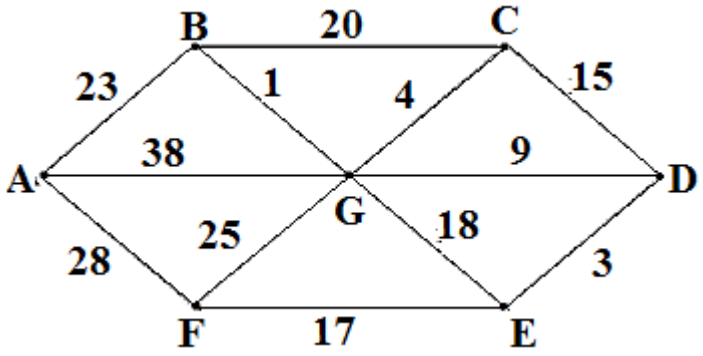
(i) Construct the binary search tree.
(ii) Find the in-order, pre-order and post-order traversal of BST created. **(9)**

b. Consider a polynomial p(x, y, z) as
$p(x, y, z) = 8x^2y^2z - 6yz^8 + 3x^3yz + 2xy^7z - 5x^2y^3 - 4xy^7z^3$
(i) Rewrite the polynomial so that the terms are ordered.
(ii) Suppose the terms are stored in the order shown in the problem statement in the linear arrays COEF, XEXP, YEXP, and ZEXP, with the HEAD node first. Assign values to LINK so that the linked list contains the ordered sequence of terms. **(9)**

Q.6 a. Consider 5 items along with their respective weights and values
$I = <I_1, I_2, I_3, I_4, I_5>$
w = <5, 10, 20, 30, 40>
v = <30, 20, 100, 90, 160>
The capacity of knapsack W = 60. Find the solution to the fractional knapsack problem. **(9)**

b. Write an algorithm to search a key in a B-tree. What is the worst case of searching in a B-tree? List the possible situations that can occur while inserting a key in a B-tree? **(9)**

Q.7 a. Define the following:
(i) Adjacency Matrix
(ii) Path Matrix
(iii) Adjacency list representation
For the following graph find the adjacency matrix and adjacency list representation of the graph. **(8)**



b. Briefly describe and differentiate between firstfit and bestfit memory allocation strategy. **(5)**

c. Describe any string matching algorithm. Also calculate its time complexity. **(5)**