ROLL NO. _____

Code: CS21 Subject: DATA STRUCTURES & ALGORITHM DESIGN

ALCCS – OLD 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. Calculate complexity in terms of n of the running time for each of the following LOOP1 and LOOP2 algorithm

(i) Algorithm LOOP1(n) :
```
S=0;
for (i=1; i<=n; i++)
S=S+i;
```

(ii) Algorithm LOOP2(n) :
```
p=1;
for (i=1; i<=n^2; i++)
p=p.i;
```

b. Describe any four features of top down approache to algorithmic design.

c. Can a Queue be represented by circular linked list with only one pointer pointing to the tail of the queue? Substantiate your answer using an example.

d. Explain the term 'garbage collection'. Distinguish between best fit and worst fit memory allocation strategies.

e. Consider the following stack of characters, where STACK is allocated N = 8 memory cells STACK : A,C,D,F,K,_,_,_. (_ means empty allocated cell). Describe the stack as the following operations takes place:
(a) POP(STACK, ITEM)
(b) POP(STACK, ITEM)
(c) POP(STACK, ITEM)
(d) PUSH(STACK, R)
(e) PUSH(STACK,L)
(f) PUSH(STACK, S)
(g) PUSH(STACK,P)
(h) POP(STACK, ITEM)

f. A Binary tree has 9 nodes. The inorder and preorder traversals of the tree yields the following sequence of nodes:

Inorder : E A C K F H D B G
Preorder: F A E K C D H G B
Draw the tree. Explain the steps performed in the algorithm.

g. A saddle point in a two dimensional array is the value which is minimum in the row and maximum in the column. Devise an algorithm to find the saddle point of a matrix. What is the order of the algorithm? **(7×4)**

Q.2 a. Write an algorithm to delete a node in the beginning (head node) and to search for a node in linked list whose value is equal to 'x'. If the node with value 'x' is found it should return the position otherwise it should return 0. **(10)**

b. Starting from an empty doubly-linked list, the following operations are performed, in order: addFirst(A), addFirst(B), addLast(C), addLast(D), insertBefore (2,E), insertAfter(3, F), remove(2), where indices start at 0 and A, B, etc, are instances of the Node interface. Draw the list that results after those operations. Draw only the final result. **(4)**

c. Show the various passes of bubble sort on an unsorted list 11, 15, 2, 13, 6 **(4)**

Q.3 a. Given an array of 6 elements: 15, 19, 10, 7, 17, 16 construct a heap tree using array representation. Discuss the complexity of the heap sort algorithm. **(6+2)**

b. Construct Huffman tree for the data in the below given table and also give the code word for all given characters**.** **(2+5)**

Character	A	B	C	D	E
Probability	0.35	0.1	0.2	0.2	0.15

c. Let the following circular queue can accommodate maximum six elements with the following data
front = 2 rear = 4
queue = __, L, M, N, __, __
What will happen after ADD 'O' operation takes place? **(3)**

Q.4 a. Apply Quick sort algorithm for the following array of elements and sort the elements (Take the element 28 from the list as the pivot element). Also discuss the complexity of the algorithm for worst case and best case. **(6+3)**

28, 32, 12, 5, 48, 13, 35, 11

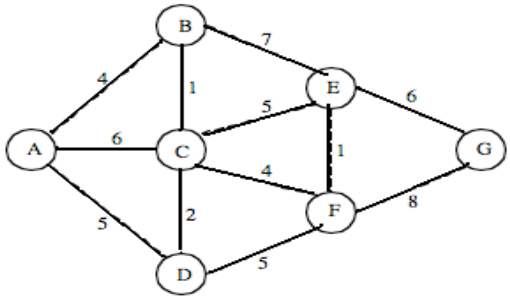
b. Write an algorithm to merge the nodes of two AVL trees to obtain a new AVL tree. What is the computing time of your algorithm. **(9)**

Q.5 a. Write a function to perform string copy and string compare operations given two strings stored in an array which are passed as arguments to functions. **(4.5+4.5)**

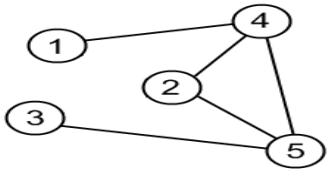
b. Write pseudocode to extract, insert and delete characters in a string of characters stored in an array to demonstrate manipulation of character data in arrays. Strings of characters are stored and processed in arrays. Assume suitable start index and end index to demonstrate the above operations. **(3+3+3)**

Q.6 a. List any two real world applications of Minimum Cost Spanning Trees. List two differences between Dijkstra and Kruskal's algorithm? **(4)**

b. For the following graph calculate the shortest path from start vertex 'A' using the Dijkstra's Algorithm. **(10)**



c. Traverse the graph given below using DFS traversal. Indicate the order of the nodes visited. Start with node 4. **(4)**



Q.7 a. Write an algorithm to evaluate a postfix expression. **(5)**

b. Execute your algorithm using the following postfix expression as your input:-

a b + c d +*f^ **(5)**

c. Construct an arithmetic expression tree for the expression (((a/b)+c)-(d*e)) and give the pre-order and post order traversals. **(2+3+3)**