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

ALCCS – NEW SCHEME

Time: 3 Hours   **AUGUST 2012**   **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. Explain 'complexity of an algorithm' and 'space time tradeoff' of algorithm.

   b. The running time of an algorithm is represented by the following recurrence relation

$$T(n) = \begin{cases} n & \text{if } n \leq 3 \\ T\left(n/3\right) + cn & \text{otherwise} \end{cases}$$

   Find the time complexity of algorithm.

   c. For a 3D array A (2:8, - 4:1, 6:10) find the number of elements and the address of the element (5, - 1, 8) if base address is 200 and $w = 4$ words per memory cell using row major order.

   d. In a complete k-ary tree, every internal node has exactly k children. Calculate the number of leaves in such a tree with n internal nodes.

   e. Suppose LIST is a header (circular) list in memory. Write an algorithm which deletes the last node from LIST.

   f. Explain Ackermann function.

   g. How many distinct binary search trees can be created out of 4 distinct keys?   **(7 × 4)**

Q.2   a. Write Kruskal's algorithm for finding minimum spanning tree of a graph. Use the algorithm to find MST of the following graph: **(10)**

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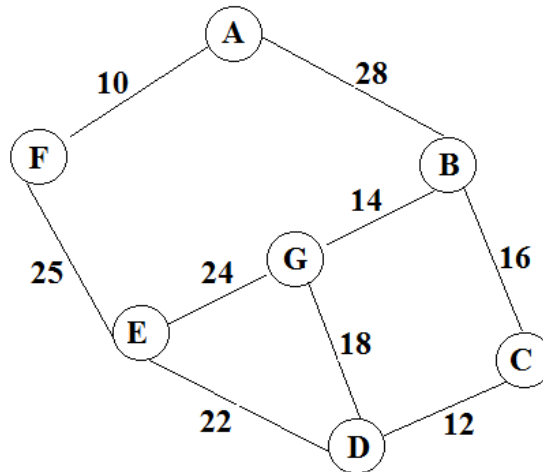
b. Write an algorithm to delete a node Z of a binary search tree if it has 2 children.   **(8)**

Q.3   a. Explain external sorting. Why do we require it? How it is different from internal sorting?   **(6)**

b. Write recursive C function to compute Fibonacci series.   **(6)**

c. For the following graph, obtain
     (i)   the in-degree and out-degree of each vertex.
     (ii) its adjacency-matrix
     (iii) its adjacency-list representation.   **(6)**
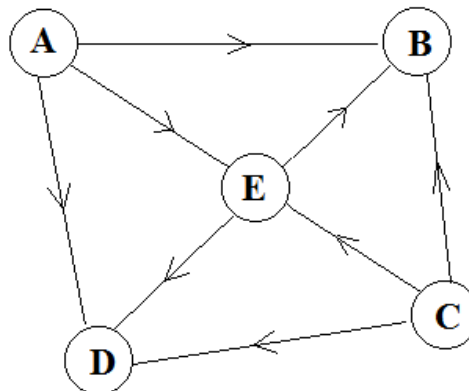
Q.4   a. Discuss boundary tag method and write a C program for freeing memory blocks. **(6)**

b. What do you mean by buddy system memory allocator? What are its drawbacks? **(6)**

c. Write a C program to add a given node at the end of a singly linked list.   **(6)**

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Q.5 a. A priority queue is implemented as a Max-heap. Initially it has 5 elements. The level order traversal of the heap is given below:
10, 8, 5, 3, 2
Two new elements '1' and '7' are inserted in the heap in that order. What is the level-order traversal of the heap after the insertion of these elements? **(7)**

b. What is the number of binary trees with 3 nodes which when traversed in post order give the sequence A, B, C? Draw all these binary trees. **(5)**

c. Explain any two types of indexing techniques. **(6)**

Q.6 a. Discuss B+ tree. How is it different from B tree? **(4)**

b. Write an algorithm to evaluate a postfix expression using stack. **(6)**

c. What do you mean by AVL tree? Construct an AVL tree by inserting the following elements in the order of their occurrence
H, I, J, B, A, E, C, F, D, G, K, L, **(8)**

Q.7 Write short note on any **THREE**

(i)   Radix Sort
(ii) Sparse matrix representation using linked list
(iii) Huffman tree
(iv) Absolute and relative addressing **(3×6)**