MCA (Revised)

Term-End Examination

June, 2008

MCS-021 : DATA AND FILE STRUCTURES

Time : 3 hours   *Maximum Marks : 100*
                              (Weightage 75%)

Note :   *Question number 1 is **compulsory**. Attempt any **three** questions from the rest. All algorithms should be written nearer to 'C' language.*

1. (a) For a given problem with inputs of size n, Algorithms A and B are executed. In terms of running time, one of the algorithms is O(n) and another is O(n log n). Some measured running times of these algorithms are given below :

	512	1024	2048
A	70	134	262
B	42	86	182

    Identify which algorithm is which and also find the running times. Which algorithm would you select for different values of n ?   10

    (b) Explain all types of asymptotic notations and importance of each notation. Also explain why this is much desirable to reduce time complexity than space complexity of an algorithm. Also compute the time complexity of

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for (i = 1; i <= n; i++)
    for (j = 1; j <= n – i; j++)
        A[i] = A[j] + A[j – 1];                    10
```

(c) Prove by induction that

   (i) The number of leaves in a binary tree of height h is less than or equal to 2^h.

   (ii) The number of nodes in full binary tree of height h is equal to $2^{h+1} – 1$.   2×5=10

(d) Write algorithm for Heapsort. Also run your algorithm manually and show how sorting is done by your algorithm for the following sets of data :

   16, 14, 10, 8, 7, 9, 3, 2, 4, 1   10

2. (a) Draw the AVL tree by inserting the following elements one by one :

   mon sun tue wed fri sat thurs

   Also explain why AVL tree is a better data structure than Binary Search tree.   10

(b) Show step-by-step construction of a B-Tree (t = 3) resulting from the insertion of the following keys :

   M, A, R, I, S, T, C, O, L, E, G, F.

   Also show deletion of key M and T from the B-tree constructed above.   10

3. (a) Write FLOYD-WARSHALL'S algorithm for computing "All pair shortest path" problem. Show how does your algorithm work for the following graph : 10
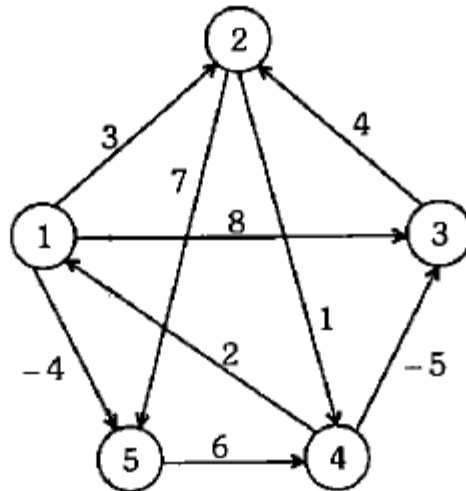
(b) Write algorithm to delete an element from a Binary Search Tree (BST). Show the deletion with the help of proper example. 10

4. (a) How does Depth First Search help us in finding strongly connected components in a graph ? Outline the algorithm and also show its functioning on the graph given below : 10
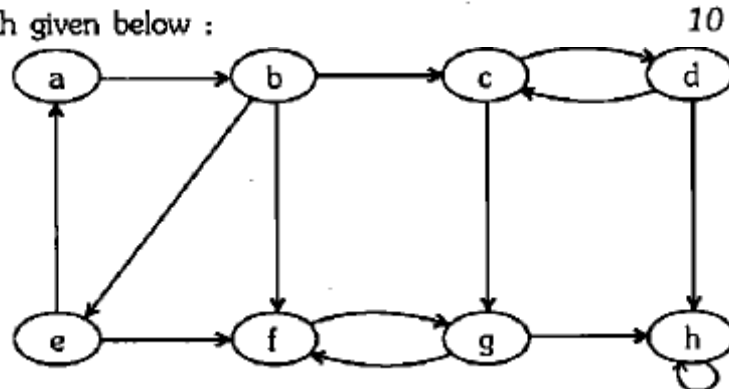
(b) Write a program in 'C' with proper comment lines to multiply two polynomials with the help of linked list.　　　10

5. (a) Why is Red-Black tree considered a better data structure than Binary Search tree and AVL tree ? Write algorithm to insert a node in Red-black tree. Take proper example also.　　　10

　(b) (i) Compare Arrays with linked list by mentioning the advantages and limitations of both.　　　5

　　 (ii) You are given an array of size N. You want to maintain two stacks in such a way that the stacks do not overflow till there are N elements in the system. How will you achieve this ?　　　5