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IIIRD SEMESTER

B.Tech. (Computer Engg.)

END SEM. EXAMINATION

(Nov-Dec. – 2019)

Paper Code: CO201

Title of the subject: **Data Structures**

Time: 3:00 Hours

Max. Marks: 40

Note: Answer any five questions. Write pseudo code/C code for all algorithms asked. Assume suitable missing data, if any. Write your assumption(s) in answer.

1. (a) Given an array A, which was obtained by swapping two elements (selected randomly) of a sorted array e.g. {5, 45, 17, 20, 32, 12, 67}. Write an algorithm to get back the original sorted array by just swapping one pair.

   (b) Write a 3-way merge program/algorithm to merge three sorted arrays into a single sorted array. [4,4]

2. (a) Implement a function [int successor(TreeNodeptr x)] that returns the successor of a node in a binary search tree (the BST stores integer keys). A successor of a node n is defined as the smallest key x in the BST such that x is bigger than the value of n, or null if that does not exist. You may assume that the BST does not contain duplicate keys. Note that getLeft(), getRight(), and getParent() return null if the node does not have a left, a right child, or is the root, respectively.

   (b) Develop an efficient algorithm called Partition-Even-Odd(A,n) that partitions an array A[0..n-1] in even and odd numbers. The algorithm must terminate with A containing all its even elements preceding all its odd elements. Partition-Even-Odd may use only a constant memory space in addition to A. In practice, this means that you may not use another temporary array. [4+4]

3. (a) Consider two shorted lists of length m and n respectively. A merge algorithm is applied to merge these lists into a single sorted array of size m+n (assuming all number are unique). Give exact number of comparisons in best case and in worst case.

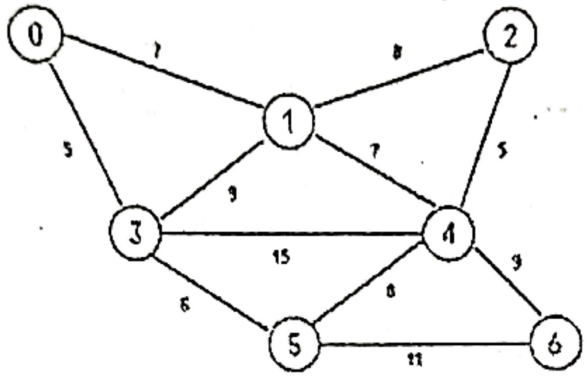
   (b) Write an algorithm (preferably recursive and linear time) to delete all nodes of a linked list and set the pointer (initially pointing to first node) to NULL. Remember we need to physically delete each node and free the memory occupied by each node. [4,4]

4. (a) Write an algorithm to check if given binary tree is a Binary Search Tree or not.

(b) Suppose that we insert a new data x into a Binary Search tree and then immediately delete x from the tree. Will the new tree be identical to the original one? If yes give the reason in no more than 3 sentences. If no give a counterexample. Draw pictures if you necessary.

[4,4]

5. Write Prim's Algorithm for MST. Apply Prim's MST algorithm on following graph and find Minimum Spanning Tree. Show each step of the algorithm.

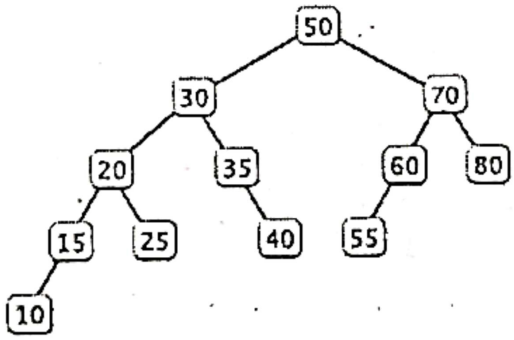


[8]

6. (a) Write algorithm to print all connected components of a given undirected graph.

(b) Write an algorithm to find kth element/node from end in a singly linked list using two pointers and one pass/scan of the linked list). Assume k>=1 and linked list is having more than k nodes. [4,4]

7. (a). Consider following height balanced tree (AVL tree)



Draw the tree after insertion of each of the following data in given order: 5, 45, 53.

(b) Explain BFS graph traversal technique. Write an algorithm for BFS traversal such that along with traversal it also computes single source shortest path for a given unweighted graph. Apply this algorithm on graph given in Question 5 ignoring weights and starting from vertex '0'. [4,4]