BACHELOR OF COMPUTER SC. & ENGINEERING EXAMINATION, 2012
(2nd Year, 1st Semester)
DATA STRUCTURES AND ALGORITHMS

Time : Three hours   Full Marks : 100

Answer question no. 1 and any *four* from the rest.

1. (a) Find the new heap created by removing the first item from the following heap:
        854 89 72 75 1 5 12.

                                                                                                                2

    (b) Draw a hash table with open addressing and a size of 11. Use the "modulo 11" hash function to insert the following keys in the given order into your table:
        7, 35, 0, 40, 33, 20, 44.

                                                                                                                3

    (c) Draw the binary tree for which the pre-order and in-order traversal sequences are given below:

        Pre-order : 2, 20, 10, 25, 5, 3, 30, 4
        In-order: 10, 20, 5, 25, 2, 3, 4, 30

                                                                                                                3

    (d) What do you mean by $O(f(x))$? Prove that $O(f(n)) * O(g(n)) = O(f(n) * g(n))$

                                                                                                                4

    (e) Show how the following infix expression can be converted to the postfix representation:
        a + b * c + (d * e + f) * g.

                                                                                                                4

    (f) What do you mean by a Transitive Closure Matrix? Explain with an example.

                                                                                                                4

2. Explain the rationale of Merge Sort. What kind of algorithm is it?

    Describe the algorithm of Merge sort and explain its working with the help of the following input array:
        23, 4, 55, 6, 66, 7, 77, 8, 88, 90.
    What is the complexity of Merge sort? Explain.

                                                                                    3+2+5+6+4=20

3. What do you mean by Hashing? What are the applications where you will prefer Hash Tables to other data structures?

    Explain the Folding hash function using an example.

    What are the advantages and disadvantages of Quadratic Probing and Double Hashing? Explain with their definitions.
    What is the use of Bucket Hashing?

                                                                                    4+6+ 6+4=20

4. A rat has entered in a checkerboard maze through one corner, where the white boxes are open and black boxes represent obstacles. Develop an algorithm by which the rat can exit the maze though the opposite corner. Clearly explain the representation of the maze and any specific data structure you have used for the algorithm.

20

5. What are the problems of Binary Search Tree? Explain the improvement of performance by the use of Height Balanced Tree.
Explain how a height –balanced tree can be formed by inserting the following elements in the given order:
    4, 5, 7, 2, 1, 3, 6, 15, 10.
Show how the root element can be deleted from the above tree.

2+4+10+4=20

6. Develop the idea of implementation of single-linked list using an array and cursor. Clearly explain and develop the algorithms for initializing such an array, initializing a linked list and inserting an element at the front of an existing list.

7+3+5+5=20

7. What are the methods of representation of Graph Data Structure?
Differentiate between the methods of graph traversal. How can you implement them?

State an algorithm for finding the shortest paths from a designated vertex to all other vertices of a Graph. What is the time complexity of your algorithm?

6+6+8=20

6. Write the following functions in C with proper comments:
    a. To test whether a binary tree is a Binary Search Tree.
    b. To in-order traverse a threaded binary tree.
    c. To rotate right an AVL tree.
    d. To search a Graph using the Depth First Search Algorithm.

6+6+3+5=20

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