BACHELOR OF COMPUTER SC. & ENGINEERING EXAMINATION, 2013

(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) Define a Priority Queue.

2

(b) Draw the 2-3 tree constructed by inserting the following integers in the order they are given:
9, 26, 0, 31, 24, 11, 35, 6, 53, 3.

4

(c) Comment on the correctness of the recursive function given below:

```
int R1 (int n) {
        if (n == 0)
        return 1;
        else return (R1(n-3) * R1(n-4));
}
```

3

(d) What do you mean by O(f(x))? Prove that O(f(n)) + O(g(n)) = O(max (f(n), g(n)))

4

(e) Show how the following postfix expression can be evaluated (# is a sentinel):
57 4 6 7 + * - 15 * 3 / #

3

(f) What do you mean by a Stable Sorting Algorithm? Explain with an example.

4

2. Explain the rationale of Heap Sort.

Describe the algorithm of Heap 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 Heap sort? Explain.

4+6+6+4=20

3. Explain what you mean by Abstract Data Type (ADT). How is it related to Data Structure?

What do you mean by Static and Dynamic data Structure? Explain with examples.

Define the ADT for List.

Assuming list is represented by array with a sentinel, write the algorithm for deleting the 5th element of the list.

4+6+ 6+4=20

4. Define Queue ADT.
Implement Queue Data Structure using and array and two integer variables front and rear, representing array indices of the front and rear element of the Queue respectively.

20

5. Define a B-Tree of order d. How can a B-Tree be stored on the Hard Disk? Explain why efficient searching can be implemented using a B-Tree based data-storage.

Show how the letters of the English alphabet 'A'..'Z' can be stored in a B-Tree of order 5, when input in the alphabetic sequence. What is the height of the resultant B-Tree.

3+4+8+5=20

6. Explain how Push and Pop operations are implemented for a stack implemented using linked lists using pointers. Is checking whether a stack is full, relevant to such a design? If not, how will the user know that no more data can be pushed onto a stack? Explain.

Explain what you mean by equality of two stacks. Write a C language function to check whether two stacks are equal.

6+2+4+2+6=20

7. What are the methods of representation of Graph Data Structure?
What is a Spanning Tree? Explain the difference between the Kruskal's and Prim's Algorithms for finding out Minimum Spanning Tree in a Graph.

What do you mean by Transitive Closure Matrix? Give an algorithm to find the Transitive Closure Matrix of a Directed Graph.

4+2+8+2+4=20

8. Write the following functions in C with proper comments:
   a. To test whether a binary tree is Height-balanced or not. (Balance Factors are not stored in the nodes of the tree)
   b. To compute the hash value of a large alphabetic string using the Folding algorithm, the table size and the number of folds being passed as parameters of the function.
   c. To rotate left an AVL tree.
   d. To search a Graph using the Breadth First Search Algorithm.

6+6+3+5=20