BACHELOR OF ENGINEERING IN INFORMATION TECHNOLOGY
1st YEAR 2nd SEMESTER EXAMINATION, 2018
Data Structures and Algorithms

Time: 3 Hours

Full Marks: 100

ANSWER FROM EVERY GROUP

All part of a group must be written in one place.
Diagrams should be drawn using pencil.

Group 1: (CO1 = 20)

$((3+2)\times2)+5+5 = 20$

1. What do you mean by Time Complexity and Space Complexity of Algorithms? Explain with examples.
2. Write an algorithm to evaluate an arithmetic expression represented in postfix form.
3. Find out the time complexity of the following segment of algorithm with proper explanation:

```
for(i=1; i<=n; i++)
read A[i];
for (i=1; i<=n-1; i++)
        for(j=n; j>=i+1; j--)
                if(A[j-1] > A[j])
                        Swap(A[j-1], A[j]);
for(i=1; i<=n; i++)
write A[i];
```
Assume Swap, read and write functions take constant time.

Or

$4+(4+2)+3+7 = 20$

1. Write down the recursive algorithms for pre-order and post order traversal in a tree.
2. In a binary tree:
   a. Pre-order traversal yields: G B Q A C K F P D E R H
   b. In-order traversal yields: Q B K C F A G P E D H R
   Construct the binary tree (write each step clearly) and show the result of post order traversal.
3. Which data structure is most suitable for recursion – stack or queue? Give reasons.
4. Write an algorithm to insert an element in a stack implemented using a linked list.

Group 2: (CO2 = 35)

1. What is B-Tree?
   Or
   What are the applications of B-Tree?

$2+7+3+10+8+5 = 35$

2. Show how the 26 capital letters of the English alphabet will be inserted in order from A to Z in a B-Tree of order 4.

3. What are the problems of Binary Search Tree?
   Or
   Explain the improvement of performance by the use of Height Balanced Tree?

4. Explain how a height balanced tree can be formed by inserting the following elements in the given order: 21, 22, 23, 24, 25, 26, 28, 29, 30, 27, 31. Show how the root element can be deleted from the above tree.
5. Show with example that changing child pointers during single and double rotation does not violate binary search tree property.

Or

Write an algorithm to delete an item from AVL tree.

6. What is the maximum possible number of nodes in a binary tree at level k? Draw a BST with at least three nodes for which the in-order and pre-order traversals are the same.

Group 3: (CO3 = 20)

1. Complexity analysis of any three sort   (3x3)+11 = 20
      a. Merge Sort
      b. Bubble Sort
      c. Insertion Sort
      d. Quick Sort

2. Write down the algorithm for quick sort. Trace quick sort on the following data (clearly show each steps): 46, 23, 57, 11, 78, 31, 19, 37, 12, 92, 86, 25

   Or   (5 + 6)

                                                                                              (3+4+4)
      a. Insertion sort gives better result when number of elements to be sorted is less – Illustrate.
      b. Why merge sort run faster than bubble sort in most of the cases - explain?
      c. Show the complexity of merge sort algorithm is $O(n\log_2 n)$.

Group 4: (CO4 = 25)

1. What do you mean by Hashing?   2+3+4+6+6+4 = 25
2. What are the applications where you will prefer Hash table to other data structures?
3. Differentiate between Linear Probing and Double Hashing.
4. Illustrate the Collision Resolution in Hashing.
5. State an algorithm for finding out the minimum cost spanning tree of a graph.
6. What are the methods of representation of graph data structure, explain with example?