B.E. COMPUTER SCIENCE AND ENGINEERING SECOND YEAR FIRST SEMESTER
SUPPLEMENTARY EXAM - 2018
DATA STRUCTURES AND ALGORITHMS

Time : Three hours   Full Marks : 100

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

1. (a) Show how the following array will be sorted in increasing order using selection sort:
     30 90 60 100 10 20 40 70 50.

   3

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

   4

   (c) Show that $5x^2 + 6x + 7 = \Theta(x^2)$.

   5

   (d) How can you represent a generalized tree using a binary tree? Explain with an example.

   3

   (e) What is a synonym? Explain.

   2

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

   3

2. Define the ADT Stack. Implement the Stack Data Structure using pointers in C.

   20

3. Explain the Insertion sort algorithm. In which case it runs very fast?
   Show how the Insertion sort algorithm will sort the following array in increasing order:
     100 90 80 70 60 50 40 30 20.
   Analyse the time complexity of the Insertion sort algorithm.

   7+5+8=20

4. What is B-Tree? 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.

   What are the applications of B-Tree? How can the B-Tree be maintained in a Hard Disk File?

   3+8+3+6=20

5. What do you mean by Hashing? What are the applications where you will prefer Hash Tables to other data structures? Describe the Mid-square and Folding hash functions.

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

   10 + 10

6. 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 out the Minimum Cost Spanning Tree of a Graph. Find its time complexity.

   10 + 10

7. What do you mean by Time Complexity and Space Complexity of algorithms? Explain with examples.

   Find the time complexity of the following segment of algorithm:

   ```
   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.

   10+10

8. 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.

   8+8+4=20

--------X--------