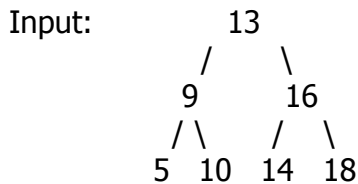# Top-20 Training Program
(Data Structures)
Assignment-5

1) Floor & Ceil: Find an efficient algorithm to compute the floor and ceil of given element in a BST. Floor(x) refers to maximum element that is smaller than x. Ceil(x) refers to minimum element that is higher than x.
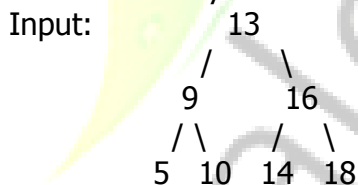
```
Input:         13
            /      \
          9         16
        / \        /   \
       5   10    14    18
```

Output: Floor(17): 16   Ceil(17): 18
        Floor(10): 10   Ceil(10): 10

2) BST Verification: Find an efficient algorithm to verify whether a given binary tree is BST or not. What are the time and space complexities of your solution?

3) IP lookup by country. Find an efficient algorithm to determine what country a given IP address is coming from. An ip-to-country.csv data file is given as input and available under assignments folder of algorithmica github repository. The data file has four fields (begining of IP address range, ending of IP address range, two character country code, and country name). Assume that the IP addresses are non-overlapping. This requirement arises in applications like credit card fraud detection, spam filtering, auto-selection of language on a web site, and web server log analysis.

4) BST to List: Find an efficient algorithm to convert Binary Search Tree into Circular Ordered Doubly linked list.

```
Input:         13
            /      \
          9         16
        / \        /   \
       5   10    14    18
```
Output: 5 <-> 9 <-> 10 <-> 13 <-> 14 <-> 16 <-> 18