National University of Computer and Emerging Sciences

Lab Manual 10
Data Structures

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Objectives

After performing this lab, students shall be able to:

- √ Binary Search Tree
  - √ Insertion
  - √ Deletion
  - √ Check Sibling

TASK 1:

```
template <class T>
Class Node
{
        T data;
        Node<T>*left;
        Node<T> *right;
        Node(T d = 0);
}
template<class T>;
Node <T>::Node(T d) {
        data = d;
        left = nullptr;
        right = nullptr;
}
```

Now implement class tree, which is Binary Search Tree and has node type root as a data member.
In the class BST, you have to implement the following functions.

1. BST() // Default constructor, which sets root to NULL
2. BST(const BST &obj) // Write a copy constructor for BST, which must create a deep copy. Note that copy constructor will make the copy recursively.
3. void **insert**(T n) // It iteratively inserts the value while considering the insertion rules for Binary Search Tree.
   - ➢ To insert a node, our first task is to find the place to insert the node.
   - ➢ Take current = root .
   - ➢ start from the current and compare root data with n
   - ➢ if the current data is greater than n, which means we need to go to the left of the root.
   - ➢ if the current data is smaller than n, we need to go to the right of the root.
   - ➢ if any point of time current is null, that means we have reached to the leaf node, insert your node here with the help of the parent node.
4. bool **find**(T value) // This function returns true if given value is found otherwise false.
5. bool **delete_iterative**(T val) // Delete a node based on given value. In deletion, you have to deal with cases.
   - ➢ Node to be deleted is a leaf node (No Children).
6. void **insert_recursive**(T value, Node<T>*& node) // Write a recursive function to insert a value in BST where we examine the root and recursively insert the new node to the left subtree if its key is less than that of the root or the right subtree if its key is greater than or equal to the root.
7. bool **delete_recursive**(T val) // Write recursive delete function
8. void **display**() // Print the entire tree in increasing order. This should be recursive.
9. void **leafSum**(Node<T>*root, int& sum) // Implement a recursive function void leafSum() to find total leaf nodes of BST.
10. Write a **destructor** to clean the memory. When deleting a node, first delete the left and right child and then the node itself.

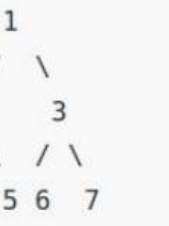
TASK 2:

Given a binary tree and two nodes, the task is to check if the nodes are siblings of each other or not.

Two nodes are said to be **siblings** if they are present at the same level, and their parents are same.

Examples:

Input :



First node is 4 and Second node is 6.

Output : No, they are not siblings.

Input :

First node is 3 and Second node is 4

Output : Yes