Assignment No :2(B)

Problem Statement: Beginning with an empty binary search tree, Construct binary search tree by inserting the values in the order given. After constructing a binary tree –
i.Insert new node
ii.Find number of nodes in longest path
iii.Minimum data value found inthe tree
iv.Change a tree so that the roles of the left and right pointers are swapped at every node
v.Search a value

Objective:

To understand the basic concept of Non Linear Data Structure "TREE "and its basic operation in Data structure.

Outcome:

To implement the basic concept of Binary Search Tree to store a numbers in it. Also perform basic Operation Insert, Delete and search,Traverse in tree in Data structure.

Software & Hardware Requirements:

1. 64-bit Open source Linux or its derivative
2. Open Source C++ Programming tool like G++/GCC

Theory –

Concept in brief :

Tree represents the nodes connected by edges. **Binary Tree** is a special data structure used for data storage purposes. A binary tree has a special condition that each node can have a maximum of two children. A binary tree has the benefits of both an ordered array and a linked list as search is as quick as in a sorted array and insertion or deletion operation are as fast as in linked list.

Binary Search Tree Representation
Binary Search tree exhibits a special behavior. A node's left child must have a value less than its parent's value and the node's right child must have a value greater than its parent value.

A Binary Search Tree (BST) is a tree in which all the nodes follow the below-mentioned properties −

- The left sub-tree of a node has a key less than or equal to its parent node's key.
- The right sub-tree of a node has a key greater than or equal to its parent node's key.

Thus, BST divides all its sub-trees into two segments;the left sub-tree and the right sub-tree and can be defined as –

left_subtree (keys) ≤ node (key) ≤ right_subtree (keys)

Tree Node
Following Structure is used for Node creation

```
Struct node {
Int data ;
Struct node *leftChild;
Struct node *rightChild;
};
```

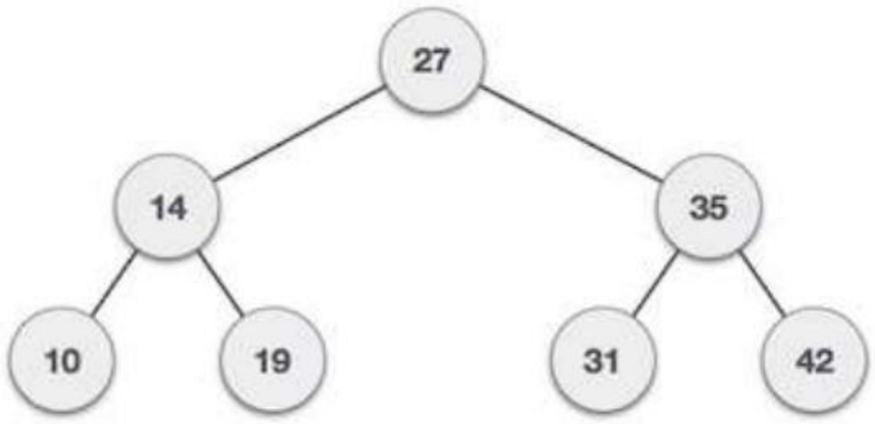


Fig: Binary Search Tree

BST Basic Operations
The basic operations that can be performed on a binary search tree data structure, are the following −

- **Insert**− Inserts an element in a tree/create a tree.
- **Search**− Searches an element in a tree.
- **Traversal**− A traversal is a systematic way to visit all nodes of T -Inorder, Preprder, Postorder,
    - a. pre-order: Root, Left, Right
        - Parent comes before children; overall root first
    - B.post-order: Left, Right, Root
        - Parent comes after children; overall root last
    - c. In Order: In-order: Left, Root, Right,

Insert Operation: Algorithm

```
If root is NULL
   then create root node
return

If root exists then
   compare the data with node.data

   while until insertion position is located

      If data is greater than node.data
         goto right subtree
      else
         goto left subtree
```

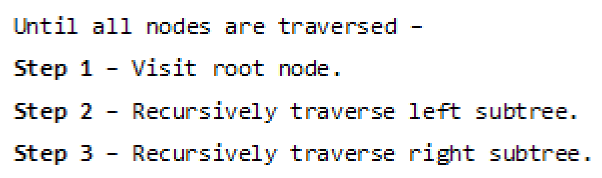
Search Operation:
Algorithm

```
If root.data is equal to search.data
   return root
else
   while data not found

      If data is greater than node.data
         goto right subtree
      else
         goto left subtree

      If data found
         return node

   endwhile
```

Tree Traversal
In order traversal algorithm

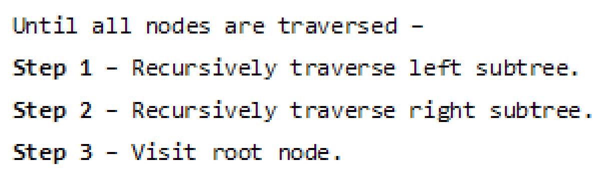
```
Until all nodes are traversed −
Step 1 − Recursively traverse left subtree.
Step 2 − Visit root node.
Step 3 − Recursively traverse right subtree.
```

Pre order traversal Algorithm



```
Until all nodes are traversed -
Step 1 - Visit root node.
Step 2 - Recursively traverse left subtree.
Step 3 - Recursively traverse right subtree.
```

Post order traversal Algorithm



```
Until all nodes are traversed -
Step 1 - Recursively traverse left subtree.
Step 2 - Recursively traverse right subtree.
Step 3 - Visit root node.
```

Deleting in a BST

case 1: delete a node with zero child-

    if x is left of its parent, set parent(x).left = null
    else set parent(x).right = null

case 2: delete a node with one child

    link parent(x) to the child of x

case 3: delete a node with 2 children

    Replace inorder successor to deleted node position.

Conclusion:

We are able to implement Binary search Tree and its operation in Data Structure