Assignment 4

Mayur Zope SE Comp A 75

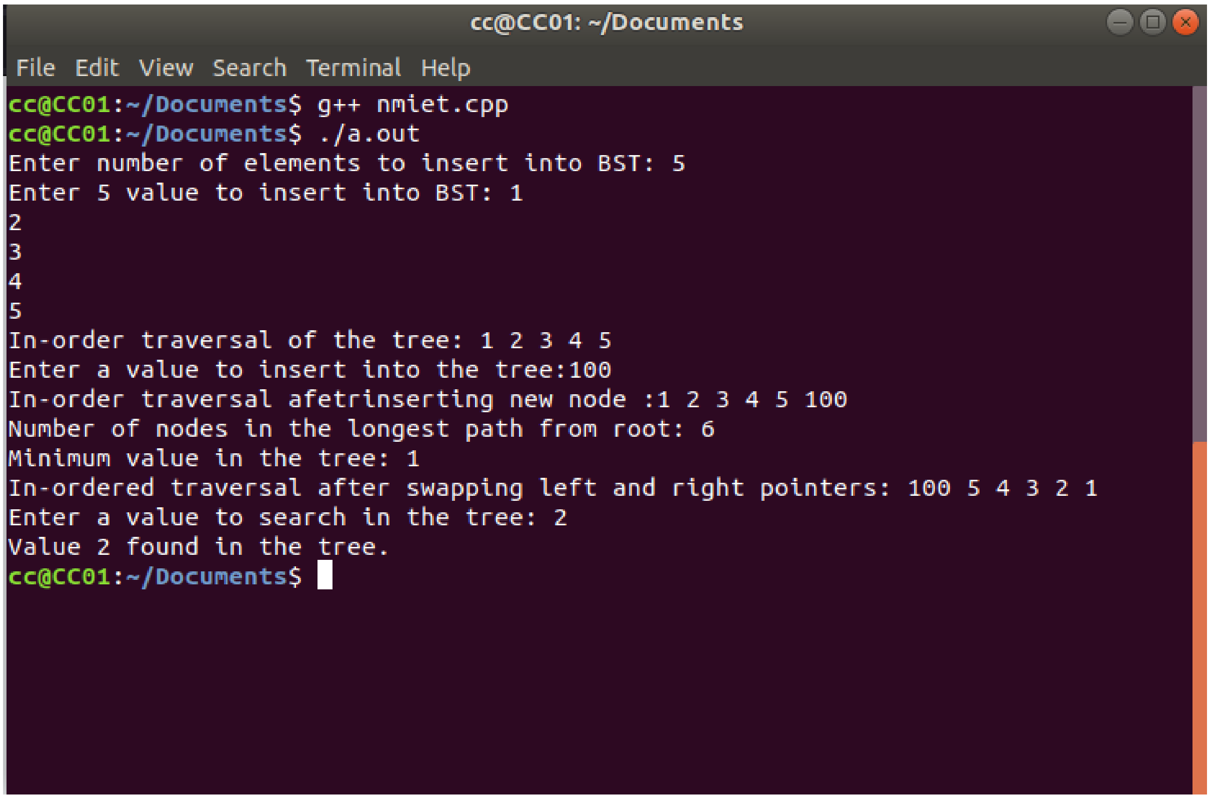
Beginning with an empty binary search tree, Construct binary search tree by inserting the values in the order given. After constructing a binary tree - i. Insert new node, ii. Find number of nodes in longest path from root, iii. Minimum data value found in the tree, iv. Change a tree so that the roles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

```
#include <iostream>
using namespace std;

// Structure for a Node
struct Node
{
    int data;
    Node* left;
    Node* right;
    Node(int value)
    {
        data = value;
        left = right = nullptr;
    }
};

// Class for Binary Search Tree
class BinarySearchTree
{
    public:
        Node* root;
        BinarySearchTree()
        {
            root = nullptr;
        }
```

```
// Insert a node into the BST
void insert(int value)
{
   root = insertHelper(root, value);
}
// Function to insert a node into the BST
Node* insertHelper(Node* node, int value)
{
   if(node == nullptr)
   {
      return new Node(value);
   }
   if(value < node -> data)
   {
      node -> left = insertHelper(node -> left, value);
   }
   else
   {
      node -> right = insertHelper(node -> right, value);
   }
   return node;
}
// Find the number of nodes in the longest path from root
int longestPath()
{
   return longestPathHelper(root);
}
int longestPathHelper(Node* node)
{
      if(node == nullptr)
      {
          return 0;
      }
      int leftDepth = longestPathHelper(node -> left);
      int rightDepth = longestPathHelper(node -> right);

      return max(leftDepth, rightDepth) + 1;
  }
  // Find the minimum value in the BST
  int findMinValue()
  {
      if(root == nullptr)
      {
          cout << "Tree is empty!" << endl;
          return -1;
      }
      return findMinValueHelper(root);
  }
  int findMinValueHelper(Node* node)
  {
      while(node -> left != nullptr)
      {
          node = node -> left;
      }
      return node -> data;
  }
// Swap left and right pointers at every node
void swapChildren()
{
  swapChildrenHelper(root);
}
void swapChildrenHelper(Node* node)
{
  if(node == nullptr)
  {
     return;
  }
  swap(node -> left, node -> right);
  swapChildrenHelper(node -> left);
  swapChildrenHelper(node -> right);
}
// Search for a value in the BST
bool search(int value)
{
  return searchHelper(root, value);
}
bool searchHelper(Node *node, int value)
{
  if(node == nullptr)
  {
     return false;
  }
  if(node -> data == value)
  {
     return true;
  }
  if(value < node -> data)
  {
     return searchHelper(node -> left, value);
```

```
        }
        else
        {
            return searchHelper(node -> right, value);
        }
      }
      // Function to print the tree in-order (for visualization)
      void inorder()
      {
        inorderHelper(root);
        cout << endl;
      }
      void inorderHelper(Node* node)
      {
        if(node != nullptr)
        {
            inorderHelper(node -> left);
            cout << node -> data << " ";
            inorderHelper(node -> right);
        }
      }
};
int main()
{
    BinarySearchTree tree;
    int n, value;
    cout << "Enter number of elements to insert into BST: ";
    cin >> n;

    cout << "Enter " << n << " value to insert into BST: ";
    for(int i = 0; i  <n; ++i)
    {
        cin >> value;
        tree.insert(value);
    }
    cout << "In-order traversal of the tree: ";
    tree.inorder();

    // i. Insert a new node
    cout << "Enter a value to insert into the tree:";
    cin >> value;
    tree.insert(value);
    cout << "In-order traversal afetrinserting new node :";
    tree.inorder();

    // ii. Find the number of nodes in the longest path from root
    cout << "Number of nodes in the longest path from root: " <<
tree.longestPath() << endl;

    // iii. Minimum data value found in the tree
    cout << "Minimum value in the tree: " << tree.findMinValue() << endl;

    // iv. Change the tree so that the roles of the left and right pointers are
swapped at every node
    tree.swapChildren();
    cout << "In-ordered traversal after swapping left and right pointers: ";
    tree.inorder();

    // v. Search for a specific value
    cout << "Enter a value to search in the tree: ";
    cin >> value;
    if(tree.search(value))
    {
        cout << "Value " << value << " not found in the tree." << endl;
    }
    else
    {
        cout << "Value " << value << " found in the tree." << endl;
    }
    return 0;
}
```

// OUTPUT



```
cc@CC01:~/Documents$ g++ nmiet.cpp
cc@CC01:~/Documents$ ./a.out
Enter number of elements to insert into BST: 5
Enter 5 value to insert into BST: 1
2
3
4
5
In-order traversal of the tree: 1 2 3 4 5
Enter a value to insert into the tree:100
In-order traversal afetrinserting new node :1 2 3 4 5 100
Number of nodes in the longest path from root: 6
Minimum value in the tree: 1
In-ordered traversal after swapping left and right pointers: 100 5 4 3 2 1
Enter a value to search in the tree: 2
Value 2 found in the tree.
cc@CC01:~/Documents$ 
```