This program illustrates how to find the inorder successor and predecessor of a given node in a Binary Search Tree.

#include<stdio.h>

#include<stdlib.h>

struct BSTNode

{

/\*

\* this is the basic structure representing a node of the Tree

\*/

**int** key; // key stores the data part of the node.

struct BSTNode \*left,\*right,\*parent;

/\*

\* the left pointer points to the left child

\* right pointer points to the right child

\* parent points to the parent of this node.

\*/

};

struct BST

{

/\*

\* Any binary search tree can be identified alone by its root.

\*/

struct BSTNode \*root;

};

struct BSTNode\*makeNode(**int** key)

{

struct BSTNode\*newNode;

newNode=(struct BSTNode\*)malloc(sizeof(struct BSTNode));

newNode->key=key;

newNode->left=newNode->right=newNode->parent=NULL;

**return** newNode;

}

**void** inorderTraversal(struct BSTNode\*root)

{

**if**(root==NULL)

**return**;

inorderTraversal(root->left);

printf("%d ",root->key);

inorderTraversal(root->right);

}

**void** BSTInsert(struct BST\*T,struct BSTNode\*newNode)

{

**int** direction;

struct BSTNode\*currentNode,\*previousNode;

**if**(T->root==NULL)

T->root=newNode;

**else**

{

currentNode=T->root;

**while**(currentNode!=NULL)

{

previousNode=currentNode;

**if**(currentNode->key > newNode->key)

currentNode=currentNode->left;

**else**

currentNode=currentNode->right;

}

**if**(newNode->key < previousNode->key)

previousNode->left=newNode;

**else**

previousNode->right=newNode;

newNode->parent=previousNode;

}

}

struct BSTNode\*treeMinimum(struct BSTNode\*node)

{

**while**(node->left!=NULL)

node=node->left;

**return** node;

}

struct BSTNode\*inorderSuccessor(struct BSTNode\*x)

{

struct BSTNode\*y;

**if**(x->right!=NULL)

**return** treeMinimum(x->right);

y=x->parent;

**while**(y!=NULL && x==y->right)

{

x=y;

y=x->parent;

}

**return** y;

}

struct BSTNode\*inorderPredecessor(struct BSTNode\*x)

{

struct BSTNode\*y;

**if**(x->left!=NULL)

**return** treeMinimum(x->left);

y=x->parent;

**while**(y!=NULL && x==y->left)

{

x=y;

y=x->parent;

}

**return** y;

}

**int** main()

{

struct BSTNode\*x;

struct BST\*T;

T=(struct BST\*)malloc(sizeof(struct BST\*));

T->root=NULL;

struct BSTNode \*\*nodeArray;

nodeArray=(struct BSTNode\*\*)malloc(sizeof(struct BstNode\*)\*10);

nodeArray[0]=makeNode(500);

nodeArray[1]=makeNode(200);

nodeArray[2]=makeNode(700);

nodeArray[3]=makeNode(100);

nodeArray[4]=makeNode(300);

nodeArray[5]=makeNode(400);

nodeArray[6]=makeNode(600);

nodeArray[7]=makeNode(0);

nodeArray[8]=makeNode(900);

nodeArray[9]=makeNode(800);

BSTInsert(T,nodeArray[0]);

BSTInsert(T,nodeArray[1]);

BSTInsert(T,nodeArray[2]);

BSTInsert(T,nodeArray[3]);

BSTInsert(T,nodeArray[4]);

BSTInsert(T,nodeArray[5]);

BSTInsert(T,nodeArray[6]);

BSTInsert(T,nodeArray[7]);

BSTInsert(T,nodeArray[8]);

BSTInsert(T,nodeArray[9]);

x=inorderPredecessor(nodeArray[9]);

**if**(x==NULL)

printf("the inorder predecessor of the given node does not exist");

**else**

printf("%d\n",x->key);

x=inorderSuccessor(nodeArray[4]);

**if**(x==NULL)

printf("the inorder successor of the given node does not exist");

**else**

printf("%d\n",x->key);

**return** 0;

}