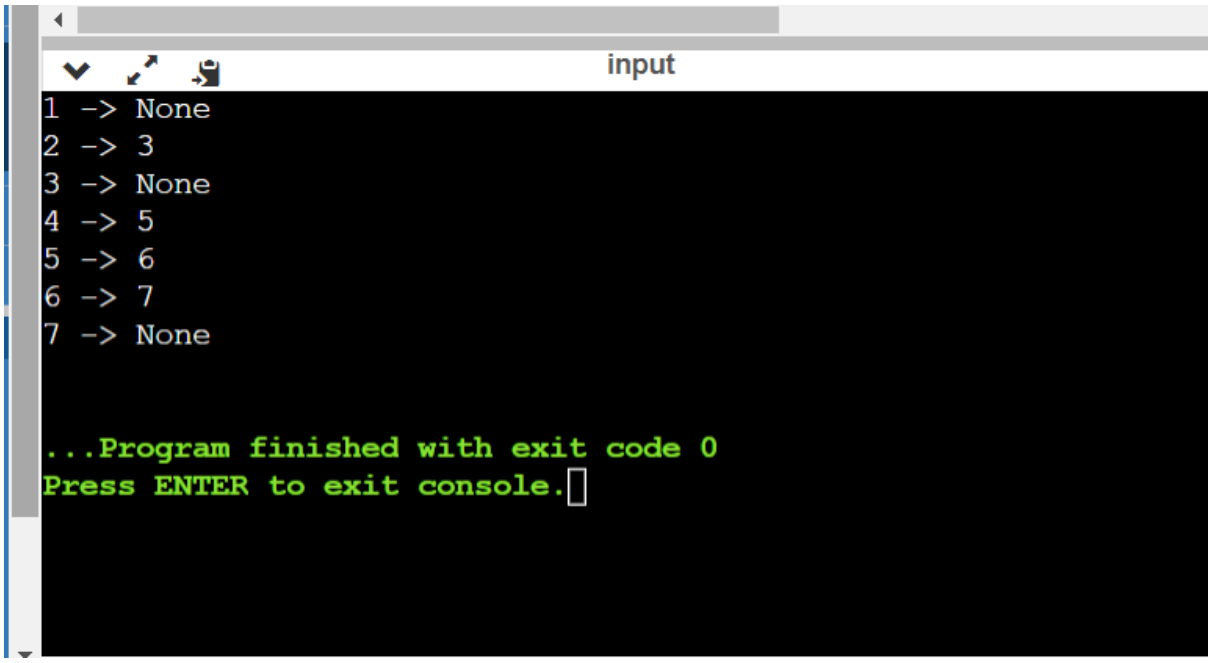
Problem 1: Populate Next Right pointers of Tree class TreeNode:

```
    def __init__(self, val=0, left=None, right=None, next=None):
        self.val = val
        self.left = left
        self.right = right
        self.next = next



def connect(root):
    if not root:
        return None

    level_start = root

    while level_start:
        current = level_start
        while current:
            if current.left:
                current.left.next = current.right
            if current.right and current.next:
                current.right.next = current.next.left
            current = current.next
        level_start = level_start.left

    return root

root = TreeNode(1)
root.left = TreeNode(2)
root.right = TreeNode(3)
root.left.left = TreeNode(4)
root.left.right = TreeNode(5)
```

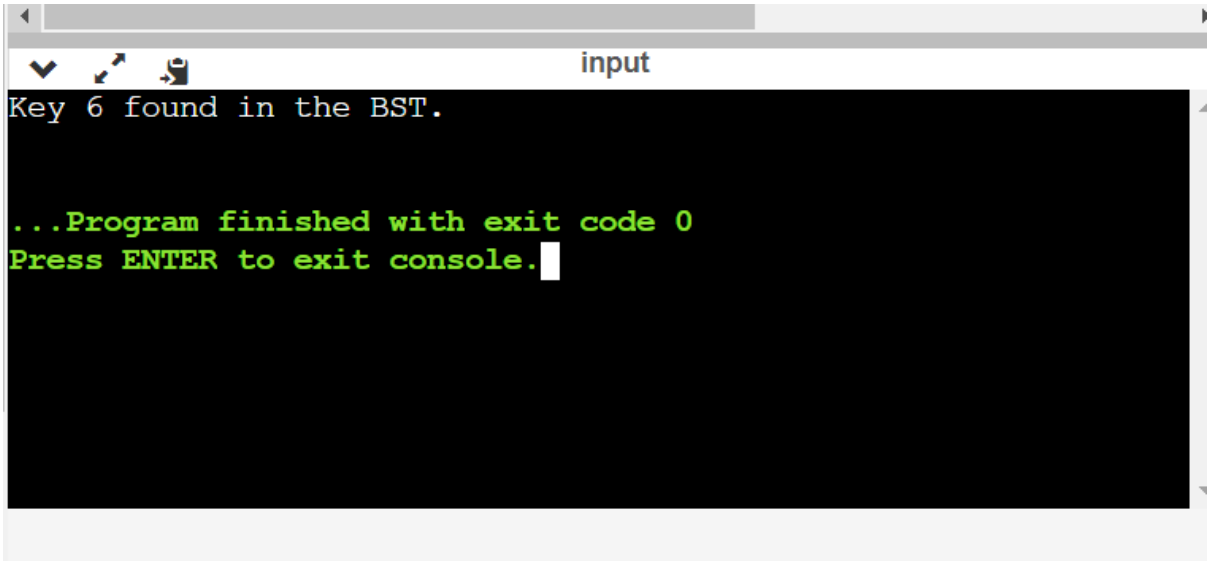
```
root.right.left = TreeNode(6)
root.right.right = TreeNode(7)

connect(root)

print(root.val, "->", root.next)
print(root.left.val, "->", root.left.next.val)
print(root.right.val, "->", root.right.next)
print(root.left.left.val, "->", root.left.left.next.val)
print(root.left.right.val, "->", root.left.right.next.val)
print(root.right.left.val, "->", root.right.left.next.val)
print(root.right.right.val, "->", root.right.right.next)
```



Problem 2: Search given Key in BST

```
class Node:
    def __init__(self, key):
        self.key = key
        self.left = None
        self.right = None

class BST:
    def __init__(self):
        self.root = None

    def insert(self, key):
        self.root = self._insert_recursive(self.root, key)

    def _insert_recursive(self, root, key):
        if root is None:
            return Node(key)
        if key < root.key:
            root.left = self._insert_recursive(root.left, key)
        elif key > root.key:
            root.right = self._insert_recursive(root.right, key)
        return root

    def search(self, key):
        return self._search_recursive(self.root, key)

    def _search_recursive(self, root, key):
        if root is None or root.key == key:
            return root
        if key < root.key:
            return self._search_recursive(root.left, key)
```

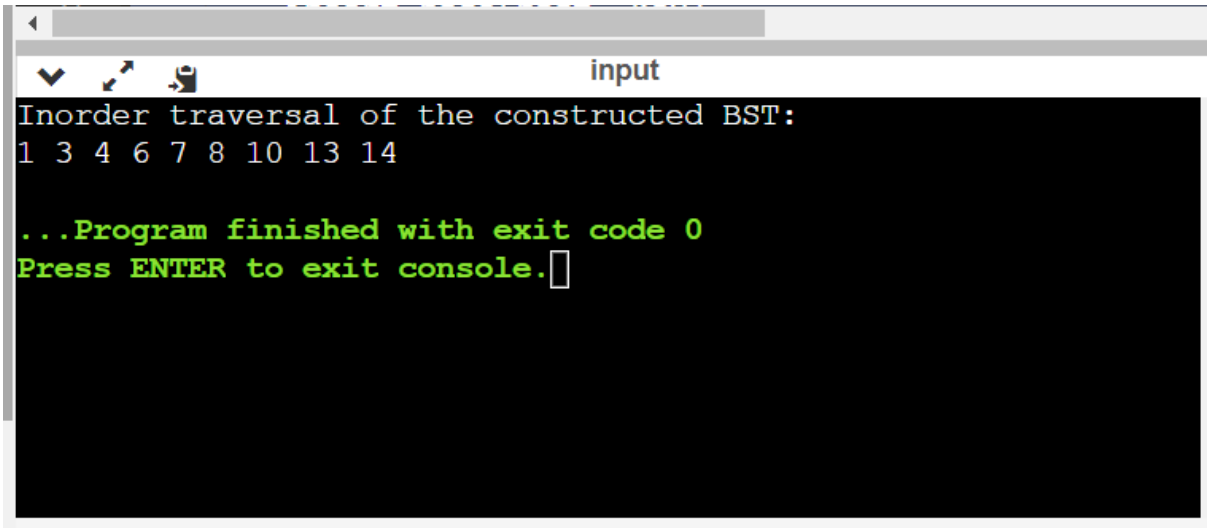
```
        return self._search_recursive(root.right, key)


bst = BST()
bst.insert(8)
bst.insert(3)
bst.insert(10)
bst.insert(1)
bst.insert(6)
bst.insert(14)
bst.insert(4)
bst.insert(7)
bst.insert(13)


key_to_search = 6
result = bst.search(key_to_search)


if result:
    print(f"Key {key_to_search} found in the BST.")
else:
    print(f"Key {key_to_search} not found in the BST.")
```



Problem 3: Construct BST from given keys

```
class Node:
    def __init__(self, key):
        self.key = key
        self.left = None
        self.right = None



def construct_bst(keys):
    if not keys:
        return None

    root = Node(keys[0])

    for key in keys[1:]:
        insert_node(root, key)

    return root



def insert_node(root, key):
    if key < root.key:
        if root.left:
            insert_node(root.left, key)
        else:
            root.left = Node(key)
    else:
        if root.right:
            insert_node(root.right, key)
        else:
            root.right = Node(key)
```

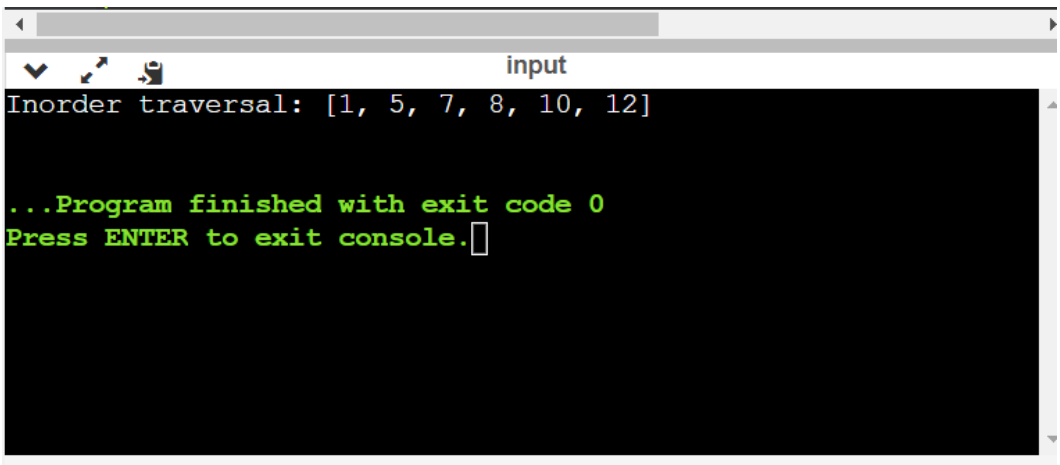
```
def inorder_traversal(node):
    if node:
        inorder_traversal(node.left)
        print(node.key, end=" ")
        inorder_traversal(node.right)

keys = [8, 3, 10, 1, 6, 14, 4, 7, 13]
bst_root = construct_bst(keys)

print("Inorder traversal of the constructed BST:")
inorder_traversal(bst_root)
```



Problem 4: Construct a BST from a preorder traversal

```
class TreeNode:
    def __init__(self, value):
        self.val = value
        self.left = None
        self.right = None



def construct_bst(preorder):
    if not preorder:
        return None

    root = TreeNode(preorder[0])
    stack = [root]

    for value in preorder[1:]:
        node = TreeNode(value)

        if value < stack[-1].val:
            stack[-1].left = node
        else:
            while stack and value > stack[-1].val:
                last = stack.pop()

            last.right = node

        stack.append(node)

    return root
```

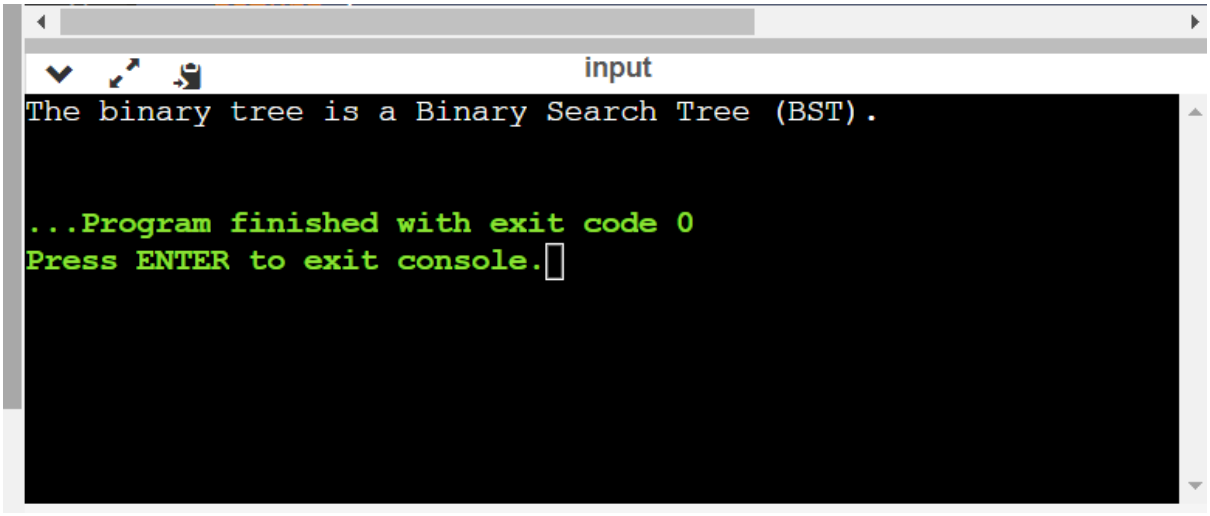
```
def inorder_traversal(root):
    if root is None:
        return []

    result = []
    stack = []

    while stack or root:
        if root:
            stack.append(root)
            root = root.left
        else:
            node = stack.pop()
            result.append(node.val)
            root = node.right

    return result

preorder = [8, 5, 1, 7, 10, 12]
bst = construct_bst(preorder)

inorder = inorder_traversal(bst)
print("Inorder traversal:", inorder)
```



Problem 5: Check is a BT is BST or not

```
class Node:
    def __init__(self, value):
        self.value = value
        self.left = None
        self.right = None



def is_bst(node, min_value=float('-inf'), max_value=float('inf')):
    if node is None:
        return True

    if node.value <= min_value or node.value >= max_value:
        return False

    return (
        is_bst(node.left, min_value, node.value) and
        is_bst(node.right, node.value, max_value)
    )

root = Node(4)
root.left = Node(2)
root.right = Node(6)
root.left.left = Node(1)
root.left.right = Node(3)
root.right.left = Node(5)
root.right.right = Node(7)

if is_bst(root):
    print("The binary tree is a Binary Search Tree (BST).")
else:
```

print("The binary tree is not a Binary Search Tree (BST).")



Problem 6: Find LCA of two nodes in BST

```
class TreeNode:
    def __init__(self, val):
        self.val = val
        self.left = None
        self.right = None

def insert(root, val):
    if root is None:
        return TreeNode(val)
    if val < root.val:
        root.left = insert(root.left, val)
    else:
        root.right = insert(root.right, val)
    return root



def find_lca(root, p, q):
    if root is None:
        return None

    if p.val < root.val and q.val < root.val:
        return find_lca(root.left, p, q)
```

```
    if p.val > root.val and q.val > root.val:
        return find_lca(root.right, p, q)

    return root

root = None
root = insert(root, 6)
root = insert(root, 2)
root = insert(root, 8)
root = insert(root, 0)
root = insert(root, 4)
root = insert(root, 7)
root = insert(root, 9)
root = insert(root, 3)
root = insert(root, 5)

node_p = TreeNode(2)
node_q = TreeNode(8)
lca = find_lca(root, node_p, node_q)
if lca:
    print("LCA:", lca.val)
else:
```

```
print("LCA not found.")
```