INSTITUTE OF INFORMATION TECHNOLOGY

JAHANGIRNAGAR UNIVERSITY

Lab Exam : 02

Submission Date : 17/02/2021

Course Tittle : Data Structure Lab

Course Code : ICT - 2102

Submitted To

Dr. M. Abu Yousuf

Professor

IIT – JU

Submitted By

MD. Shakil Hossain

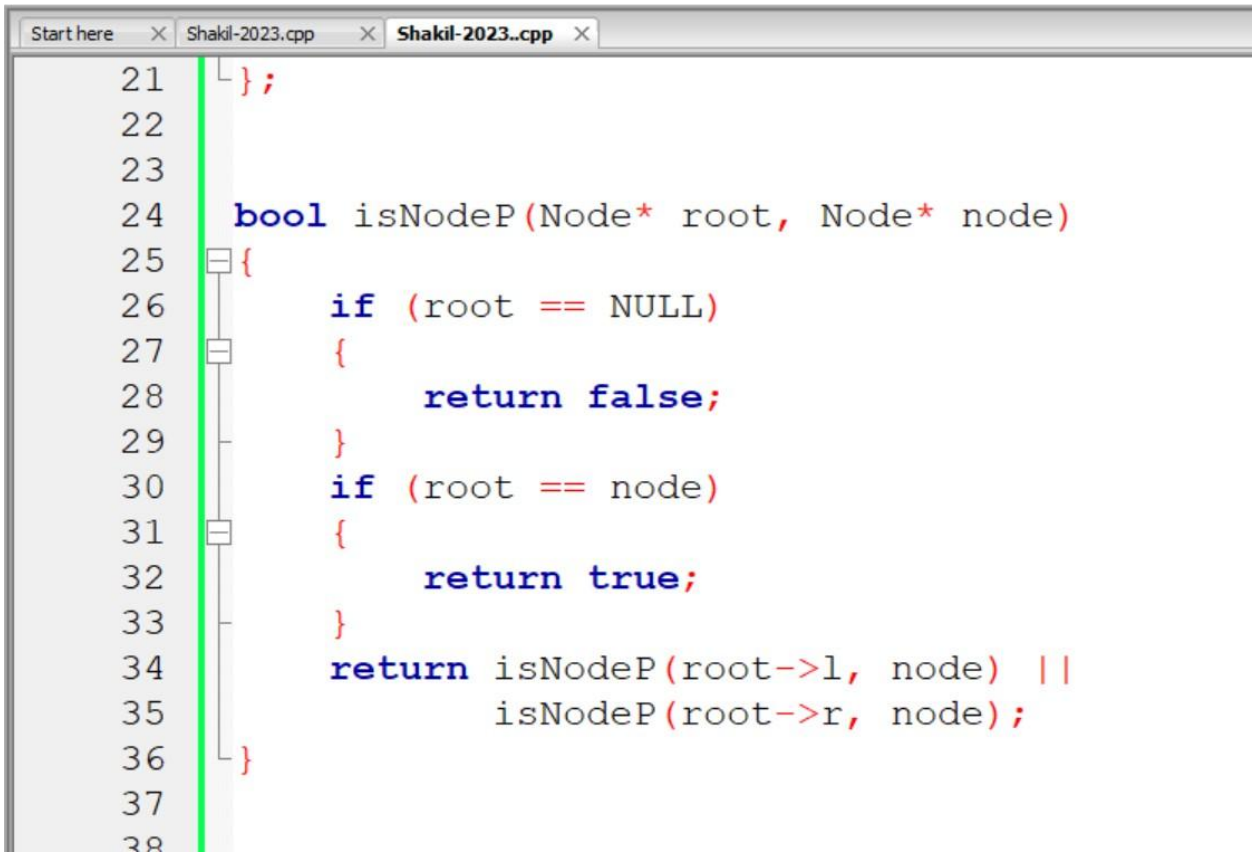
Roll – 2023

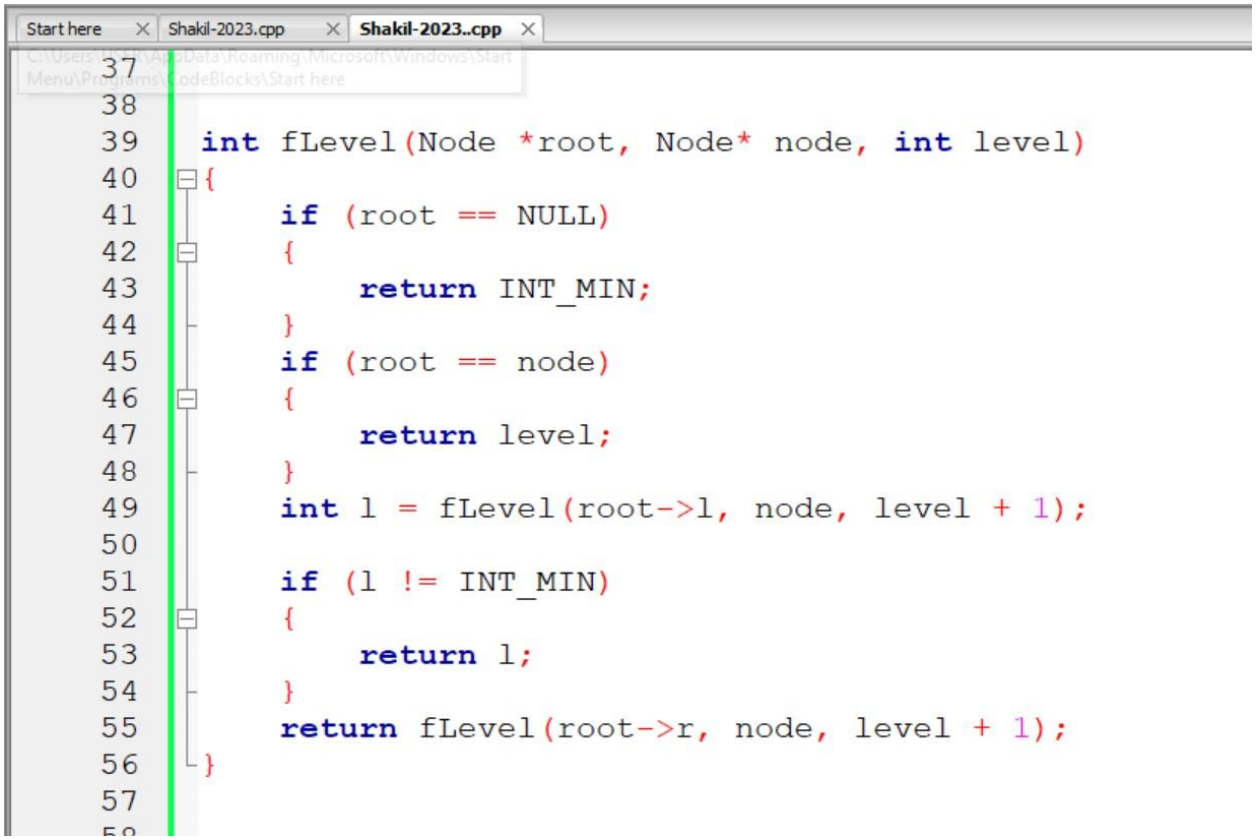
2nd year 1st Semester

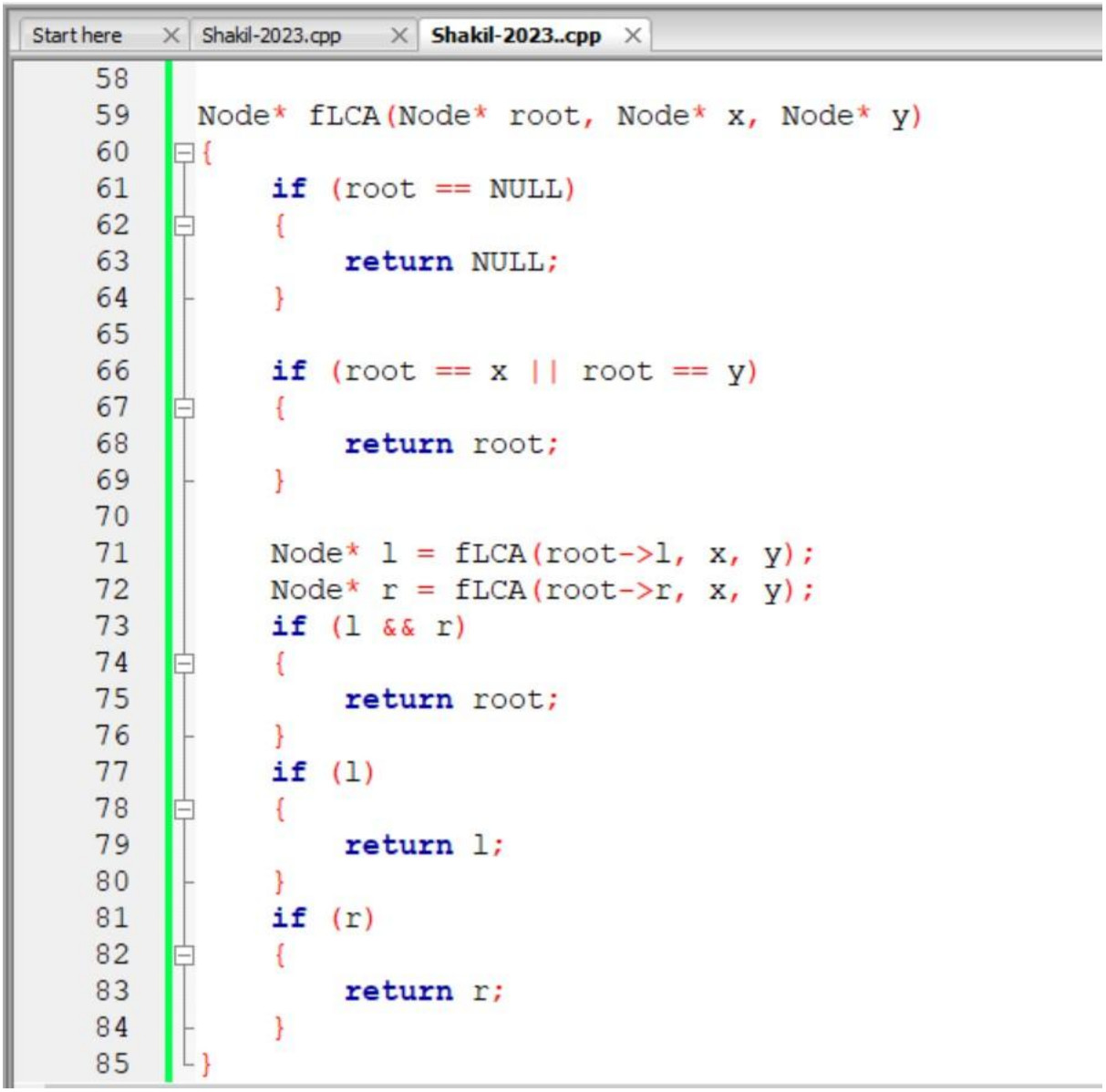
IIT – JU

Start here | Shakil-2023.cpp | Shakil-2023..cpp

```cpp
/// Md. Shakil Hossain
/// Roll - 2023
/// Lab Test 2
/// Question 1


#include<bits/stdc++.h>
using namespace std;

struct Node
{
    int data;
    Node *l, *r;

    Node(int data)
    {
        this->data = data;
        this->l = this->r = NULL;
    }
};

```


Start here
Shakil-2023.cpp
Shakil-2023..cpp
21 };
22
23
24 bool isNodeP(Node* root, Node* node)
25 {
26 if (root == NULL)
27 {
28 return false;
29 }
30 if (root == node)
31 {
32 return true;
33 }
34 return isNodeP(root->l, node) ||
35 isNodeP(root->r, node);
36 }
37
38

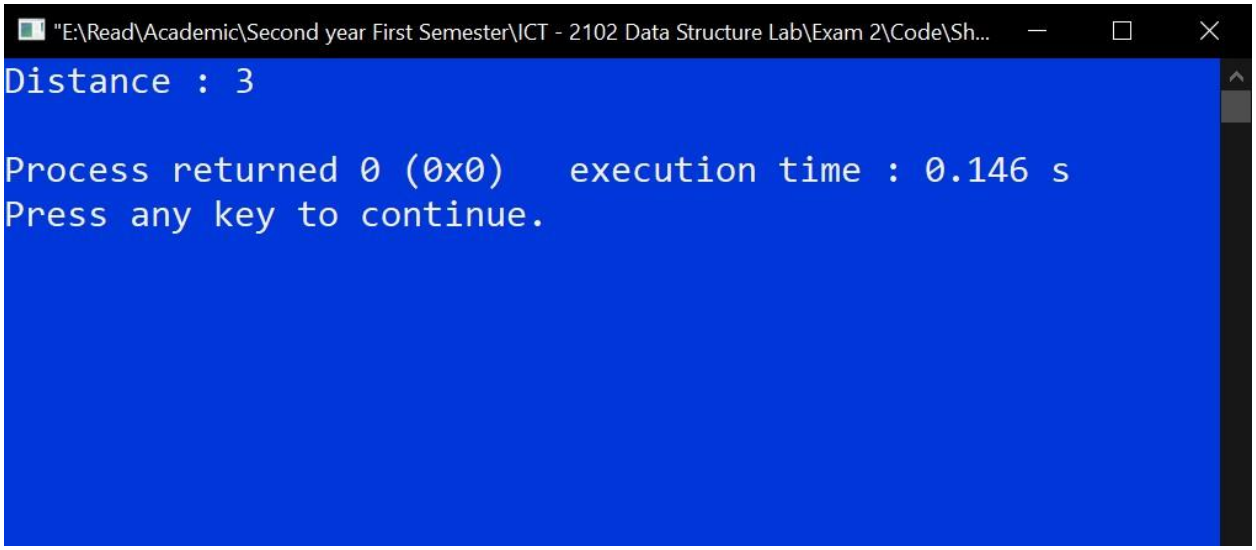

Start here
Shakil-2023.cpp
Shakil-2023..cpp
37
38
39 int fLevel(Node *root, Node* node, int level)
40 {
41 if (root == NULL)
42 {
43 return INT_MIN;
44 }
45 if (root == node)
46 {
47 return level;
48 }
49 int l = fLevel(root->l, node, level + 1);
50
51 if (l != INT_MIN)
52 {
53 return l;
54 }
55 return fLevel(root->r, node, level + 1);
56 }
57


Start here
Shakil-2023.cpp
Shakil-2023..cpp
58
59 Node* fLCA(Node* root, Node* x, Node* y)
60 {
61 if (root == NULL)
62 {
63 return NULL;
64 }
65
66 if (root == x || root == y)
67 {
68 return root;
69 }
70
71 Node* l = fLCA(root->l, x, y);
72 Node* r = fLCA(root->r, x, y);
73 if (l && r)
74 {
75 return root;
76 }
77 if (l)
78 {
79 return l;
80 }
81 if (r)
82 {
83 return r;
84 }
85 }

Start here | Shakil-2023.cpp | Shakil-2023..cpp

```cpp

int fDis(Node *root, Node* x, Node* y)
{
    Node *lca = NULL;
    if (isNodeP(root, y) && isNodeP(root, x))
    {
        lca = fLCA(root, x, y);
    }
    else
    {
        return INT_MIN;
    }
    return fLevel(lca, x, 0) + fLevel(lca, y, 0);

}

```

```cpp

int main()
{
    Node* root = NULL;

    root = new Node(1);
    root->l = new Node(2);
    root->r = new Node(3);
    root->l->r = new Node(4);
    root->r->l = new Node(5);
    root->r->r = new Node(6);
    root->r->l->l = new Node(7);
    root->r->r->r = new Node(8);

    cout << "Distance : " << fDis(root, root->r->l->l, root->r->r)<<endl;

    return 0;
}

```


"E:\Read\Academic\Second year First Semester\ICT - 2102 Data Structure Lab\Exam 2\Code\Sh...
Distance : 3
Process returned 0 (0x0)   execution time : 0.146 s
Press any key to continue.

Start here | Shakil-2023.cpp | Shakil-2023..cpp

```cpp

/// Md. Shakil Hossain
/// Roll - 2023
/// Lab Test 2
/// Question 2

#include<bits/stdc++.h>
using namespace std;

struct Node
{
    int data;
    Node *left, *right;
};


Node* newNode(int V)
{
    Node* node = new Node;
    node->data = V;
    node->left = node->right = NULL;

    return node;
}
```

Start here | Shakil-2023.cpp | Shakil-2023..cpp

```
26
27  Node* insert(Node* root, int V)
28  {
29
30      if (root == NULL)
31      {
32          return newNode(V);
33      }
34      if (V < root->data)
35      {
36          root->left = insert(root->left, V);
37      }
38      else
39      {
40          root->right = insert(root->right, V);
41      }
42
43      return root;
44  }
45
```

Start here | Shakil-2023.cpp | Shakil-2023..cpp

```
46
47  Node* fMin(Node* root)
48  {
49      while (root->left)
50      {
51          root = root->left;
52      }
53
54      return root;
55  }
56
```

Start here | Shakil-2023.cpp | Shakil-2023..cpp

```
56
57
58  void fSuccessor(Node* root, Node*& succ, int V)
59  {
60      if (root == NULL)
61      {
62          succ = NULL;
63          return;
64      }
65      if (root->data == V)
66      {
67          if (root->right)
68          {
69              succ = fMin(root->right);
70          }
71      }
72      else if (V < root->data)
73      {
74          succ = root;
75          fSuccessor(root->left, succ, V);
76      }
77      else
78      {
79          fSuccessor(root->right, succ, V);
80      }
81  }
82
```

Start here | Shakil-2023.cpp | Shakil-2023..cpp

```cpp
int main()
{
    int Vs[] = {15,10,20,8,12,16,25};

    Node* root = NULL;
    for (int V: Vs)
    {
        root = insert(root, V);
    }
    for (int V: Vs)
    {
        Node* prec = NULL;
        fSuccessor(root, prec, V);

        if (prec != NULL)
        {
            cout << "The successor of node " << V << " is " << prec->data;
        }
        else
        {
            cout << "The successor doesn't exist for " << V;
        }

        cout << '\n';
    }

    return 0;
}
```

"E:\Read\Academic\Second year First Semester\ICT - 2102 Data Structure Lab\Exam 2\Co...

```
The successor of node 15 is 16
The successor of node 10 is 12
The successor of node 20 is 25
The successor of node 8 is 10
The successor of node 12 is 15
The successor of node 16 is 20
The successor doesn't exist for 25

Process returned 0 (0x0)   execution time : 0.150 s
Press any key to continue.
```

THE END