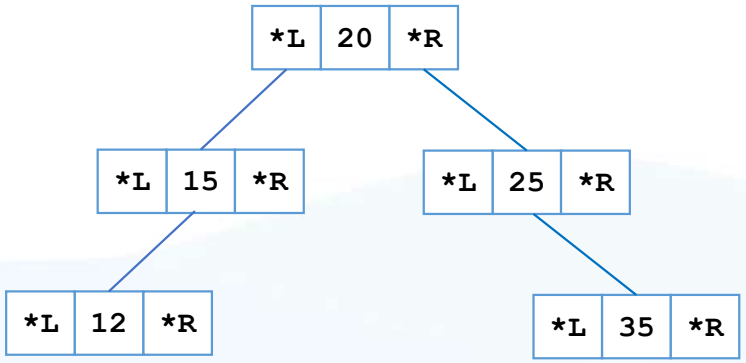
PROGRAM STUDI
TEKNIK INFORMATIKA
FAKULTAS ILMU KOMPUTER
UNIVERSITAS DIAN NUSWANTORO

Mata Kuliah
Algoritma dan
Struktur Data

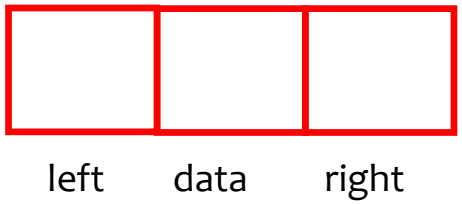


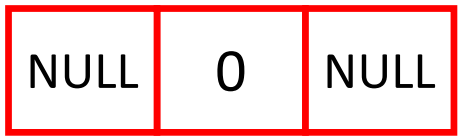
Tree

Tim Pengampu Mata Kuliah Algoritma dan Struktur Data

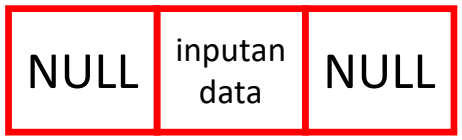
Class Node

```
class Node{
    public:
    int data;
    Node *left;
    Node *right;

    Node(){
        data = 0;
        left = right = NULL;
    }
    Node(int data){
        this->data = data;
        left = right = NULL;
    }
};
```





Konstruktor default



Konstruktor inputan
Data tergantung inputan

pointer right berisi alamat Node selanjutnya
pointer left berisi alamat Node sebelumnya

Class Tree

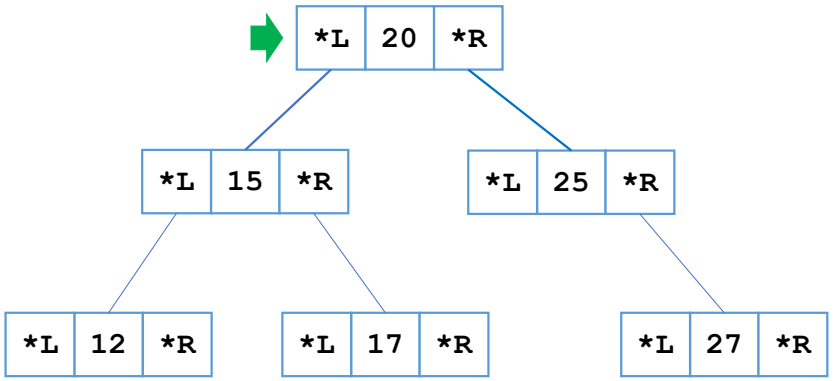
```
class Tree{
    public:
    Node *root;

    Node *insertBinaryRoot(Node *root, int nilai);
    void preOrder(Node *root);
    void inOrder(Node *root);
    void postOrder(Node *root);
    int heightNode(Node *root);
    void printCurrentLevel(Node *root, int level);
    void levelOrder(Node *root);
};
```

main.cpp insert manual

```
int main()
{
    /* representasi tree
         20
        /  \
       15  25
      / \    \
     12 17   27  */
    //insert manual
    Node *root = new Node(20);
    root->left = new Node(15);
    root->left->left = new Node(12);
    root->left->right = new Node(17);
    root->right = new Node(25);
    root->right->left = new Node(27);
    Tree pohon;
    cout << "Pre Order: " << endl;
    pohon.preOrder(root); //20 15 12 17 25 27
    cout << "\nIn Order: " << endl;
    pohon.inOrder(root); //12 15 17 20 25 27
    cout << "\nPost Order: " << endl;
    pohon.postOrder(root); //12 17 15 27 25 20

    return 0;
}
```

preOrder Traversal

```
void Tree::preOrder(Node * root){
    if(root != NULL){
        cout << root->data << " ";
        preOrder(root->left);
        preOrder(root->right);
    }
}
```



Contoh preOrder Traversal sudah ada pada file Pertemuan 14-15 – Tree.pdf
Slide 25-46

inOrder Traversal #1

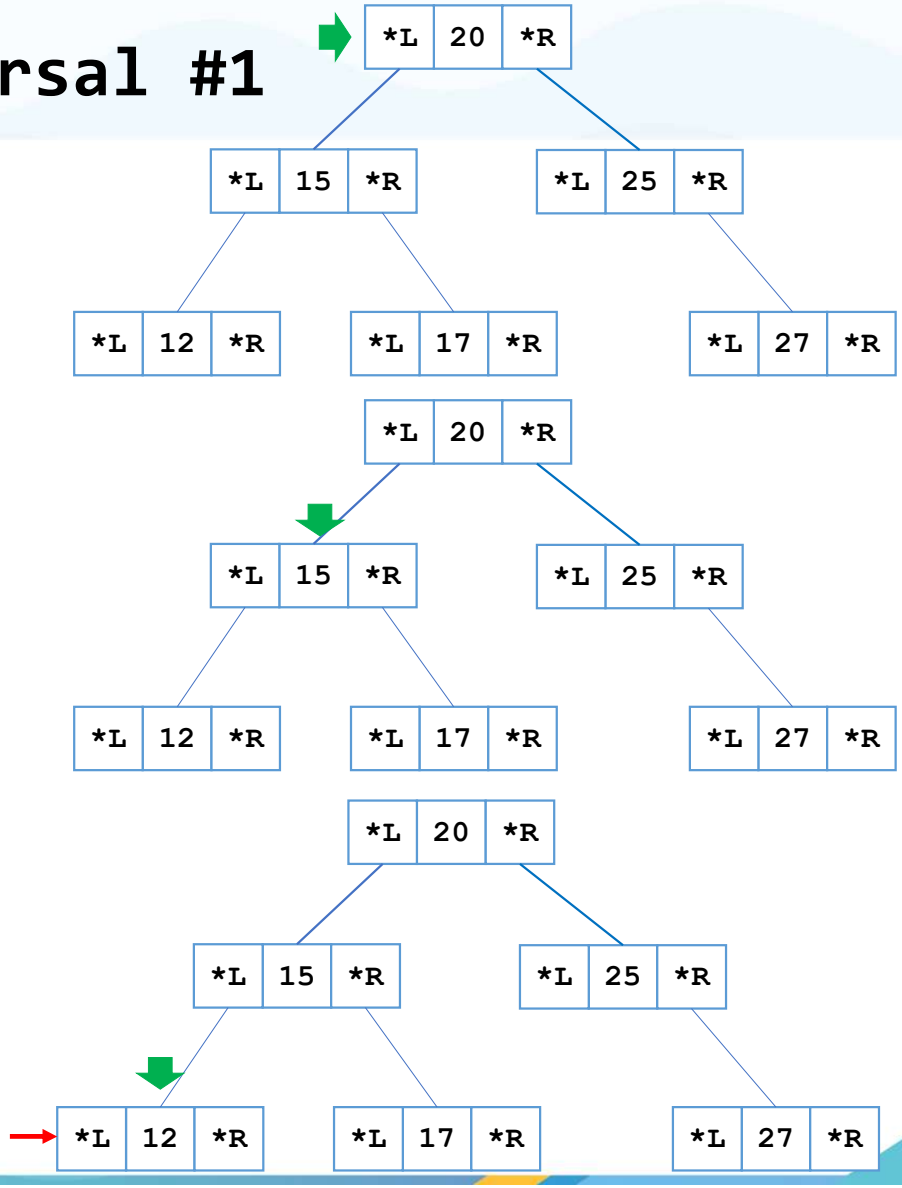
```
void Tree::inOrder(Node * root){
    if(root != NULL){
        inOrder(root->left);
        cout << root->data << " ";
        inOrder(root->right);
    }
}
```

```
void Tree::inOrder(Node * root){
    if(root != NULL){
        inOrder(root->left);
        cout << root->data << " ";
        inOrder(root->right);
    }
}
```

```
void Tree::inOrder(Node * root){
    if(root != NULL){
        inOrder(root->left);
        cout << root->data << " ";
        inOrder(root->right);
    }
}
```

Cetak = 12

```
void Tree::inOrder(Node * root){
    if(root != NULL){
        inOrder(root->left);
        cout << root->data << " ";
```



inOrder Traversal #2

```
void Tree::inOrder(Node * root){
    if(root != NULL){
        inOrder(root->left);
        cout << root->data << " ";
        inOrder(root->right);
    }
}
```

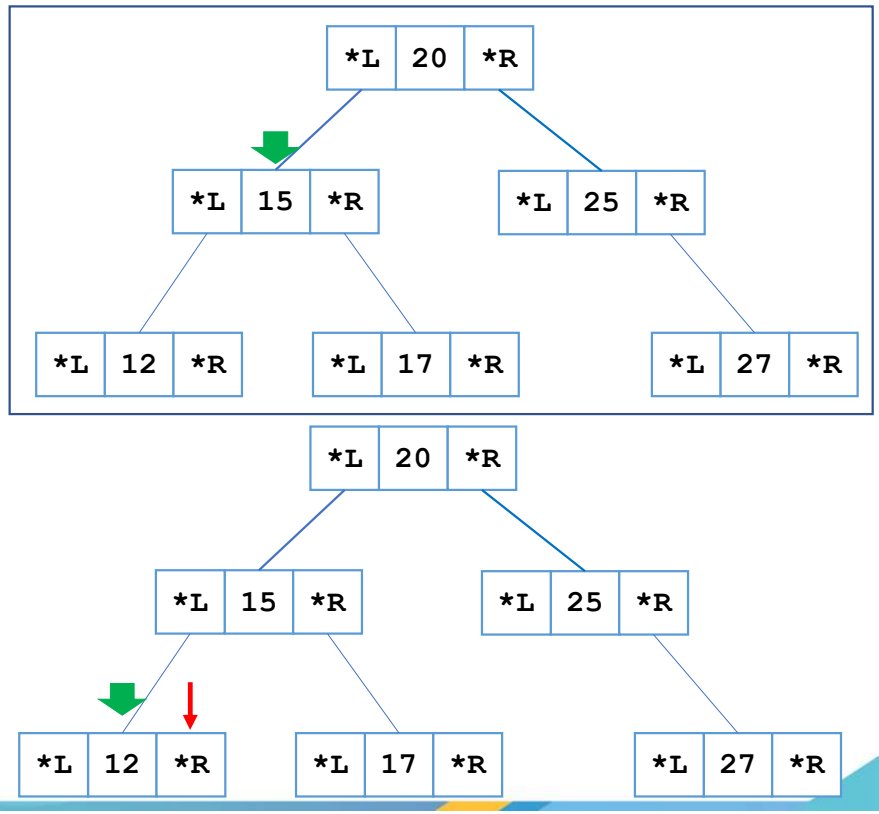
```
void Tree::inOrder(Node * root){
    if(root != NULL){
        inOrder(root->left);
        cout << root->data << " ";
        inOrder(root->right);
    }
}
```

Cetak = 12 15

```
void Tree::inOrder(Node * root){
    if(root != NULL){
        inOrder(root->left);
        cout << root->data << " ";
        inOrder(root->right);
    }
}
```

Cetak = 12

```
void Tree::inOrder(Node * root){
    if(root != NULL){
        inOrder(root->left);
        cout << root->data << " ";
        inOrder(root->right);
```



inOrder Traversal #3

```
void Tree::inOrder(Node * root){
    if(root != NULL){
        inOrder(root->left);
        cout << root->data << " ";
        inOrder(root->right);
    }
}
```

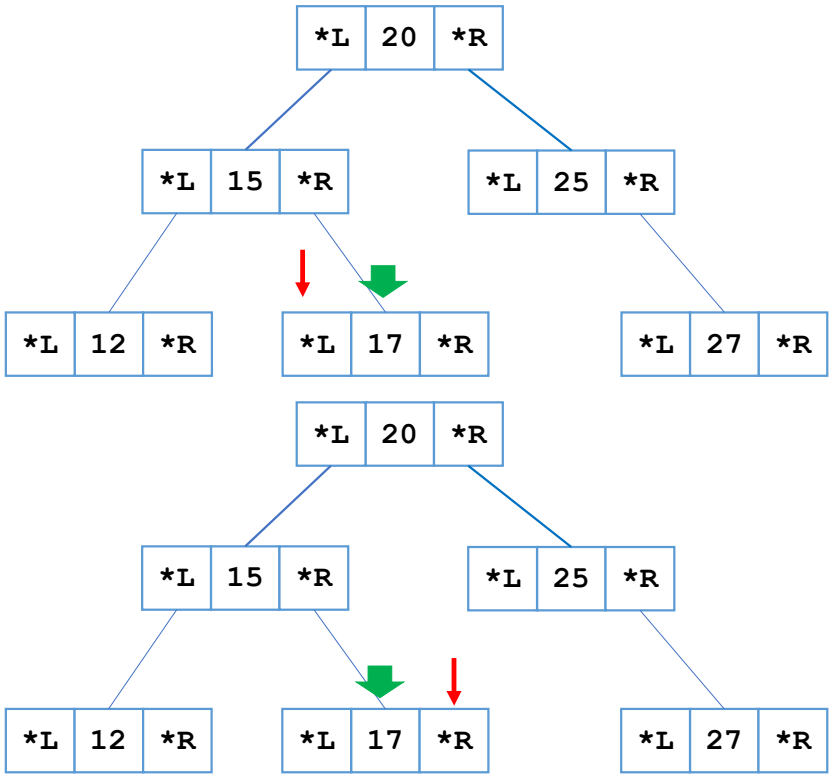
```
void Tree::inOrder(Node * root){
    if(root != NULL){
        inOrder(root->left);
        cout << root->data << " ";
        inOrder(root->right);
    }
}
```

```
void Tree::inOrder(Node * root){
    if(root != NULL){
        inOrder(root->left);
        cout << root->data << " ";
        inOrder(root->right);
    }
}
```

```
void Tree::inOrder(Node * root){
    if(root != NULL){
        inOrder(root->left);
        cout << root->data << " ";
        inOrder(root->right);
```

```
void Tree::inOrder(Node * root){
    if(root != NULL){
        inOrder(root->left);
        cout << root->data << " ";
        inOrder(root->right);
```

Cetak = 12 15 17



inOrder Traversal #4

```
void Tree::inOrder(Node * root){
    if(root != NULL){
        inOrder(root->left);
        cout << root->data << " ";
        inOrder(root->right);
    }
}
```

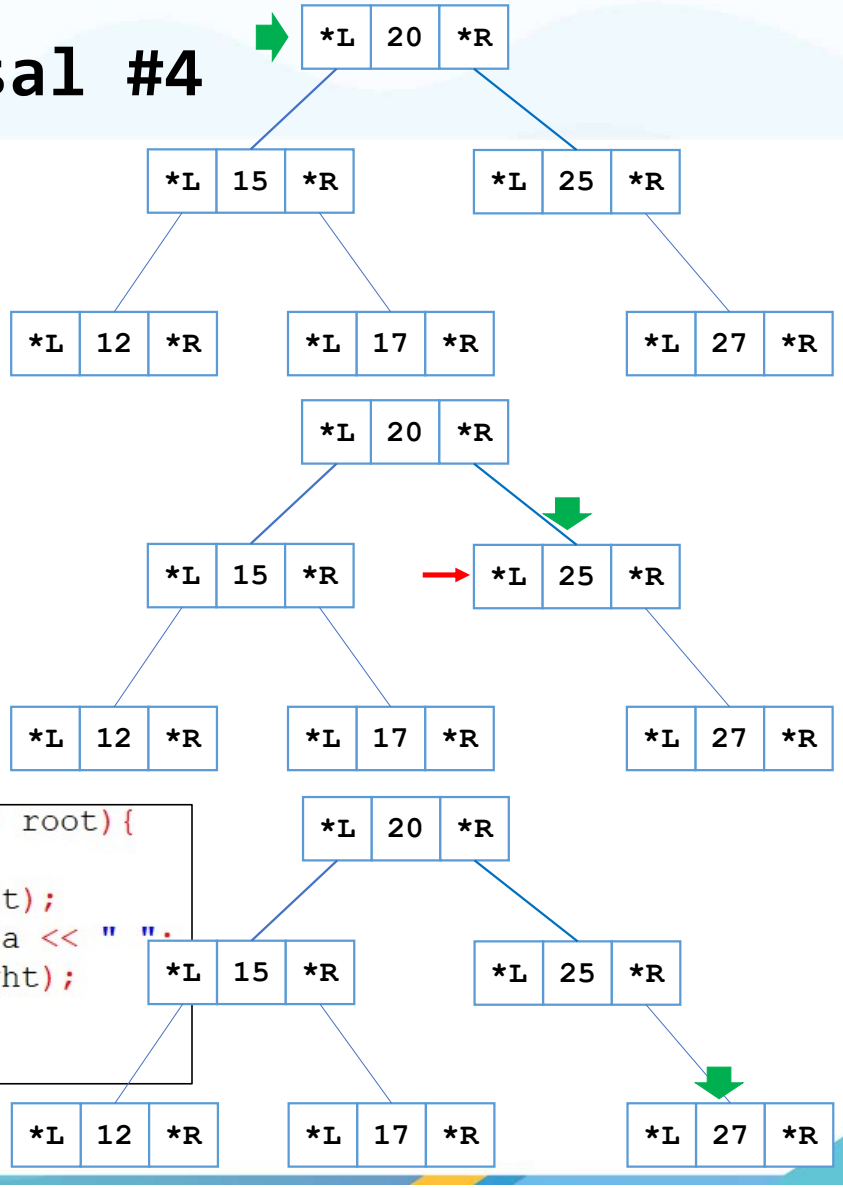
Cetak = 12 15 17 20

```
void Tree::inOrder(Node * root){
    if(root != NULL){
        inOrder(root->left);
        cout << root->data << " ";
        inOrder(root->right);
    }
}
```

Cetak = 12 15 17 20 25

```
void Tree::inOrder(Node * root){
    if(root != NULL){
        inOrder(root->left);
        cout << root->data << " ";
        inOrder(root->right);
    }
}
```

```
void Tree::inOrder(Node * root){
    if(root != NULL){
        inOrder(root->left);
        cout << root->data << " ";
        inOrder(root->right);
    }
}
```



inOrder Traversal #5

```
void Tree::inOrder(Node * root){
    if(root != NULL){
        inOrder(root->left);
        cout << root->data << " ";
        inOrder(root->right);
    }
}
```

Cetak = 12 15 17 20

```
void Tree::inOrder(Node * root){
    if(root != NULL){
        inOrder(root->left);
        cout << root->data << " ";
        inOrder(root->right);
    }
}
```

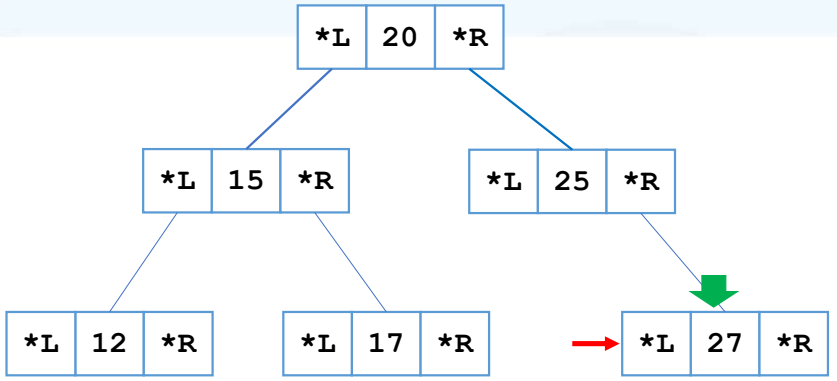
Cetak = 12 15 17 20 25

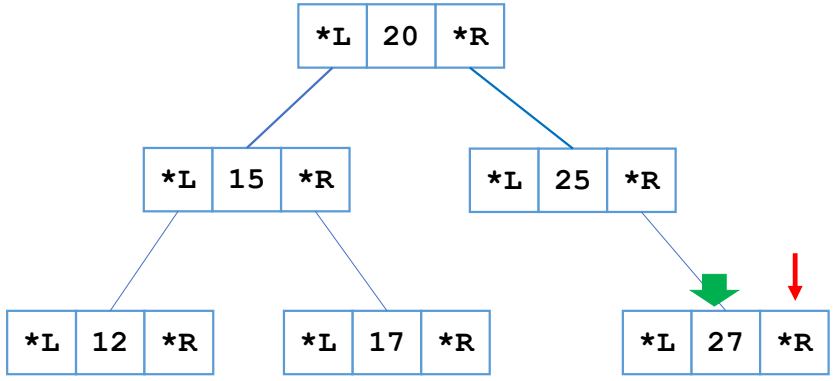
```
void Tree::inOrder(Node * root){
    if(root != NULL){
        inOrder(root->left);
        cout << root->data << " ";
        inOrder(root->right);
    }
}
```

Cetak = 12 15 17 20 25 27

```
void Tree::inOrder(Node * root){
    if(root != NULL){
        inOrder(root->left);
        cout << root->data << " ";
        inOrder(root->right);
    }
}
```

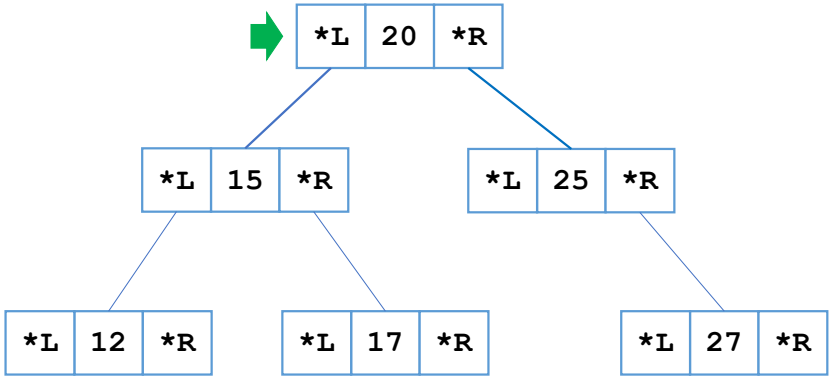
```
void Tree::inOrder(Node * root){
    if(root != NULL){
        inOrder(root->left);
        cout << root->data << " ";
        inOrder(root->right);
    }
}
```





postOrder Traversal

```
void Tree::postOrder(Node * root){
    if(root != NULL){
        postOrder(root->left);
        postOrder(root->right);
        cout << root->data << " ";
    }
}
```



postOrder Traversal #1

```
void Tree::postOrder(Node * root){
    if(root != NULL){
        postOrder(root->left);
        postOrder(root->right);
        cout << root->data << " ";
    }
}
```

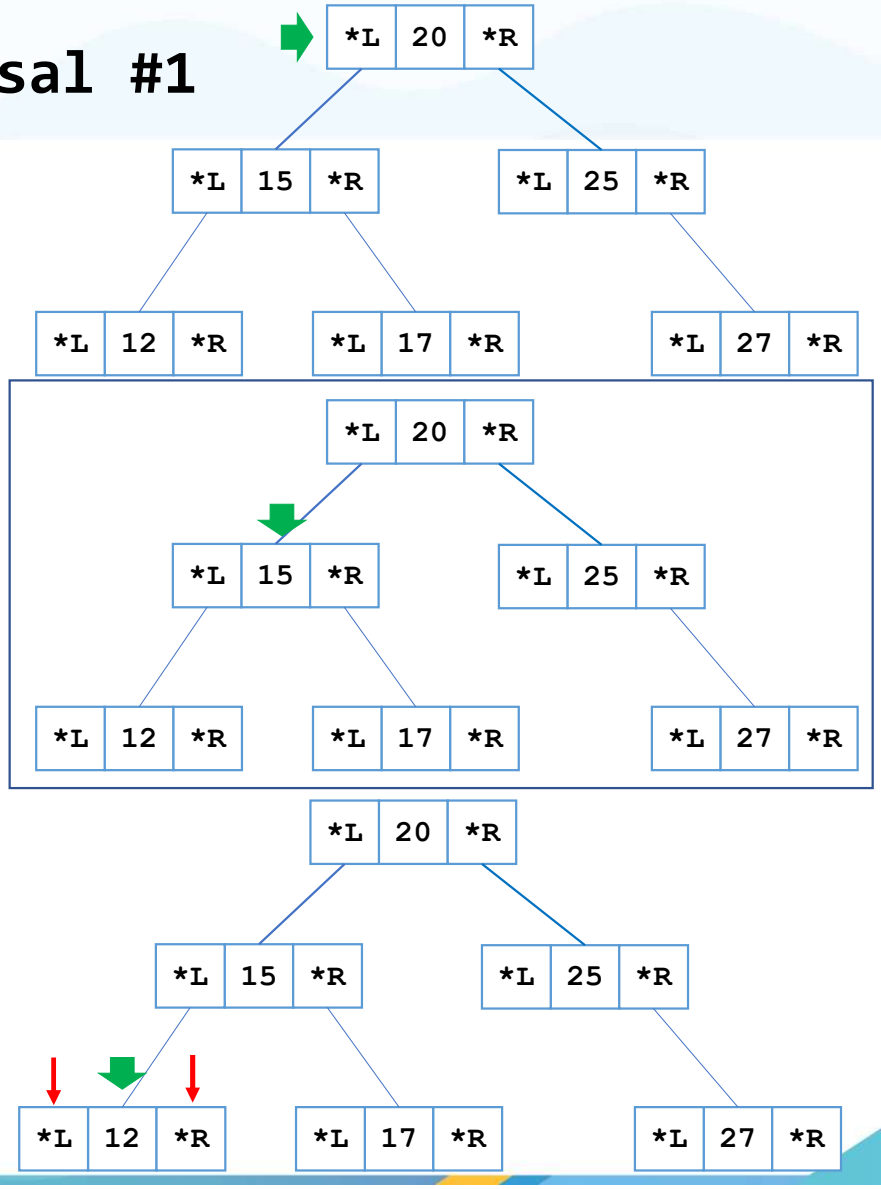
```
void Tree::postOrder(Node * root){
    if(root != NULL){
        postOrder(root->left);
        postOrder(root->right);
        cout << root->data << " ";
    }
}
```

```
void Tree::postOrder(Node * root){
    if(root != NULL){
        postOrder(root->left);
        postOrder(root->right);
        cout << root->data << " ";
    }
}
```

Cetak = 12

```
void Tree::postOrder(Node * root){
    if(root != NULL){
        postOrder(root->left);
        postOrder(root->right);
        cout << root->data << " ";
```

```
void Tree::postOrder(Node * root){
    if(root != NULL){
        postOrder(root->left);
        postOrder(root->right);
```



postOrder Traversal #2

```
void Tree::postOrder(Node * root){
    if(root != NULL){
        postOrder(root->left);
        postOrder(root->right);
        cout << root->data << " ";
    }
}
```

```
void Tree::postOrder(Node * root){
    if(root != NULL){
        postOrder(root->left);
        postOrder(root->right);
        cout << root->data << " ";
    }
}
```

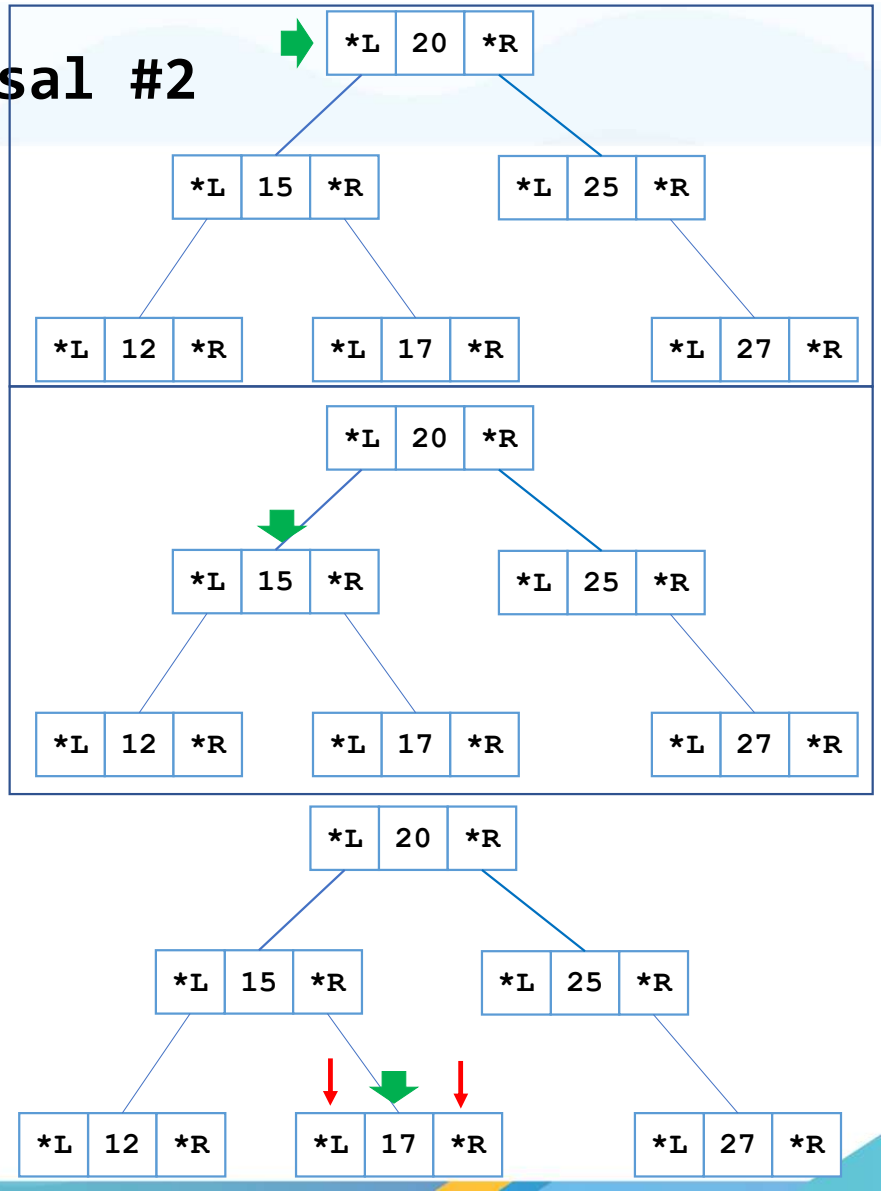
Cetak = 12 17 15

```
void Tree::postOrder(Node * root){
    if(root != NULL){
        postOrder(root->left);
        postOrder(root->right);
        cout << root->data << " ";
    }
}
```

Cetak = 12 17

```
void Tree::postOrder(Node * root){
    if(root != NULL){
        postOrder(root->left);
        postOrder(root->right);
        cout << root->data << " ";
```

```
void Tree::postOrder(Node * root){
    if(root != NULL){
        postOrder(root->left);
        postOrder(root->right);
```

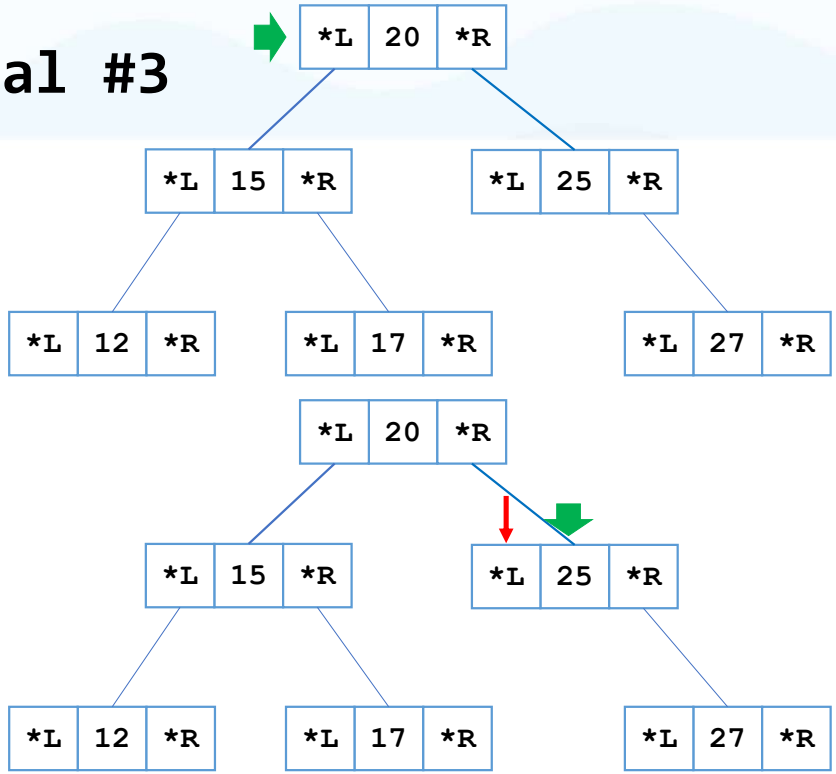


postOrder Traversal #3

```
void Tree::postOrder(Node * root){
    if(root != NULL){
        postOrder(root->left);
        postOrder(root->right);
        cout << root->data << " ";
    }
}
```

```
void Tree::postOrder(Node * root){
    if(root != NULL){
        postOrder(root->left);
        postOrder(root->right);
        cout << root->data << " ";
    }
}
```

```
void Tree::postOrder(Node * root){
    if(root != NULL){
        postOrder(root->left);
        postOrder(root->right);
        cout << root->data << " ";
    }
}
```



postOrder Traversal #4

```
void Tree::postOrder(Node * root){
    if(root != NULL){
        postOrder(root->left);
        postOrder(root->right);
        cout << root->data << " ";
    }
}
```

Cetak = 12 17 15 27 25 20

```
void Tree::postOrder(Node * root){
    if(root != NULL){
        postOrder(root->left);
        postOrder(root->right);
        cout << root->data << " ";
    }
}
```

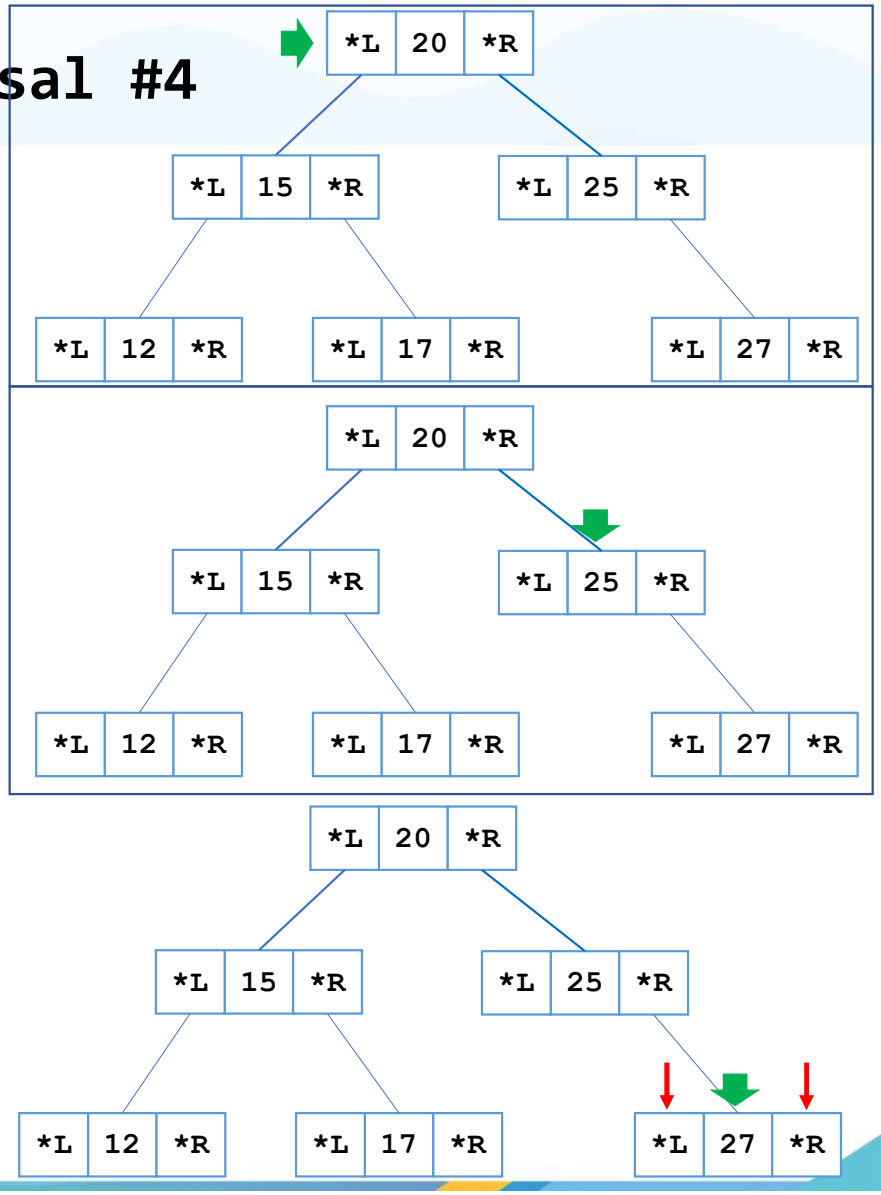
Cetak = 12 17 15 27 25

```
void Tree::postOrder(Node * root){
    if(root != NULL){
        postOrder(root->left);
        postOrder(root->right);
        cout << root->data << " ";
    }
}
```

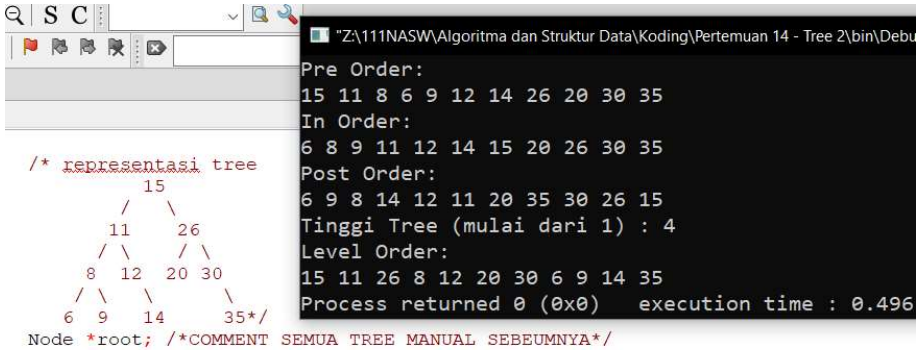
Cetak = 12 17 15 27

```
void Tree::postOrder(Node * root){
    if(root != NULL){
        postOrder(root->left);
        postOrder(root->right);
        cout << root->data << " ";
    }
}
```

```
void Tree::postOrder(Node * root){
    if(root != NULL){
        postOrder(root->left);
        postOrder(root->right);
```



main.cpp insertBinaryRoot




```
/* representasi tree
          15
         /   \
        11    26
       / \    / \
      8  12  20 30
     / \   \      \
    6  9   14     35*/
Node *root; /*COMMENT SEMUA TREE MANUAL SEBEUMNYA*/
Tree T;
root = NULL;
root = T.insertBinaryRoot(root,15);
root = T.insertBinaryRoot(root,11); root = T.insertBinaryRoot(root,26);
root = T.insertBinaryRoot(root,8); root = T.insertBinaryRoot(root,12);
root = T.insertBinaryRoot(root,20); root = T.insertBinaryRoot(root,30);
root = T.insertBinaryRoot(root,6); root = T.insertBinaryRoot(root,9);
root = T.insertBinaryRoot(root,14); root = T.insertBinaryRoot(root,35);

cout << "Pre Order: " << endl; T.preOrder(root);
cout << "\nIn Order: " << endl; T.inOrder(root);
cout << "\nPost Order: " << endl; T.postOrder(root);

int tinggi;
tinggi = T.heightNode(root);
cout <<"\nTinggi Tree (mulai dari 1) : " << tinggi;

cout << "\nLevel Order: " << endl;
T.levelOrder(root);

return 0;
```

insertBinaryRoot

```
Node *Tree::insertBinaryRoot(Node * root, int nilai){
    if(root == NULL){
        root = new Node(nilai);
    }else if(nilai <= root->data){
        root->left = insertBinaryRoot(root->left,nilai);
    }else{
        root->right = insertBinaryRoot(root->right,nilai);
    }
    return root;
}
```

Contoh insert Binary Tree sudah ada pada file Pertemuan 14-15 – Tree.pdf
Slide 20-23

insertBinaryRoot(root, 12)

Sudah ada Tree 20, 15 , 25 lalu akan insertBinaryRoot(root, 12)

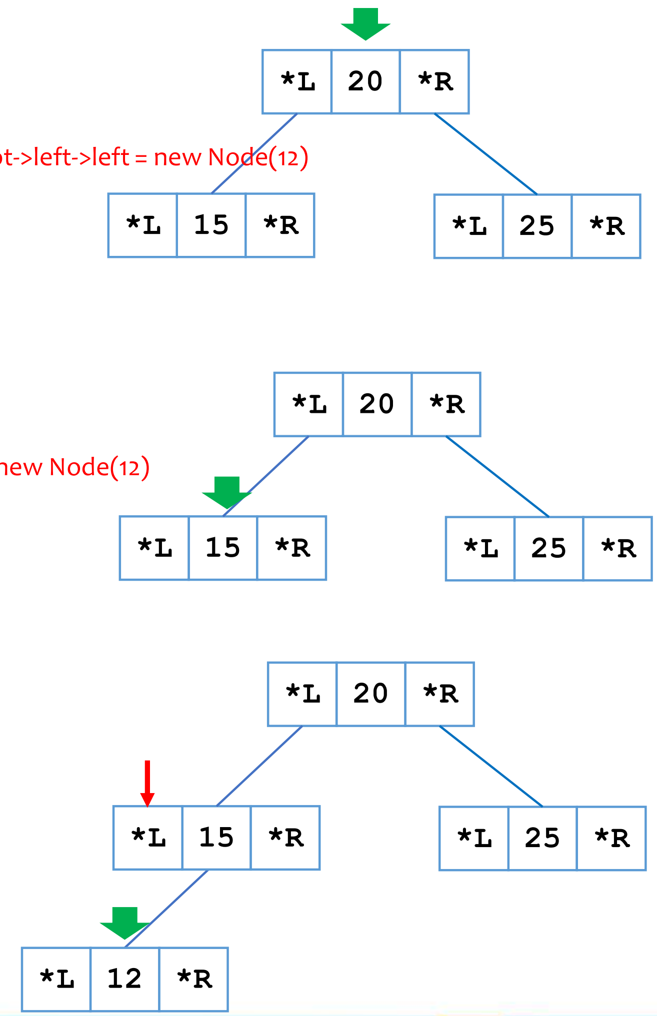
```
Node *Tree::insertBinaryRoot(Node * root, int nilai){
    if(root == NULL){
        root = new Node(nilai);
    }else if(nilai <= root->data){
        root->left = insertBinaryRoot(root->left,nilai);
    }else{
        root->right = insertBinaryRoot(root->right,nilai);
    }
    return root;
}
```

root->left->left = new Node(12)

```
Node *Tree::insertBinaryRoot(Node * root, int nilai){
    if(root == NULL){
        root = new Node(nilai);
    }else if(nilai <= root->data){
        root->left = insertBinaryRoot(root->left,nilai);
    }else{
        root->right = insertBinaryRoot(root->right,nilai);
    }
    return root;
}
```

root->left = new Node(12)

```
Node *Tree::insertBinaryRoot(Node * root, int nilai){
    if(root == NULL){
        root = new Node(nilai);
    }else if(nilai <= root->data){
        root->left = insertBinaryRoot(root->left,nilai);
    }else{
        root->right = insertBinaryRoot(root->right,nilai);
    }
    return root;
}
```



insertBinaryRoot(root, 35)

Sudah ada Tree 20, 15 , 25, 12 lalu akan insertBinaryRoot(root, 35)

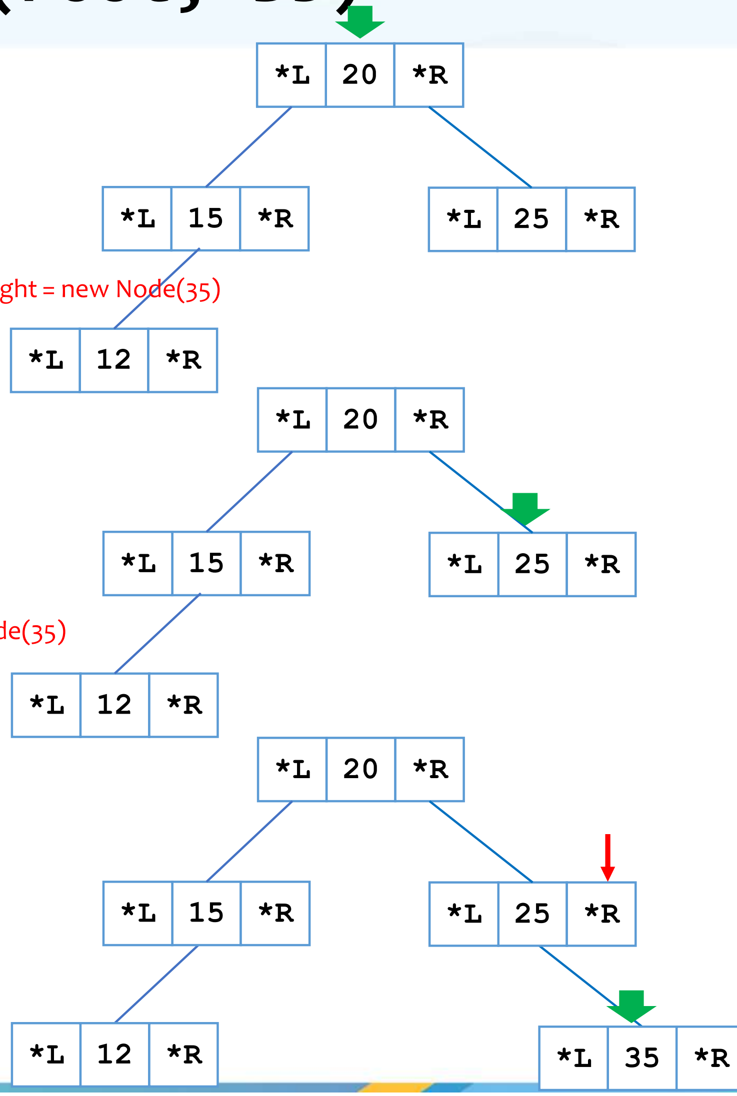
```
Node *Tree::insertBinaryRoot(Node * root, int nilai){
    if(root == NULL){
        root = new Node(nilai);
    }else if(nilai <= root->data){
        root->left = insertBinaryRoot(root->left,nilai);
    }else{
        root->right = insertBinaryRoot(root->right,nilai);
    }
    return root;
}
```

root->right->right = new Node(35)

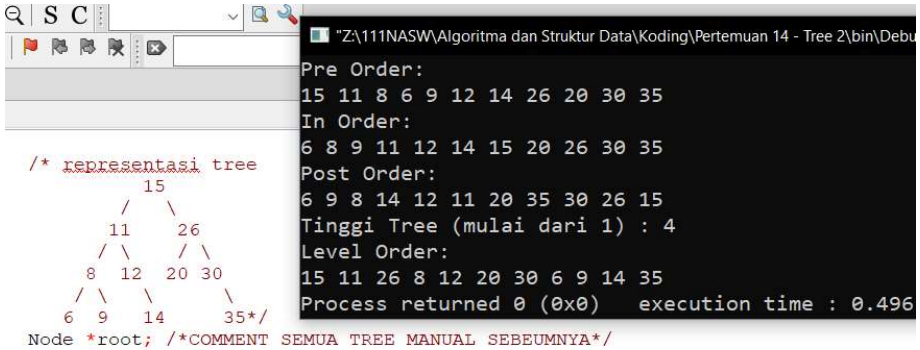
```
Node *Tree::insertBinaryRoot(Node * root, int nilai){
    if(root == NULL){
        root = new Node(nilai);
    }else if(nilai <= root->data){
        root->left = insertBinaryRoot(root->left,nilai);
    }else{
        root->right = insertBinaryRoot(root->right,nilai);
    }
    return root;
}
```

root->right = new Node(35)

```
Node *Tree::insertBinaryRoot(Node * root, int nilai){
    if(root == NULL){
        root = new Node(nilai);
    }else if(nilai <= root->data){
        root->left = insertBinaryRoot(root->left,nilai);
    }else{
        root->right = insertBinaryRoot(root->right,nilai);
    }
    return root;
}
```



main.cpp




```
/* representasi tree
          15
        /   \
       11    26
      / \    / \
     8  12  20 30
    / \   \       \
   6  9   14      35*/
Node *root; /*COMMENT SEMUA TREE MANUAL SEBEUMNYA*/
Tree T;
root = NULL;
root = T.insertBinaryRoot(root,15);
root = T.insertBinaryRoot(root,11); root = T.insertBinaryRoot(root,26);
root = T.insertBinaryRoot(root,8); root = T.insertBinaryRoot(root,12);
root = T.insertBinaryRoot(root,20); root = T.insertBinaryRoot(root,30);
root = T.insertBinaryRoot(root,6); root = T.insertBinaryRoot(root,9);
root = T.insertBinaryRoot(root,14); root = T.insertBinaryRoot(root,35);

cout << "Pre Order: " << endl; T.preOrder(root);
cout << "\nIn Order: " << endl; T.inOrder(root);
cout << "\nPost Order: " << endl; T.postOrder(root);

int tinggi;
tinggi = T.heightNode(root);
cout <<"\nTinggi Tree (mulai dari 1) : " << tinggi;

cout << "\nLevel Order: " << endl;
T.levelOrder(root);

return 0;
```

heightNode #1

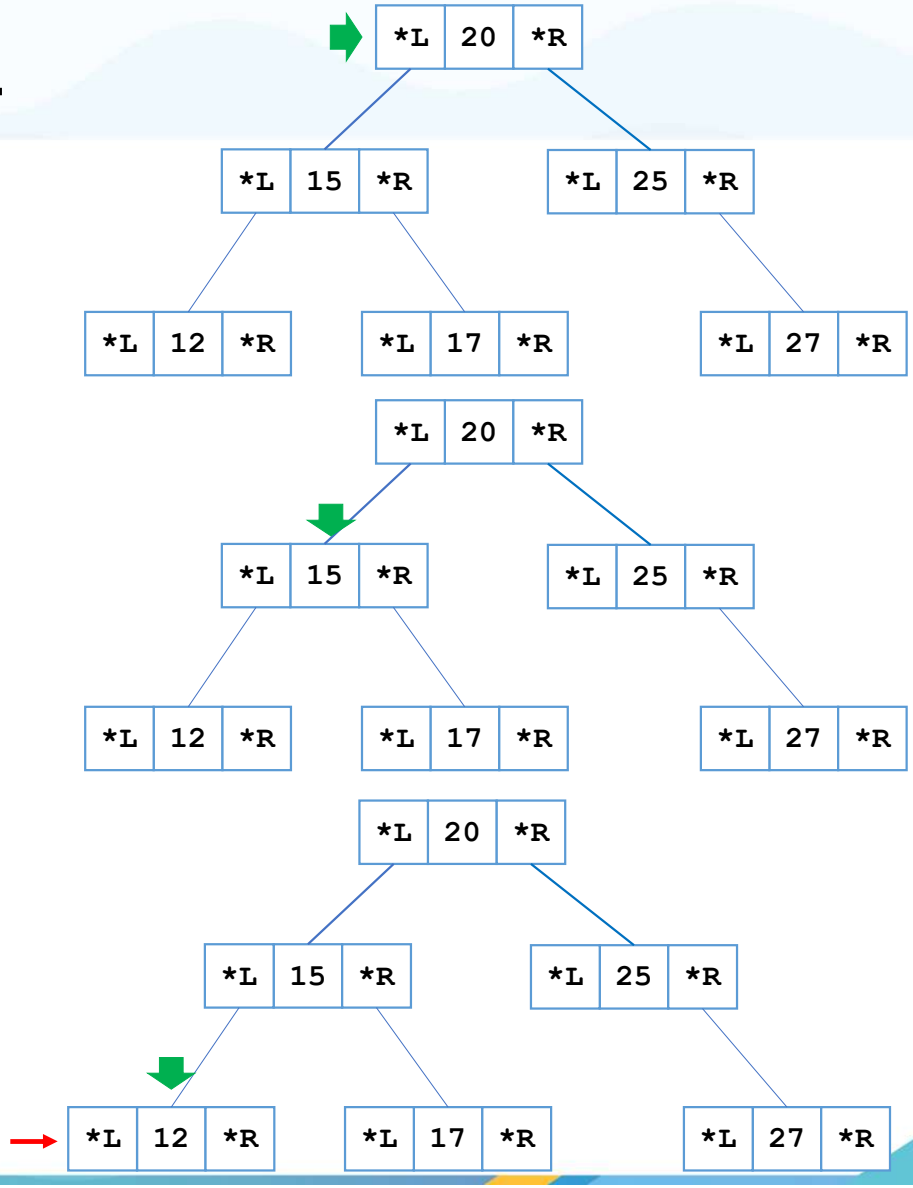
```
int Tree::heightNode(Node * root){
    if(root == NULL){
        return 0;
    }else{
        int leftH=heightNode(root->left);
        int rightH= heightNode(root->right);

        return 1+max(leftH, rightH);
    }
}
```

```
int Tree::heightNode(Node * root){
    if(root == NULL){
        return 0;
    }else{
        int leftH=heightNode(root->left);
        int rightH= heightNode(root->right);

        return 1+max(leftH, rightH);
    }
}
```

```
int Tree::heightNode(Node * root){
    if(root == NULL){
        return 0;
    }else{
        int leftH=heightNode(root->left);
        int rightH= heightNode(root->right);

        return 1+max(leftH, rightH);
    }
}
```

leftH = 0

```
int Tree::heightNode(Node * root){
    if(root == NULL){
        return 0;
    }else{
        int leftH=heightNode(root->left);
        int rightH= heightNode(root->right);

        return 1+max(leftH, rightH);
```



heightNode #2

```
int Tree::heightNode(Node * root){
    if(root == NULL){
        return 0;
    }else{
        int leftH=heightNode(root->left);
        int rightH= heightNode(root->right);

        return 1+max(leftH, rightH);
    }
}
```

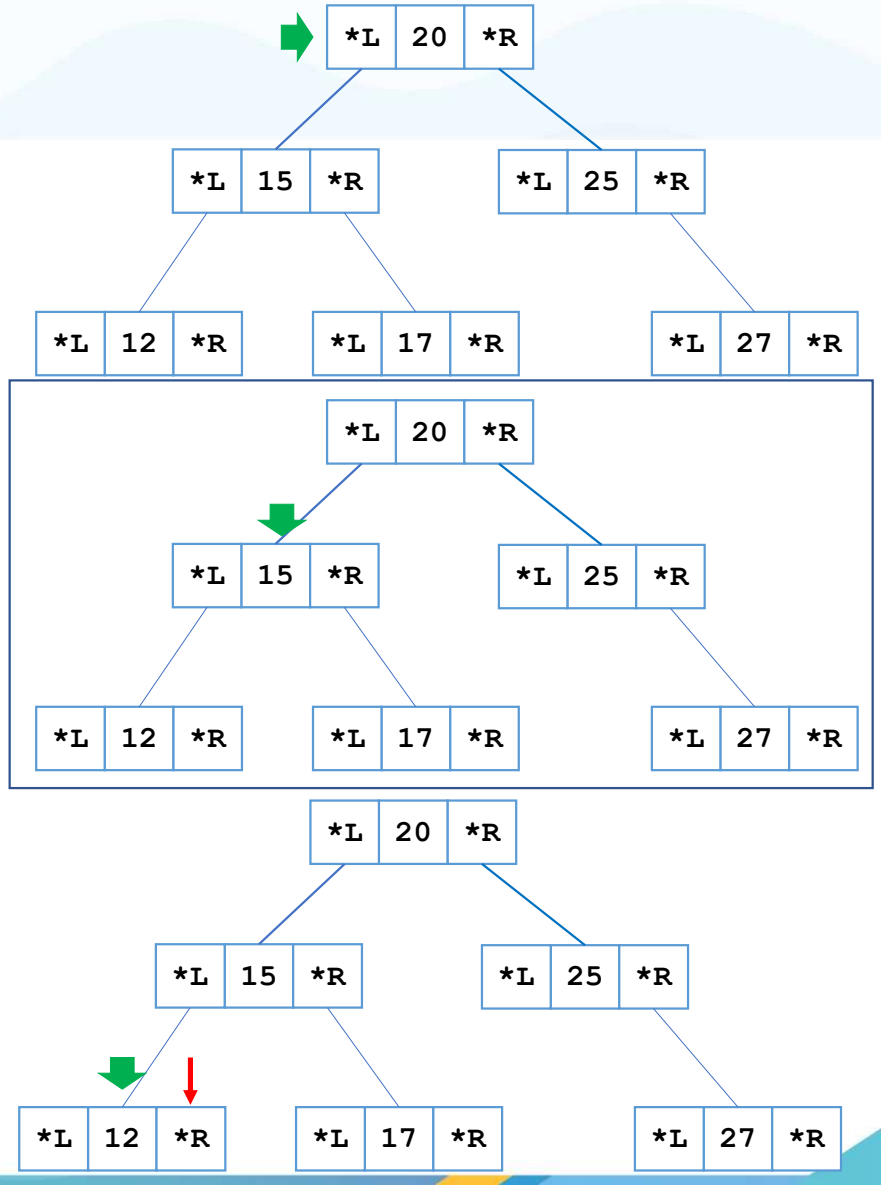
```
int Tree::heightNode(Node * root){
    if(root == NULL){
        return 0;
    }else{
        int leftH=heightNode(root->left);
        int rightH= heightNode(root->right);

        return 1+max(leftH, rightH);
    }
}
```

leftH = 1

```
int Tree::heightNode(Node * root){
    if(root == NULL){
        return 0;
    }else{
        int leftH=heightNode(root->left);
        int rightH= heightNode(root->right);

        return 1+max(leftH, rightH);
    }
}
return 1+max(0,0)
return 1
```

leftH = 0
rightH = 0

```
int Tree::heightNode(Node * root){
    if(root == NULL){
        return 0;
    }else{
        int leftH=heightNode(root->left);
        int rightH= heightNode(root->right);

        return 1+max(leftH, rightH);
```



heightNode #3

```
int Tree::heightNode(Node * root){
    if(root == NULL){
        return 0;
    }else{
        int leftH=heightNode(root->left);
        int rightH= heightNode(root->right);

        return 1+max(leftH, rightH);
    }
}
```

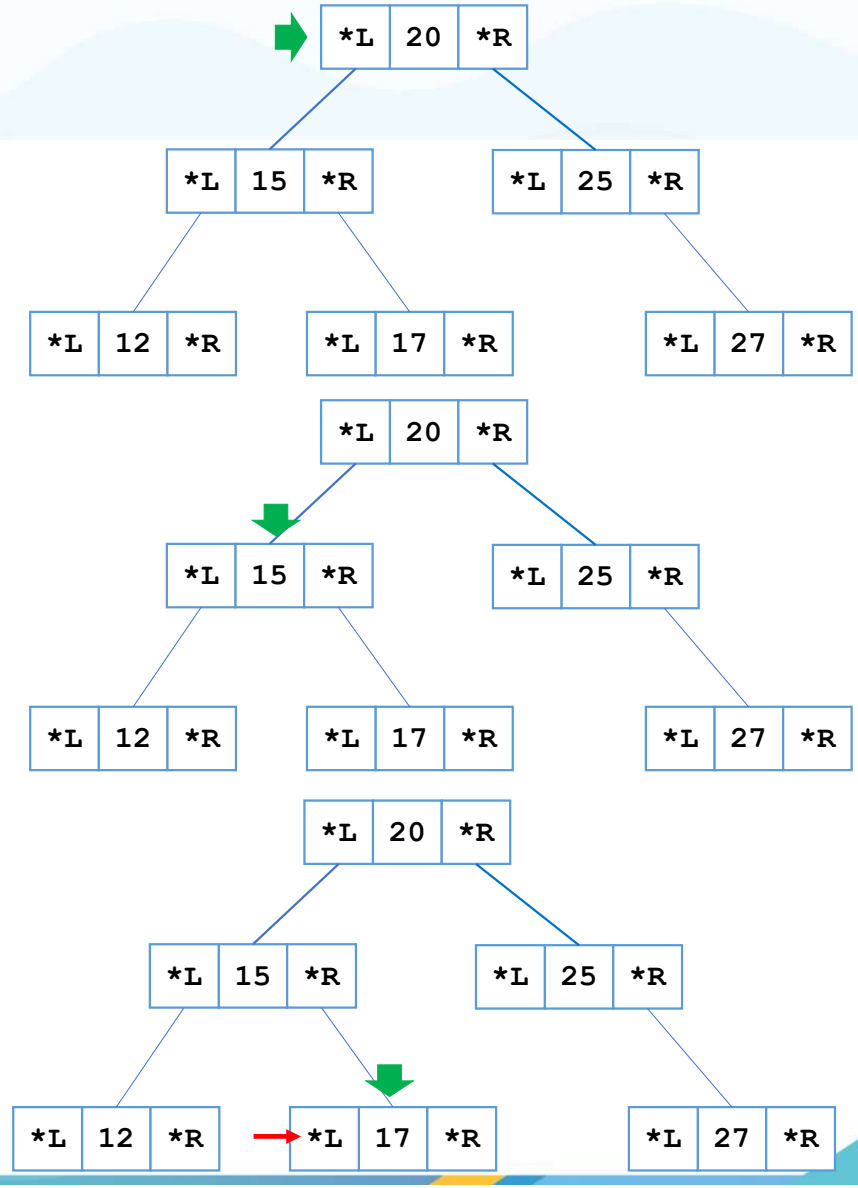
```
int Tree::heightNode(Node * root){
    if(root == NULL){
        return 0;
    }else{
        int leftH=heightNode(root->left);
        int rightH= heightNode(root->right);

        return 1+max(leftH, rightH);
    }
}
```

leftH = 1

```
int Tree::heightNode(Node * root){
    if(root == NULL){
        return 0;
    }else{
        int leftH=heightNode(root->left);
        int rightH= heightNode(root->right);

        return 1+max(leftH, rightH);
    }
}
```

leftH = 0

```
int Tree::heightNode(Node * root){
    if(root == NULL){
        return 0;
    }else{
        int leftH=heightNode(root->left);
        int rightH= heightNode(root->right);

        return 1+max(leftH, rightH);
```



heightNode #4

```
int Tree::heightNode(Node * root){
    if(root == NULL){
        return 0;
    }else{
        int leftH=heightNode(root->left);
        int rightH= heightNode(root->right);

        return 1+max(leftH, rightH);
    }
}
```

leftH = 2

```
int Tree::heightNode(Node * root){
    if(root == NULL){
        return 0;
    }else{
        int leftH=heightNode(root->left);
        int rightH= heightNode(root->right);

        return 1+max(leftH, rightH);
    }
}
```

leftH = 1
rightH = 1

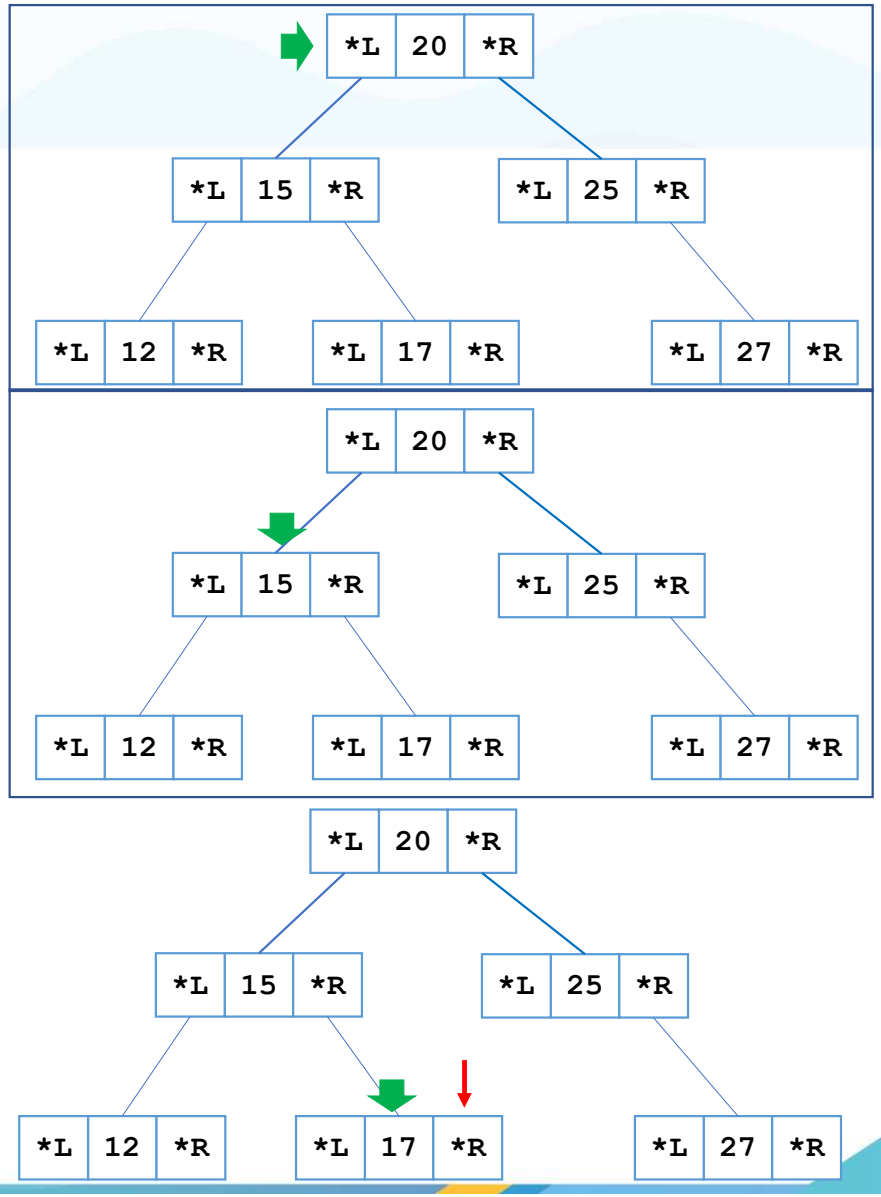
return 1+max(1,1)
return 2

```
int Tree::heightNode(Node * root){
    if(root == NULL){
        return 0;
    }else{
        int leftH=heightNode(root->left);
        int rightH= heightNode(root->right);

        return 1+max(leftH, rightH);
    }
}
```

leftH = 0
rightH = 0

return 1+max(0,0)
return 1

```
int Tree::heightNode(Node * root){
    if(root == NULL){
        return 0;
    }else{
        int leftH=heightNode(root->left);
        int rightH= heightNode(root->right);

        return 1+max(leftH, rightH);
```



heightNode #5

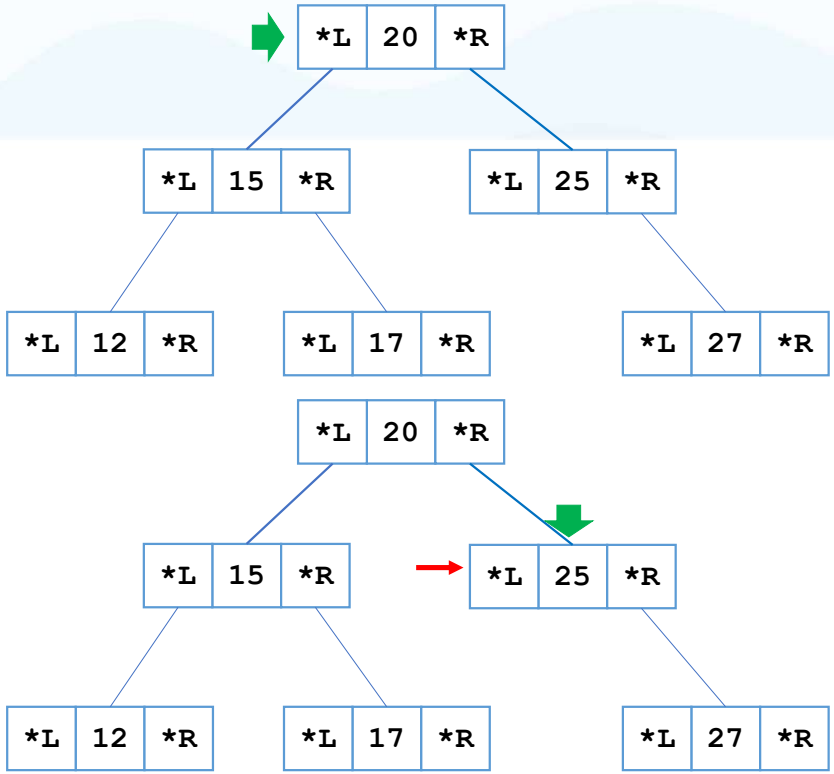
```
int Tree::heightNode(Node * root){
    if(root == NULL){
        return 0;
    }else{
        int leftH=heightNode(root->left);
        int rightH= heightNode(root->right);

        return 1+max(leftH, rightH);
    }
}
```

leftH = 2

```
int Tree::heightNode(Node * root){
    if(root == NULL){
        return 0;
    }else{
        int leftH=heightNode(root->left);
        int rightH= heightNode(root->right);

        return 1+max(leftH, rightH);
    }
}
```

leftH = 0

```
int Tree::heightNode(Node * root){
    if(root == NULL){
        return 0;
    }else{
        int leftH=heightNode(root->left);
        int rightH= heightNode(root->right);

        return 1+max(leftH, rightH);
    }
}
```



heightNode #6

```
int Tree::heightNode(Node * root){
    if(root == NULL){
        return 0;
    }else{
        int leftH=heightNode(root->left);
        int rightH= heightNode(root->right);

        return 1+max(leftH, rightH);
    }
}
```

leftH = 2

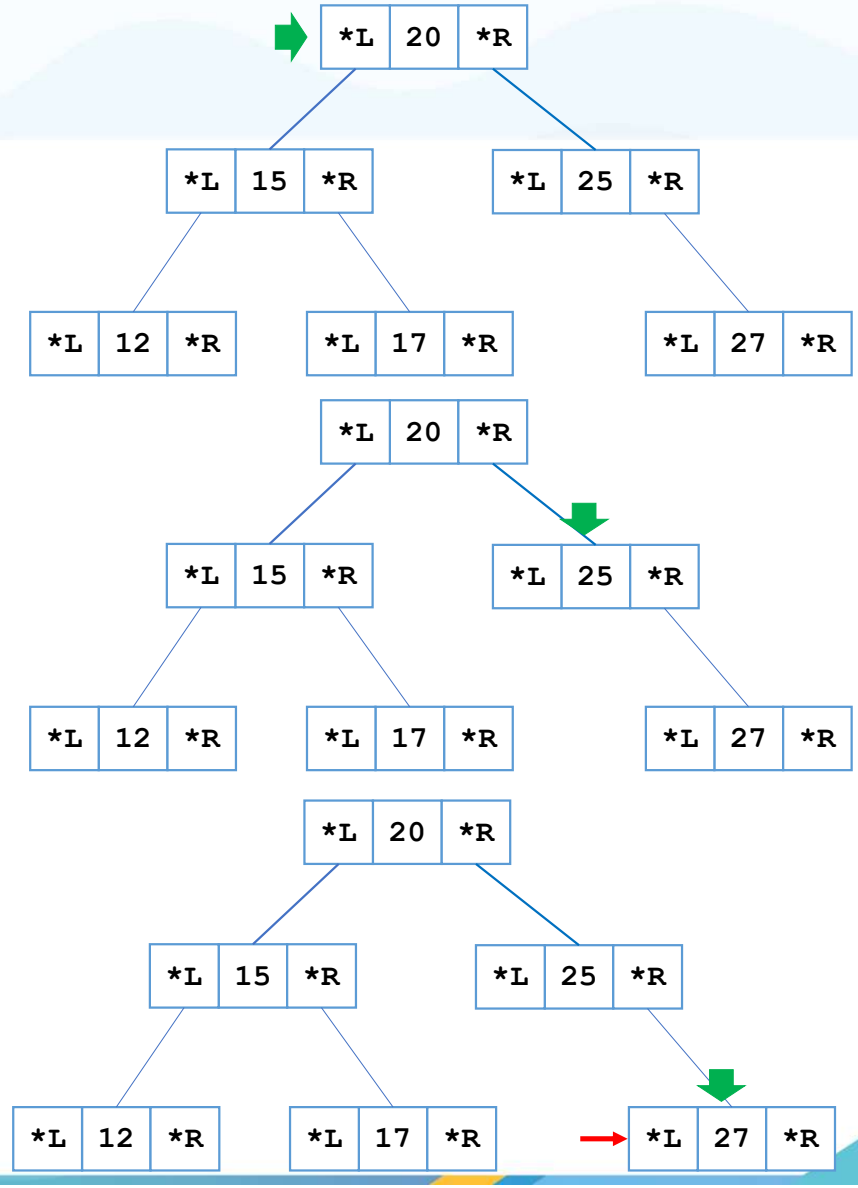
```
int Tree::heightNode(Node * root){
    if(root == NULL){
        return 0;
    }else{
        int leftH=heightNode(root->left);
        int rightH= heightNode(root->right);

        return 1+max(leftH, rightH);
    }
}
```

leftH = 0

```
int Tree::heightNode(Node * root){
    if(root == NULL){
        return 0;
    }else{
        int leftH=heightNode(root->left);
        int rightH= heightNode(root->right);

        return 1+max(leftH, rightH);
    }
}
```

leftH = 0

```
int Tree::heightNode(Node * root){
    if(root == NULL){
        return 0;
    }else{
        int leftH=heightNode(root->left);
        int rightH= heightNode(root->right);

        return 1+max(leftH, rightH);
```



heightNode #7

```
int Tree::heightNode(Node * root){
    if(root == NULL){
        return 0;
    }else{
        int leftH=heightNode(root->left);
        int rightH= heightNode(root->right);

        return 1+max(leftH, rightH);
    }
}
```

leftH = 2
rightH = 2

return 1+max(2,2)
return 3

```
int Tree::heightNode(Node * root){
    if(root == NULL){
        return 0;
    }else{
        int leftH=heightNode(root->left);
        int rightH= heightNode(root->right);

        return 1+max(leftH, rightH);
    }
}
```

leftH = 0
rightH = 1

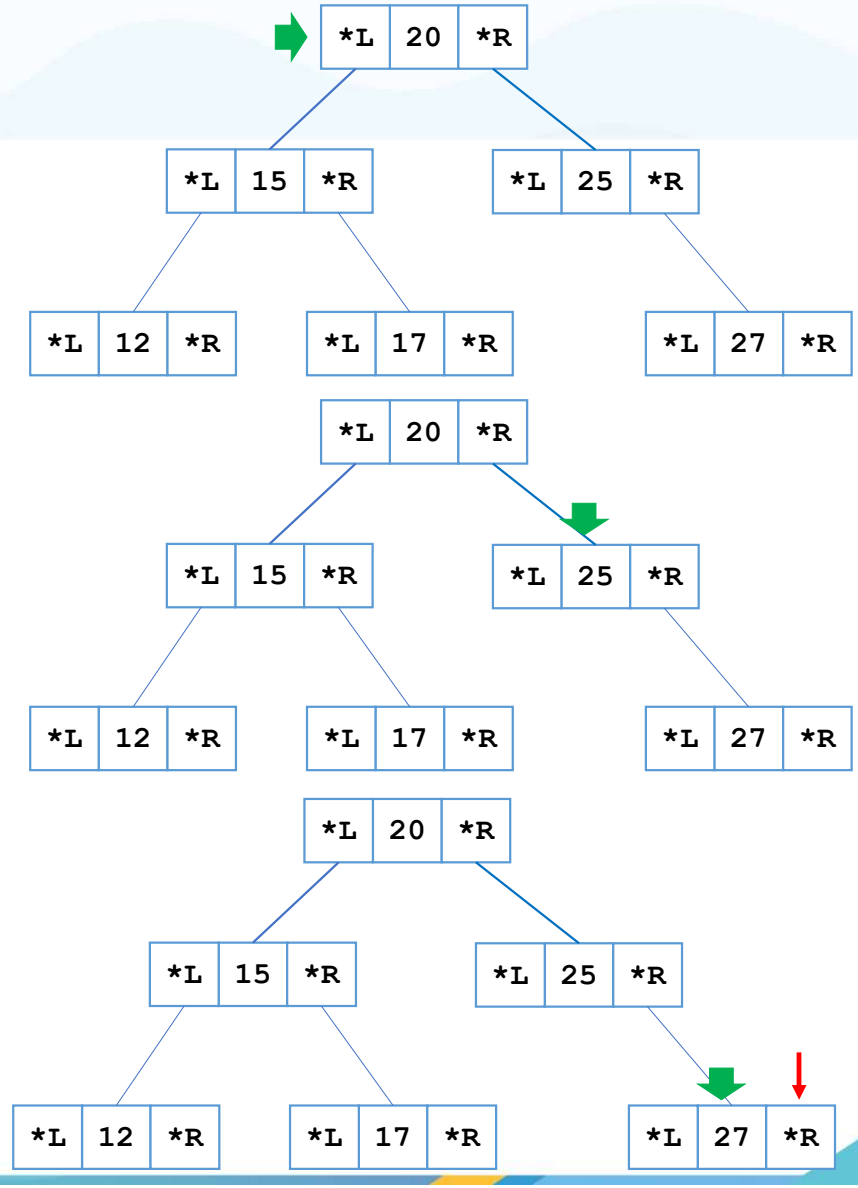
return 1+max(0,1)
return 2

```
int Tree::heightNode(Node * root){
    if(root == NULL){
        return 0;
    }else{
        int leftH=heightNode(root->left);
        int rightH= heightNode(root->right);

        return 1+max(leftH, rightH);
    }
}
```

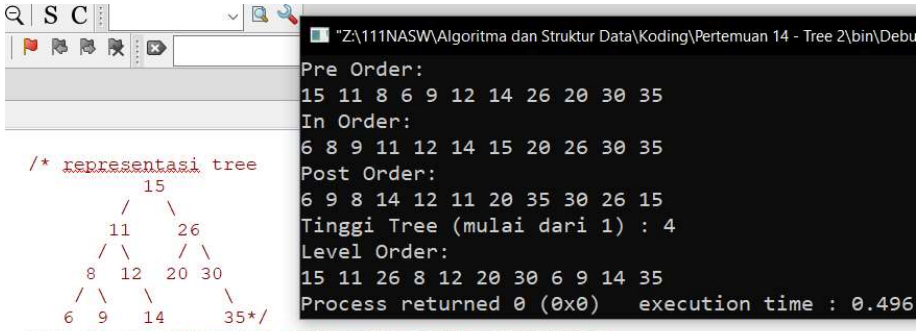
leftH = 0
rightH = 0

return 1+max(0,0)
return 1

```
int Tree::heightNode(Node * root){
    if(root == NULL){
        return 0;
    }else{
        int leftH=heightNode(root->left);
        int rightH= heightNode(root->right);

        return 1+max(leftH, rightH);
```



main.cpp



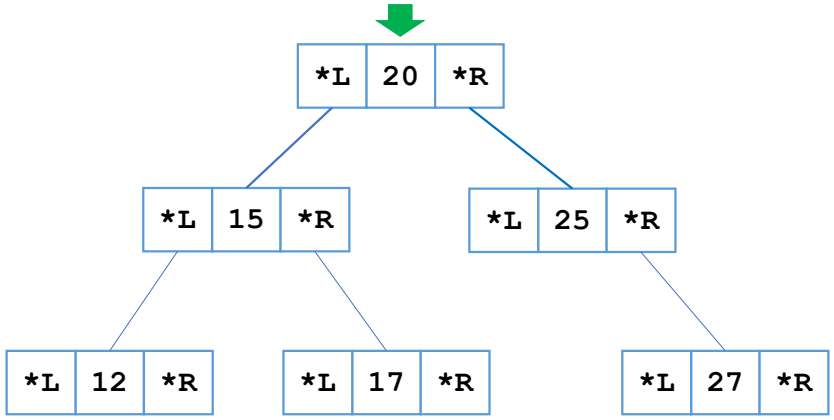

```
/* representasi tree
          15
        /   \
       11    26
      / \    / \
     8  12  20 30
    / \   \      \
   6  9   14     35*/
Node *root; /*COMMENT SEMUA TREE MANUAL SEBEUMNYA*/
Tree T;
root = NULL;
root = T.insertBinaryRoot(root,15);
root = T.insertBinaryRoot(root,11); root = T.insertBinaryRoot(root,26);
root = T.insertBinaryRoot(root,8); root = T.insertBinaryRoot(root,12);
root = T.insertBinaryRoot(root,20); root = T.insertBinaryRoot(root,30);
root = T.insertBinaryRoot(root,6); root = T.insertBinaryRoot(root,9);
root = T.insertBinaryRoot(root,14); root = T.insertBinaryRoot(root,35);

cout << "Pre Order: " << endl; T.preOrder(root);
cout << "\nIn Order: " << endl; T.inOrder(root);
cout << "\nPost Order: " << endl; T.postOrder(root);

int tinggi;
tinggi = T.heightNode(root);
cout <<"\nTinggi Tree (mulai dari 1) : " << tinggi;

cout << "\nLevel Order: " << endl;
T.levelOrder(root);

return 0;
```

printCurrentLevel

T.printCurrentLevel(root, 0)

```
void Tree::printCurrentLevel(Node *root, int level){
    if(root != NULL){
        if(level == 0){
            cout << root->data << " ";
        }else if(level > 0){
            printCurrentLevel(root->left,level-1);
            printCurrentLevel(root->right,level-1);
        }
    }
}
```

Cetak: 20



printCurrentLevel

T.printCurrentLevel(root, 1)

```
void Tree::printCurrentLevel(Node *root, int level){
    if(root != NULL){
        if(level == 0){
            cout << root->data << " ";
        }else if(level > 0){
            printCurrentLevel(root->left,level-1);
            printCurrentLevel(root->right,level-1);
        }
    }
}
```

printCurrentLevel(root->left, 0)

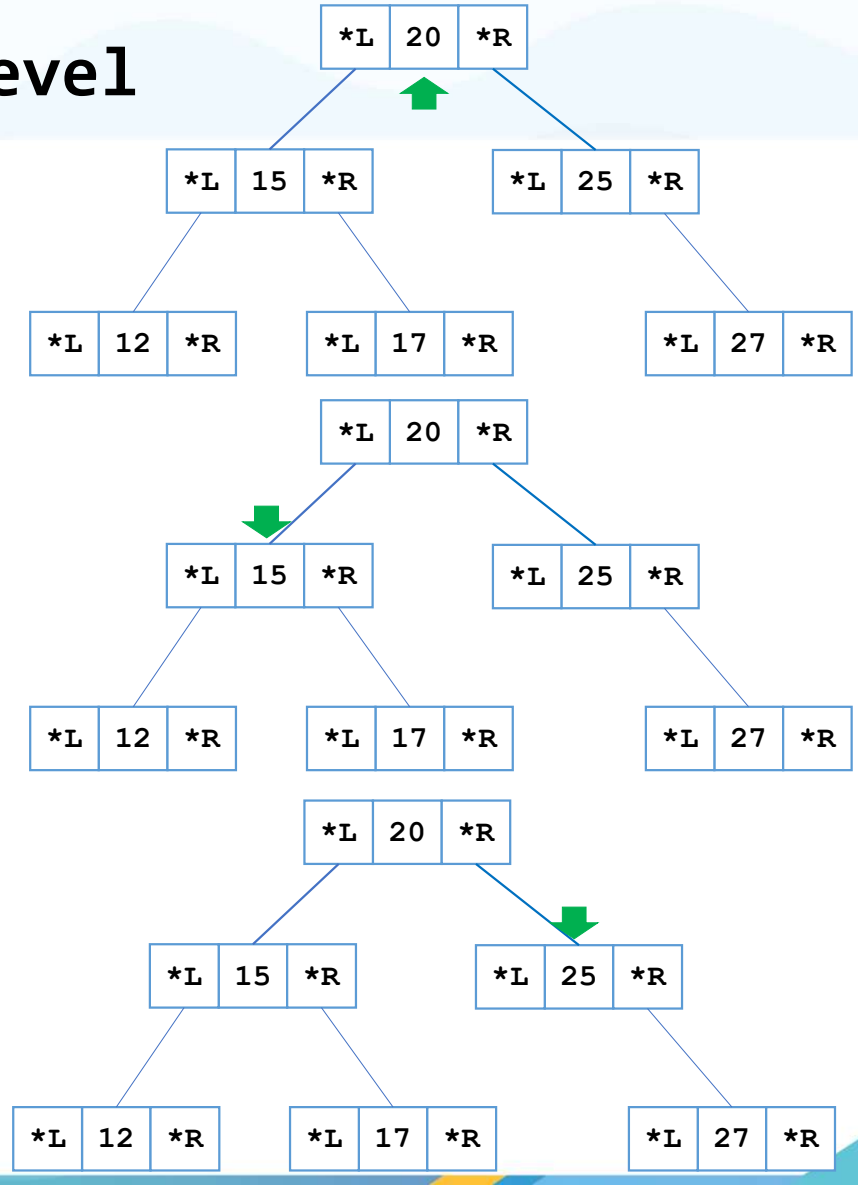
```
void Tree::printCurrentLevel(Node *root, int level){
    if(root != NULL){
        if(level == 0){
            cout << root->data << " ";
        }else if(level > 0){
            printCurrentLevel(root->left,level-1);
            printCurrentLevel(root->right,level-1);
        }
    }
}
```

Cetak: 15

printCurrentLevel(root->right, 0)

```
void Tree::printCurrentLevel(Node *root, int level){
    if(root != NULL){
        if(level == 0){
            cout << root->data << " ";
        }else if(level > 0){
            printCurrentLevel(root->left,level-1);
            printCurrentLevel(root->right,level-1);
        }
    }
}
```

Cetak: 15 25



printCurrentLevel

T.printCurrentLevel(root, 2) #1

```
void Tree::printCurrentLevel(Node *root, int level){
    if(root != NULL){
        if(level == 0){
            cout << root->data << " ";
        }else if(level > 0){
            printCurrentLevel(root->left,level-1);
            printCurrentLevel(root->right,level-1);
        }
    }
}
```

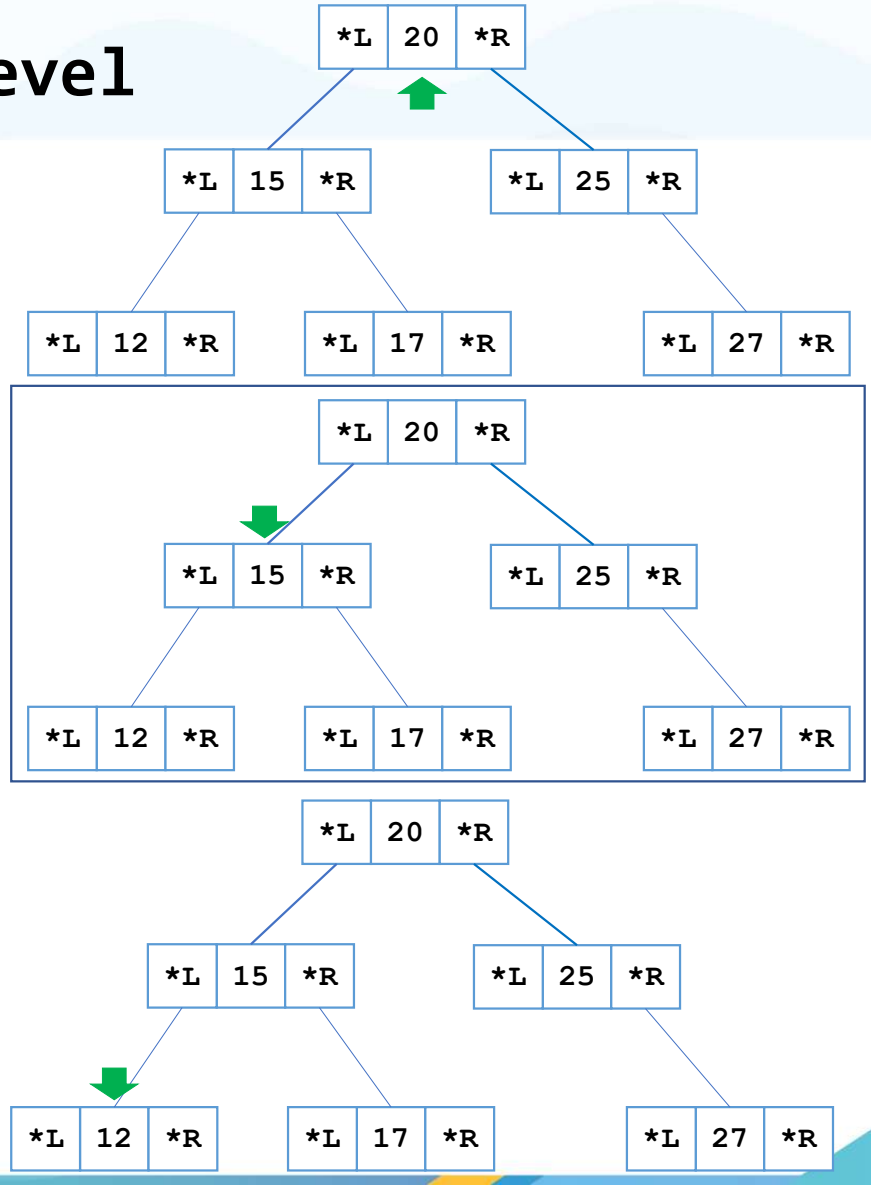
printCurrentLevel(root->left, 1)

```
void Tree::printCurrentLevel(Node *root, int level){
    if(root != NULL){
        if(level == 0){
            cout << root->data << " ";
        }else if(level > 0){
            printCurrentLevel(root->left,level-1);
            printCurrentLevel(root->right,level-1);
        }
    }
}
```

printCurrentLevel(root->left, 0)

```
void Tree::printCurrentLevel(Node *root, int level){
    if(root != NULL){
        if(level == 0){
            cout << root->data << " ";
        }else if(level > 0){
            printCurrentLevel(root->left,level-1);
            printCurrentLevel(root->right,level-1);
        }
    }
}
```

Cetak: 12



printCurrentLevel

T.printCurrentLevel(root, 2) #2

```
void Tree::printCurrentLevel(Node *root, int level){
    if(root != NULL){
        if(level == 0){
            cout << root->data << " ";
        }else if(level > 0){
            printCurrentLevel(root->left,level-1);
            printCurrentLevel(root->right,level-1);
        }
    }
}
```

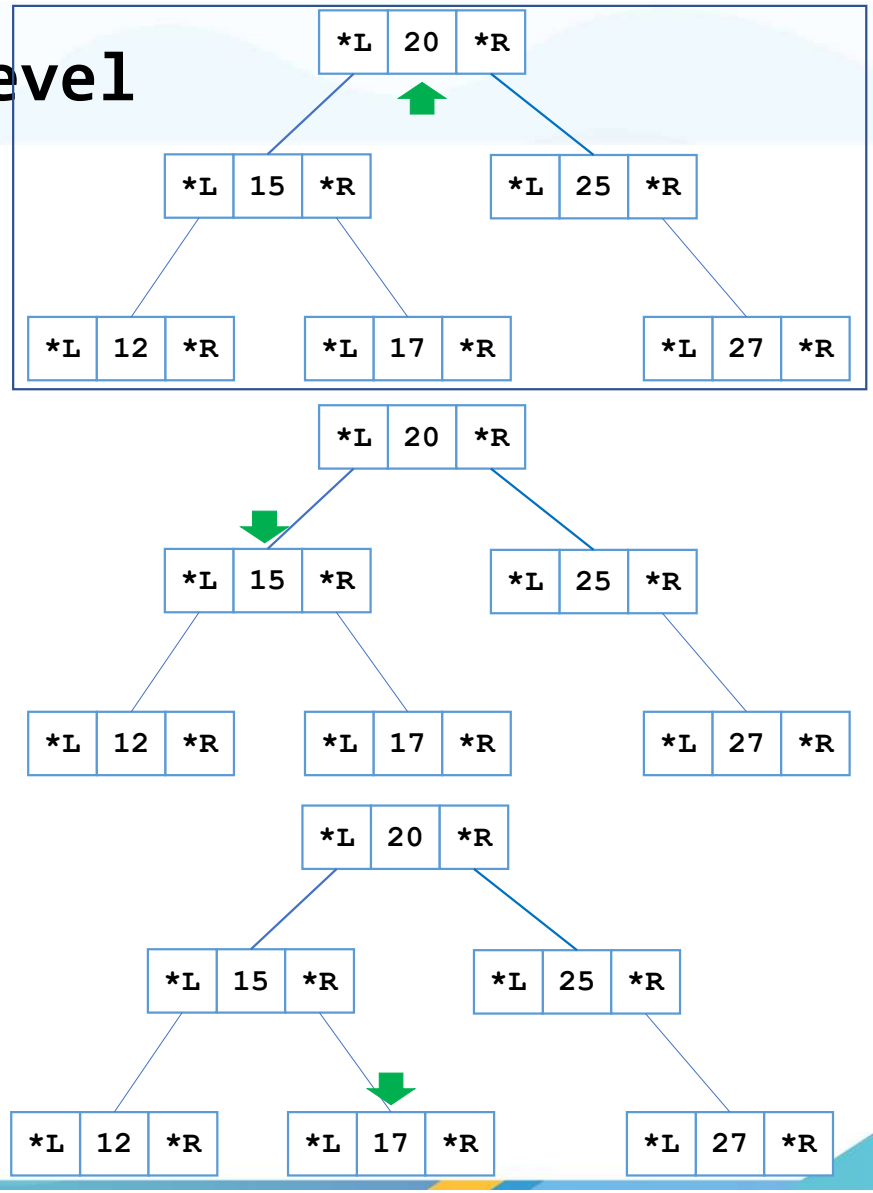
printCurrentLevel(root->left, 1)

```
void Tree::printCurrentLevel(Node *root, int level){
    if(root != NULL){
        if(level == 0){
            cout << root->data << " ";
        }else if(level > 0){
            printCurrentLevel(root->left,level-1);
            printCurrentLevel(root->right,level-1);
        }
    }
}
```

printCurrentLevel(root->right, 0)

```
void Tree::printCurrentLevel(Node *root, int level){
    if(root != NULL){
        if(level == 0){
            cout << root->data << " ";
        }else if(level > 0){
            printCurrentLevel(root->left,level-1);
            printCurrentLevel(root->right,level-1);
        }
    }
}
```

Cetak: 12 17



printCurrentLevel

T.printCurrentLevel(root, 2) #3

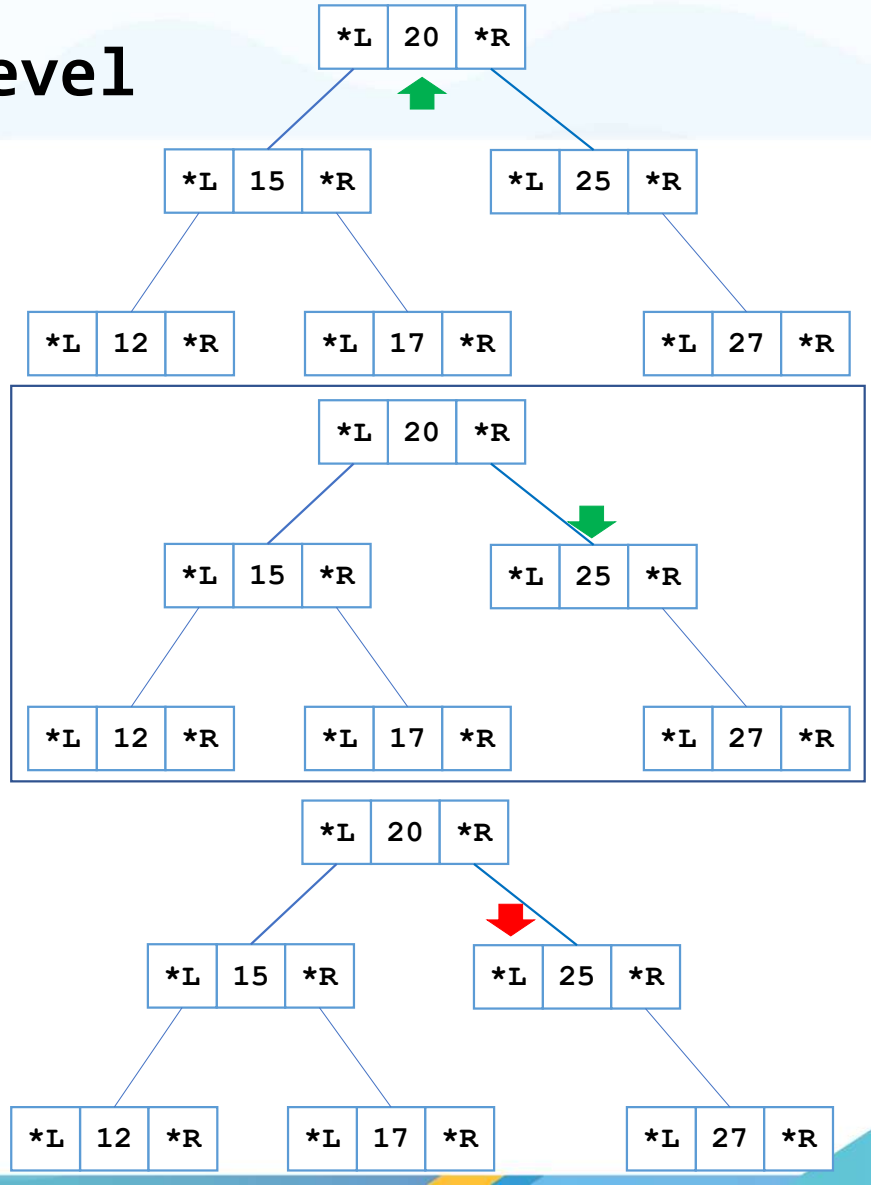
```
void Tree::printCurrentLevel(Node *root, int level){
    if(root != NULL){
        if(level == 0){
            cout << root->data << " ";
        }else if(level > 0){
            printCurrentLevel(root->left,level-1);
            printCurrentLevel(root->right,level-1);
        }
    }
}
```

printCurrentLevel(root->right, 1)

```
void Tree::printCurrentLevel(Node *root, int level){
    if(root != NULL){
        if(level == 0){
            cout << root->data << " ";
        }else if(level > 0){
            printCurrentLevel(root->left,level-1);
            printCurrentLevel(root->right,level-1);
        }
    }
}
```

printCurrentLevel(root->left, 0)

```
void Tree::printCurrentLevel(Node *root, int level){
    if(root != NULL){
        if(level == 0){
            cout << root->data << " ";
        }else if(level > 0){
            printCurrentLevel(root->left,level-1);
            printCurrentLevel(root->right,level-1);
        }
    }
}
```



printCurrentLevel

T.printCurrentLevel(root, 2) #4

```
void Tree::printCurrentLevel(Node *root, int level){
    if(root != NULL){
        if(level == 0){
            cout << root->data << " ";
        }else if(level > 0){
            printCurrentLevel(root->left,level-1);
            printCurrentLevel(root->right,level-1);
        }
    }
}
```

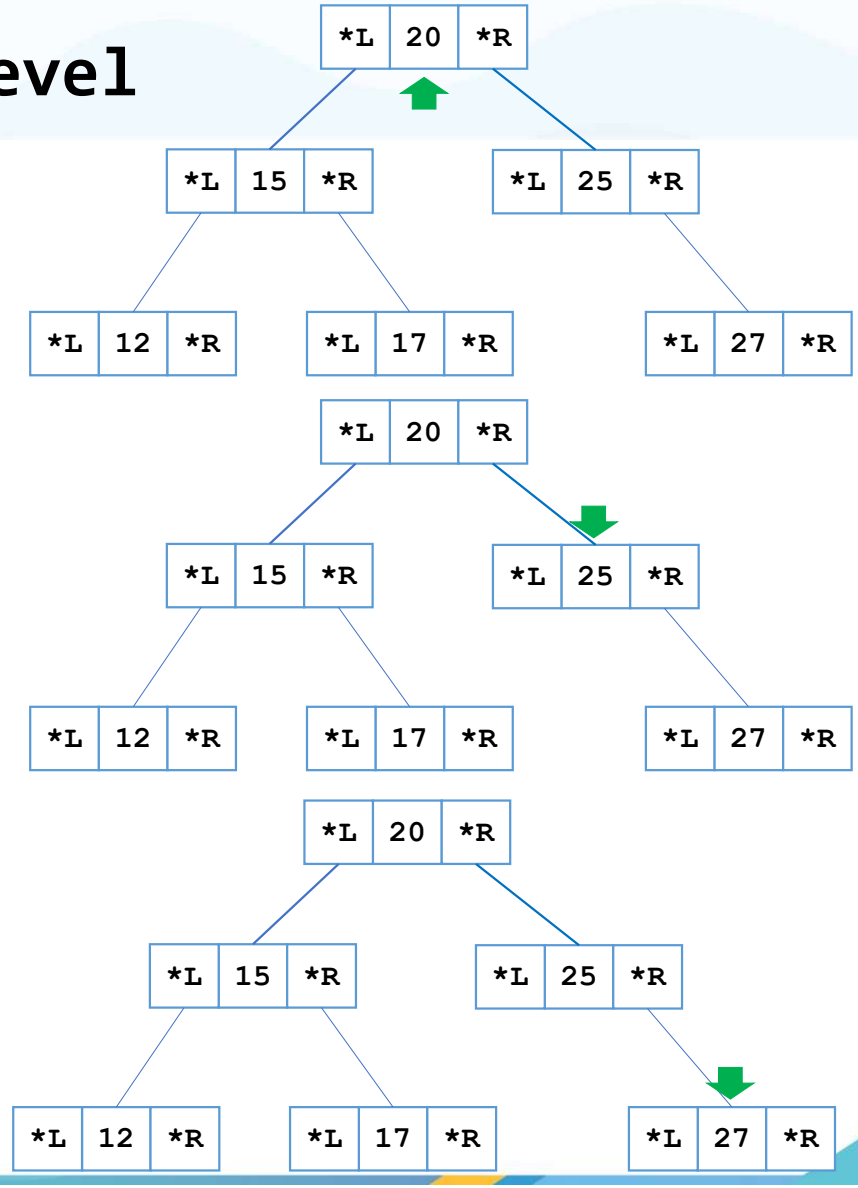
printCurrentLevel(root->right, 1)

```
void Tree::printCurrentLevel(Node *root, int level){
    if(root != NULL){
        if(level == 0){
            cout << root->data << " ";
        }else if(level > 0){
            printCurrentLevel(root->left,level-1);
            printCurrentLevel(root->right,level-1);
        }
    }
}
```

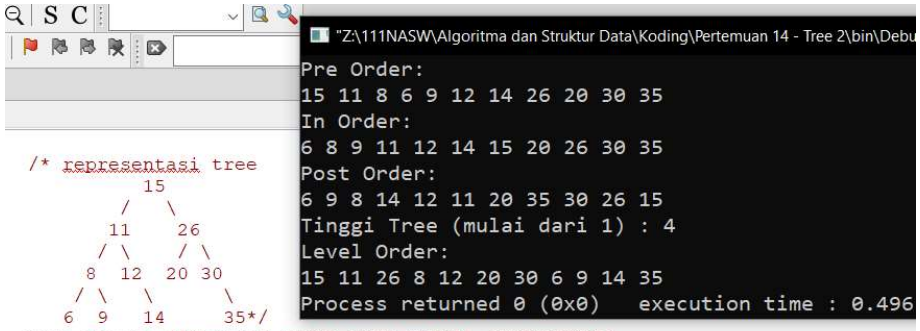
printCurrentLevel(root->right, 0)

```
void Tree::printCurrentLevel(Node *root, int level){
    if(root != NULL){
        if(level == 0){
            cout << root->data << " ";
        }else if(level > 0){
            printCurrentLevel(root->left,level-1);
            printCurrentLevel(root->right,level-1);
        }
    }
}
```

Cetak: 12 17 27



main.cpp



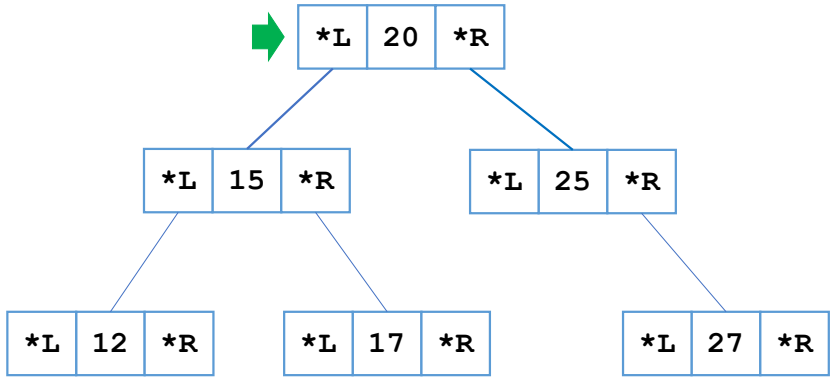

```
/* representasi tree
          15
        /   \
       11    26
      / \    / \
     8  12  20 30
    / \   \      \
   6  9   14     35*/
Node *root; /*COMMENT SEMUA TREE MANUAL SEBEUMNYA*/
Tree T;
root = NULL;
root = T.insertBinaryRoot(root,15);
root = T.insertBinaryRoot(root,11); root = T.insertBinaryRoot(root,26);
root = T.insertBinaryRoot(root,8); root = T.insertBinaryRoot(root,12);
root = T.insertBinaryRoot(root,20); root = T.insertBinaryRoot(root,30);
root = T.insertBinaryRoot(root,6); root = T.insertBinaryRoot(root,9);
root = T.insertBinaryRoot(root,14); root = T.insertBinaryRoot(root,35);

cout << "Pre Order: " << endl; T.preOrder(root);
cout << "\nIn Order: " << endl; T.inOrder(root);
cout << "\nPost Order: " << endl; T.postOrder(root);

int tinggi;
tinggi = T.heightNode(root);
cout <<"\nTinggi Tree (mulai dari 1) : " << tinggi;

cout << "\nLevel Order: " << endl;
T.levelOrder(root);

return 0;
```

levelOrder

levelOrder(root)

```
void Tree::levelOrder(Node *root){
    int h = heightNode(root);
    for(int i=0;i<h;i++){ //jika i=1; i<=h
        printCurrentLevel(root,i);
    }
}
```

h = 3
i=0; 0<3
    printCurrentLevel(root,0) #Cetak : 20
i=1; 1<3
    printCurrentLevel(root,1) #Cetak : 20 15 25
i=2; 2<3
    printCurrentLevel(root,2) #Cetak : 20 15 25 12 17 27
i=3; 3<3 loop end



Referensi

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TERIMA KASIH

ANY QUESTIONS?