Data Structure and Algorithm(Lab)

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Lab Assignment

Question:

Code :

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

class AVL {
   int data;
   AVL *left, *right;
   int height;

public:
   AVL();
   AVL(int);
   AVL* Insert(AVL*, int);
   AVL* Delete(AVL*, int);
   void Inorder(AVL*);
   void preorder(AVL*);
   void postorder(AVL*);
   int getHeight(AVL* node);
   int getBalance(AVL* node);
   AVL* rightRotate(AVL* y);
   AVL* leftRotate(AVL* x);
   AVL* minValueNode(AVL* node);
};
```

```
AVL::AVL() {
   data = 0;
   left = right = NULL;
   height = 1;
}

AVL::AVL(int value) {
   data = value;
   left = right = NULL;
   height = 1;
}

AVL* AVL::Insert(AVL* root, int value) {
   if (root == NULL) {
      return new AVL(value);
   }

   if (value < root->data) {
      root->left = Insert(root->left, value);
   } else if (value > root->data) {
      root->right = Insert(root->right, value);
   }

   root->height = 1 + max(getHeight(root->left), getHeight(root->right));

   int balance = getBalance(root);
```

```
    if (balance > 1 && value < root->left->data) {
        return rightRotate(root);
    }

    if (balance < -1 && value > root->right->data) {
        return leftRotate(root);
    }

    if (balance > 1 && value > root->left->data) {
        root->left = leftRotate(root->left);
        return rightRotate(root);
    }

    if (balance < -1 && value < root->right->data) {
        root->right = rightRotate(root->right);
        return leftRotate(root);
    }

    return root;
}

int AVL::getHeight(AVL* node) {
    if (node == NULL) {
        return 0;
    }
    return node->height;
```

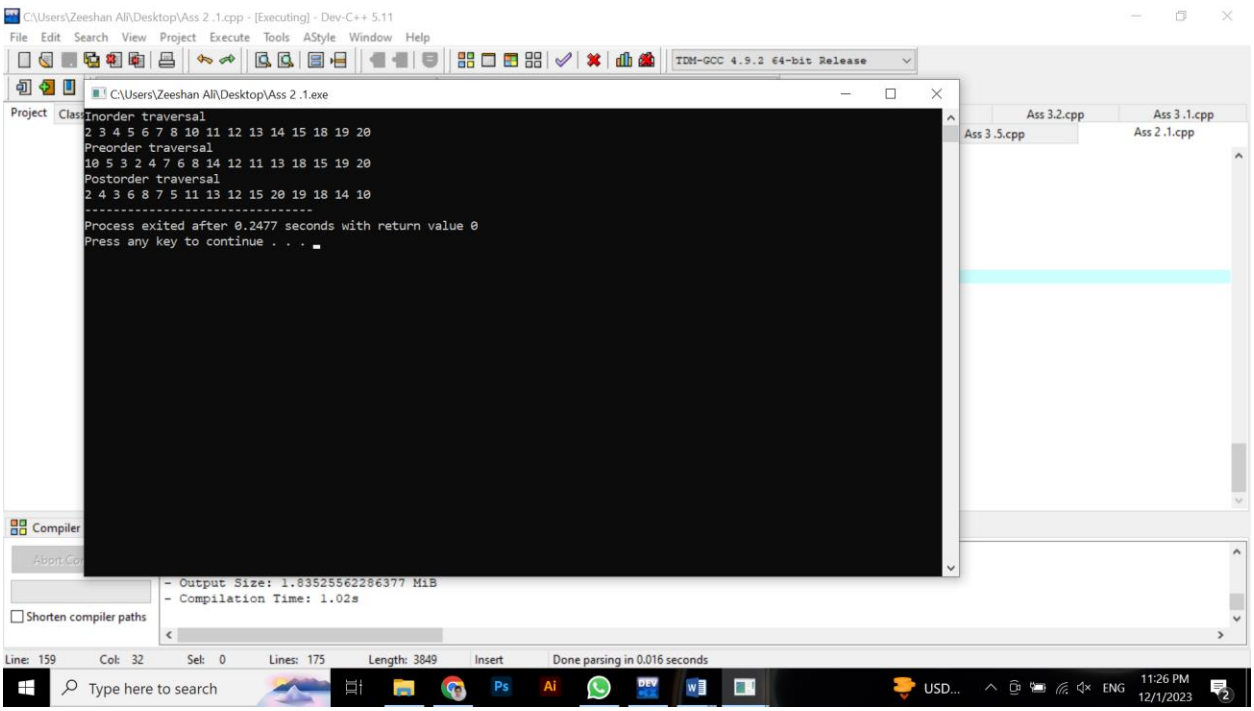
```
}

int AVL::getBalance(AVL* node) {
   if (node == NULL) {
      return 0;
   }
   return getHeight(node->left) - getHeight(node->right);
}

AVL* AVL::rightRotate(AVL* y) {
   AVL* x = y->left;
   AVL* T2 = x->right;

   x->right = y;
   y->left = T2;

   y->height = 1 + max(getHeight(y->left), getHeight(y->right));
   x->height = 1 + max(getHeight(x->left), getHeight(x->right));

   return x;
}

AVL* AVL::leftRotate(AVL* x) {
   AVL* y = x->right;
   AVL* T2 = y->left;

   y->left = x;
```

```
    x->right = T2;

    x->height = 1 + max(getHeight(x->left), getHeight(x->right));
    y->height = 1 + max(getHeight(y->left), getHeight(y->right));

    return y;
}

AVL* AVL::minValueNode(AVL* node) {
    AVL* current = node;

    while (current->left != NULL) {
        current = current->left;
    }

    return current;
}

void AVL::Inorder(AVL* root) {
    if (root == NULL) {
        return;
    }
    Inorder(root->left);
    cout << root->data << " ";
    Inorder(root->right);
}
```

```
void AVL::preorder(AVL* root) {
   if (root == NULL) {
      return;
   }
   cout << root->data << " ";
   preorder(root->left);
   preorder(root->right);
}

void AVL::postorder(AVL* root) {
   if (root == NULL) {
      return;
   }
   postorder(root->left);
   postorder(root->right);
   cout << root->data << " ";
}

int main() {
   AVL avl, *root = NULL;
   root = avl.Insert(root, 10);
   root = avl.Insert(root, 5);
   root = avl.Insert(root, 15);
   root = avl.Insert(root, 3);
   root = avl.Insert(root, 7);
   root = avl.Insert(root, 12);
   root = avl.Insert(root, 18);
```

```
    root = avl.Insert(root, 2);
    root = avl.Insert(root, 4);
    root = avl.Insert(root, 6);
    root = avl.Insert(root, 8);
    root = avl.Insert(root, 11);
    root = avl.Insert(root, 14);
    root = avl.Insert(root, 13);
    root = avl.Insert(root, 19);
    root = avl.Insert(root, 20);
    cout << "Inorder traversal" << endl;
    avl.Inorder(root);
    cout << "\nPreorder traversal" << endl;
    avl.preorder(root);
    cout << "\nPostorder traversal" << endl;
    avl.postorder(root);

    return 0;
}
```

Output:


C:\Users\Zeeshan Ali\Desktop\Ass 2 .1.cpp - [Executing] - Dev-C++ 5.11
File Edit Search View Project Execute Tools AStyle Window Help
TDM-GCC 4.9.2 64-bit Release
C:\Users\Zeeshan Ali\Desktop\Ass 2 .1.exe
Inorder traversal
2 3 4 5 6 7 8 10 11 12 13 14 15 18 19 20
Preorder traversal
10 5 3 2 4 7 6 8 14 12 11 13 18 15 19 20
Postorder traversal
2 4 3 6 8 7 5 11 13 12 15 20 19 18 14 10
Process exited after 0.2477 seconds with return value 0
Press any key to continue . . .
Project
Ass 3.2.cpp
Ass 3 .1.cpp
Ass 3 .5.cpp
Ass 2 .1.cpp
Compiler
- Output Size: 1.83525562286377 MiB
- Compilation Time: 1.02s
Shorten compiler paths
Line: 159 Col: 32 Sel: 0 Lines: 175 Length: 3849 Insert
Done parsing in 0.016 seconds
Type here to search
USD...
ENG
11:26 PM
12/1/2023