DSA LAB

Assignment 7

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Branch: CSE (AI & ML)

Binary Search Tree

Statement:

Implement a Binary search tree with operations – create, search, insert, inorder, preorder and postorder. Write a menu driven program that performs the above operations also counts the total nodes and total leaf nodes in the tree. int count(T) – returns the total number of nodes from BST int countLeaf(T) – returns the total number of leaf nodes from BST

Code:

```
#include <stdio.h>
#include <stdlib.h>

struct TreeNode {
    int val;
    struct TreeNode* left;
    struct TreeNode* right;
};

void addNode(struct TreeNode** root, int num) {
    struct TreeNode* node;
    node = (struct TreeNode*)malloc(sizeof(struct TreeNode));
    node->val = num;
    node->left = NULL;
    node->right = NULL;

    if (*root == NULL) {
        *root = node;
        return;
    }

    struct TreeNode* temp = *root;
    while (temp != NULL) {
        if (temp->val == num) {
            break;
        }if (temp->val < num) {
            if (temp->right != NULL) {
                temp = temp->right;
```

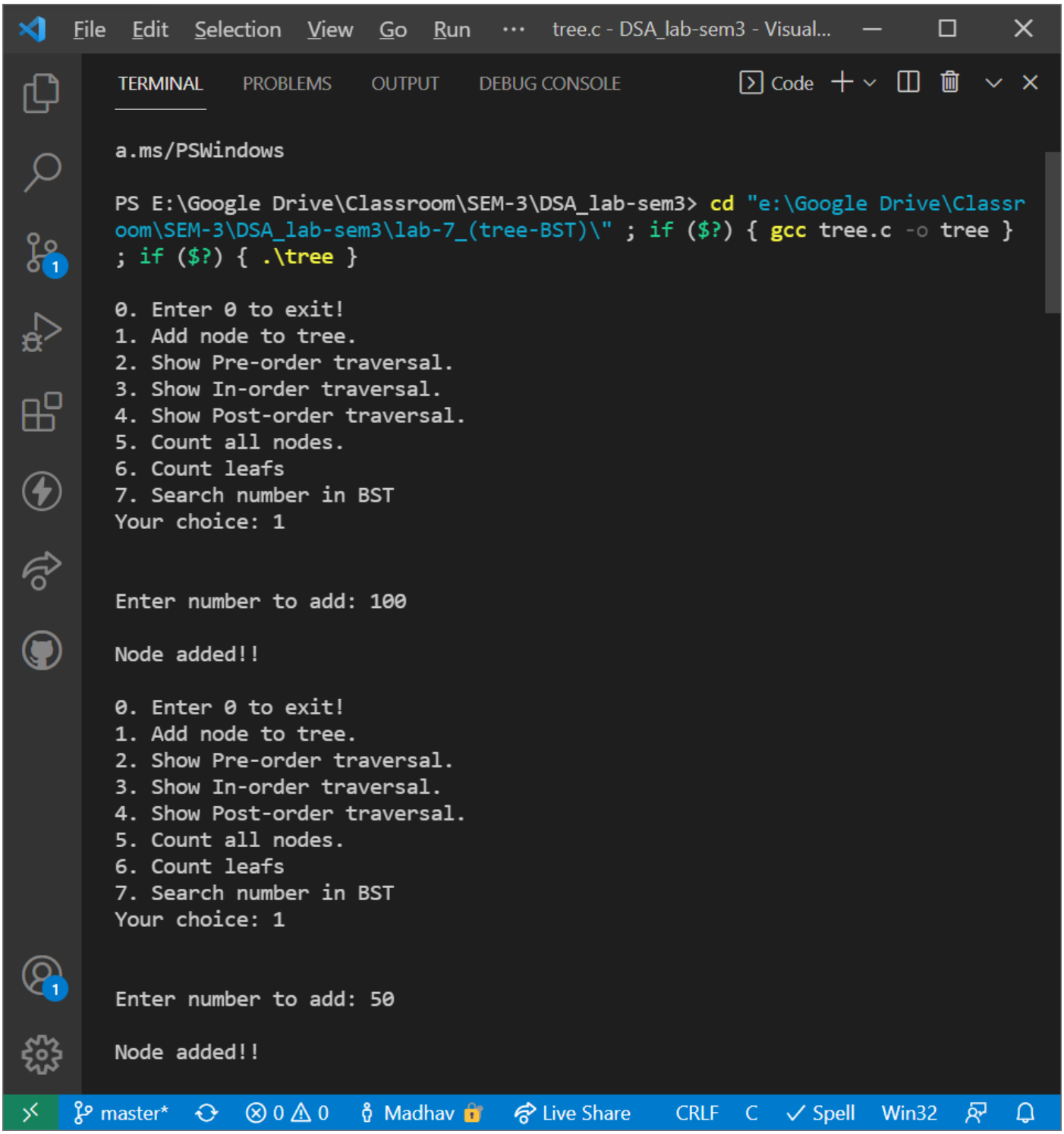
```
            }
            else {
                temp->right = node;
                break;
            }
        }
        else {
            if (temp->left != NULL) {
                temp = temp->left;
            }
            else {
                temp->left = node;
                break;
            }
        }
    }
}

void preOrder(struct TreeNode* node) {
    if (node == NULL) return;
    printf("%d ", node->val);
    preOrder(node->left);
    preOrder(node->right);
}

void inOrder(struct TreeNode* node) {
    if (node == NULL) return;
    inOrder(node->left);
    printf("%d ", node->val);
    inOrder(node->right);
}

void postOrder(struct TreeNode* node) {
    if (node == NULL) return;
    postOrder(node->left);
    postOrder(node->right);
    printf("%d ", node->val);
}

int searchBST(struct TreeNode** root, int num) {
```

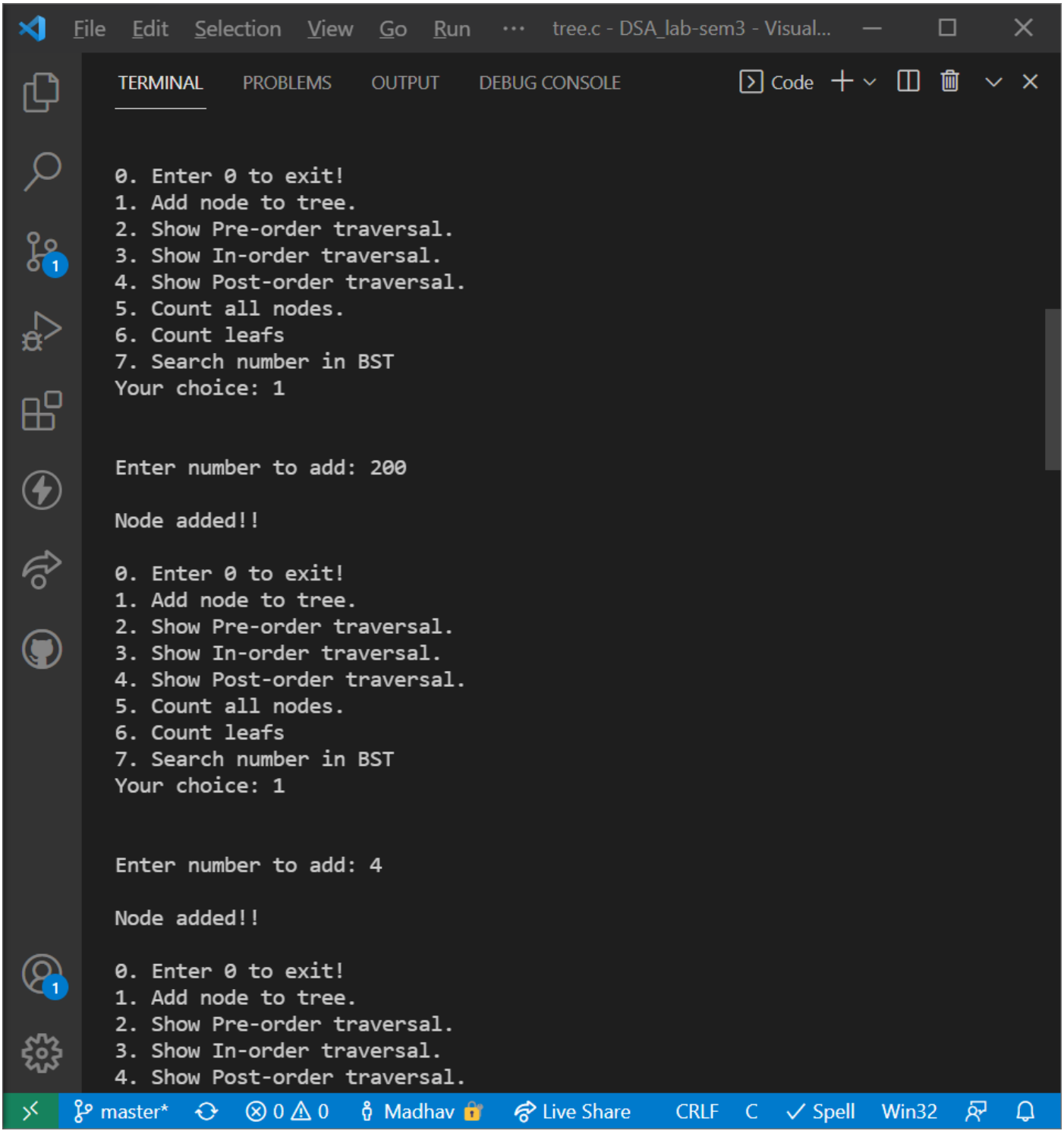
```
    struct TreeNode* temp = *root;
    while (temp != NULL) {
        if (temp->val == num) {
            return 1;
        }
        else if (temp->val < num) {
            temp = temp->right;
        }
        else {
            temp = temp->left;
        }
    }
    return 0;
}

void countNodes(struct TreeNode* node, int* num) {
    if (node == NULL) return;
    *num = *num + 1;
    countNodes(node->left, num);
    countNodes(node->right, num);
}

int countAllNodes(struct TreeNode** root) {
    int count = 0;
    countNodes(*root, &count);
    return count;
}

void countLeaf(struct TreeNode* node, int* num) {
    if (node == NULL) return;
    if (node->left == NULL && node->right == NULL) {
        *num = *num + 1;
        return;
    }
    countLeaf(node->left, num);
    countLeaf(node->right, num);
}

int countAllLeaf(struct TreeNode** root) {
    int count = 0;
```

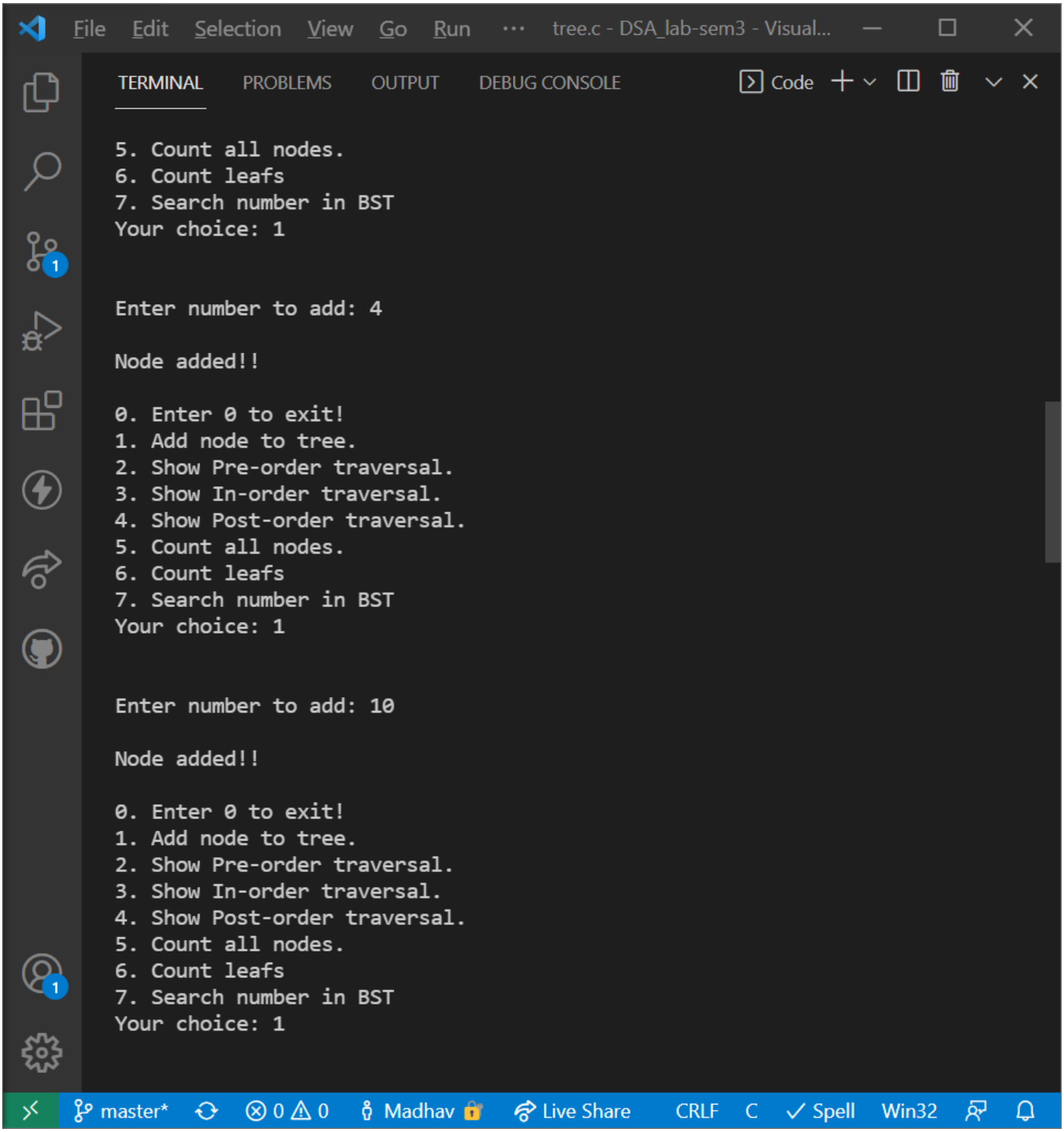
```
    countLeaf(*root, &count);
    return count;
}

int main(void) {

    struct TreeNode** root = (struct TreeNode**)malloc(sizeof(struct
TreeNode*));
    *root = NULL;

    int choice = 0;
    do {
        printf("\n0. Enter 0 to exit!");
        printf("\n1. Add node to tree.");
        printf("\n2. Show Pre-order traversal.");
        printf("\n3. Show In-order traversal.");
        printf("\n4. Show Post-order traversal.");
        printf("\n5. Count all nodes.");
        printf("\n6. Count leafs");
        printf("\n7. Search number in BST");

        printf("\nYour choice: ");
        scanf("%d", &choice);

        int inp, src;
        switch (choice) {
        case 0:
            printf("\n\nExit...!\n\n");
            break;
        case 1:
            printf("\n\nEnter number to add: ");
            scanf("%d", &inp);
            addNode(root, inp);
            printf("\nNode added!!\n");
            break;
        case 2:
            printf("\n\nPre-order: ");
            preOrder(*root);
            printf("\n\n");
            break;
```

```
        case 3:
            printf("\n\nIN-order: ");
            inOrder(*root);
            printf("\n\n");
            break;
        case 4:
            printf("\n\nPost-order: ");
            postOrder(*root);
            printf("\n\n");
            break;
        case 5:
            printf("\n\nAll nodes count: %d\n", countAllNodes(root));
            break;
        case 6:
            printf("\n\nAll leaf nodes count: %d\n",
countAllLeaf(root));
            break;
        case 7:
            printf("\n\nEnter number to search: ");
            scanf("%d", &inp);
            if (searchBST(root, inp) == 0) {
                printf("\nNumber doesn't exist!!");
            }
            else {
                printf("\nNumber does exists!!");
            }
            printf("\n\n");
            break;
        default:
            printf("\nERROR: Invalid choice!!!");
            break;
        }
    } while (choice != 0);

    return 0;
}
```

Output:


File Edit Selection View Go Run ··· tree.c - DSA_lab-sem3 - Visual...
TERMINAL PROBLEMS OUTPUT DEBUG CONSOLE
Code
a.ms/PSWindows
PS E:\Google Drive\Classroom\SEM-3\DSA_lab-sem3> cd "e:\Google Drive\Classroom\SEM-3\DSA_lab-sem3\lab-7_(tree-BST)\" ; if ($?) { gcc tree.c -o tree } ; if ($?) { .\tree }
0. Enter 0 to exit!
1. Add node to tree.
2. Show Pre-order traversal.
3. Show In-order traversal.
4. Show Post-order traversal.
5. Count all nodes.
6. Count leafs
7. Search number in BST
Your choice: 1
Enter number to add: 100
Node added!!
0. Enter 0 to exit!
1. Add node to tree.
2. Show Pre-order traversal.
3. Show In-order traversal.
4. Show Post-order traversal.
5. Count all nodes.
6. Count leafs
7. Search number in BST
Your choice: 1
Enter number to add: 50
Node added!!
master* 0 0 Madhav Live Share CRLF C Spell Win32


File Edit Selection View Go Run ··· tree.c - DSA_lab-sem3 - Visual...
TERMINAL PROBLEMS OUTPUT DEBUG CONSOLE
Code
0. Enter 0 to exit!
1. Add node to tree.
2. Show Pre-order traversal.
3. Show In-order traversal.
4. Show Post-order traversal.
5. Count all nodes.
6. Count leafs
7. Search number in BST
Your choice: 1
Enter number to add: 200
Node added!!
0. Enter 0 to exit!
1. Add node to tree.
2. Show Pre-order traversal.
3. Show In-order traversal.
4. Show Post-order traversal.
5. Count all nodes.
6. Count leafs
7. Search number in BST
Your choice: 1
Enter number to add: 4
Node added!!
0. Enter 0 to exit!
1. Add node to tree.
2. Show Pre-order traversal.
3. Show In-order traversal.
4. Show Post-order traversal.
master* 0 0 Madhav Live Share CRLF C Spell Win32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TERMINAL PROBLEMS OUTPUT DEBUG CONSOLE
Code
5. Count all nodes.
6. Count leafs
7. Search number in BST
Your choice: 1
Enter number to add: 4
Node added!!
0. Enter 0 to exit!
1. Add node to tree.
2. Show Pre-order traversal.
3. Show In-order traversal.
4. Show Post-order traversal.
5. Count all nodes.
6. Count leafs
7. Search number in BST
Your choice: 1
Enter number to add: 10
Node added!!
0. Enter 0 to exit!
1. Add node to tree.
2. Show Pre-order traversal.
3. Show In-order traversal.
4. Show Post-order traversal.
5. Count all nodes.
6. Count leafs
7. Search number in BST
Your choice: 1
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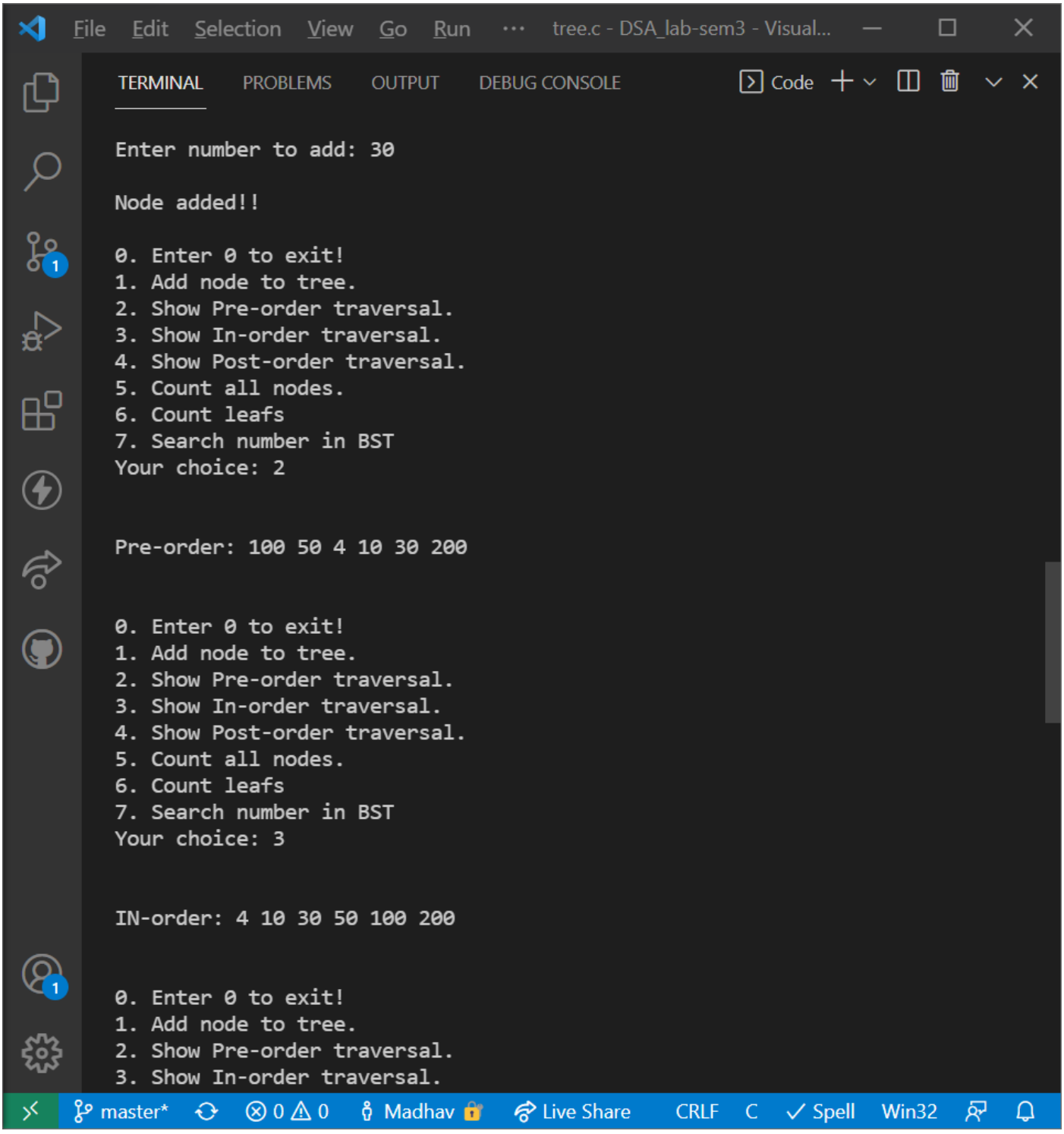
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TERMINAL PROBLEMS OUTPUT DEBUG CONSOLE
Code
Enter number to add: 30
Node added!!
0. Enter 0 to exit!
1. Add node to tree.
2. Show Pre-order traversal.
3. Show In-order traversal.
4. Show Post-order traversal.
5. Count all nodes.
6. Count leafs
7. Search number in BST
Your choice: 2
Pre-order: 100 50 4 10 30 200
0. Enter 0 to exit!
1. Add node to tree.
2. Show Pre-order traversal.
3. Show In-order traversal.
4. Show Post-order traversal.
5. Count all nodes.
6. Count leafs
7. Search number in BST
Your choice: 3
IN-order: 4 10 30 50 100 200
0. Enter 0 to exit!
1. Add node to tree.
2. Show Pre-order traversal.
3. Show In-order traversal.
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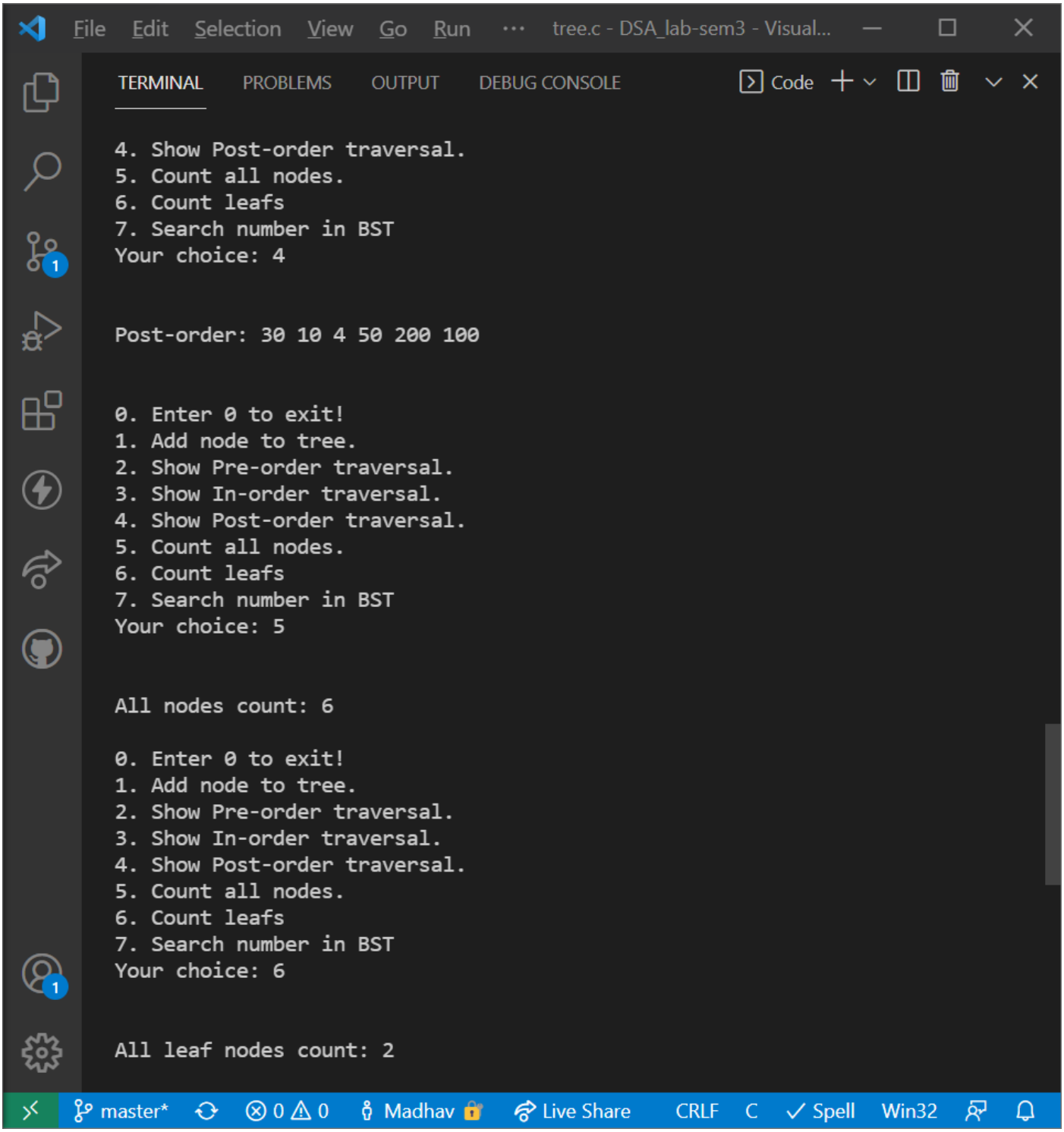
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TERMINAL PROBLEMS OUTPUT DEBUG CONSOLE
Code
4. Show Post-order traversal.
5. Count all nodes.
6. Count leafs
7. Search number in BST
Your choice: 4
Post-order: 30 10 4 50 200 100
0. Enter 0 to exit!
1. Add node to tree.
2. Show Pre-order traversal.
3. Show In-order traversal.
4. Show Post-order traversal.
5. Count all nodes.
6. Count leafs
7. Search number in BST
Your choice: 5
All nodes count: 6
0. Enter 0 to exit!
1. Add node to tree.
2. Show Pre-order traversal.
3. Show In-order traversal.
4. Show Post-order traversal.
5. Count all nodes.
6. Count leafs
7. Search number in BST
Your choice: 6
All leaf nodes count: 2
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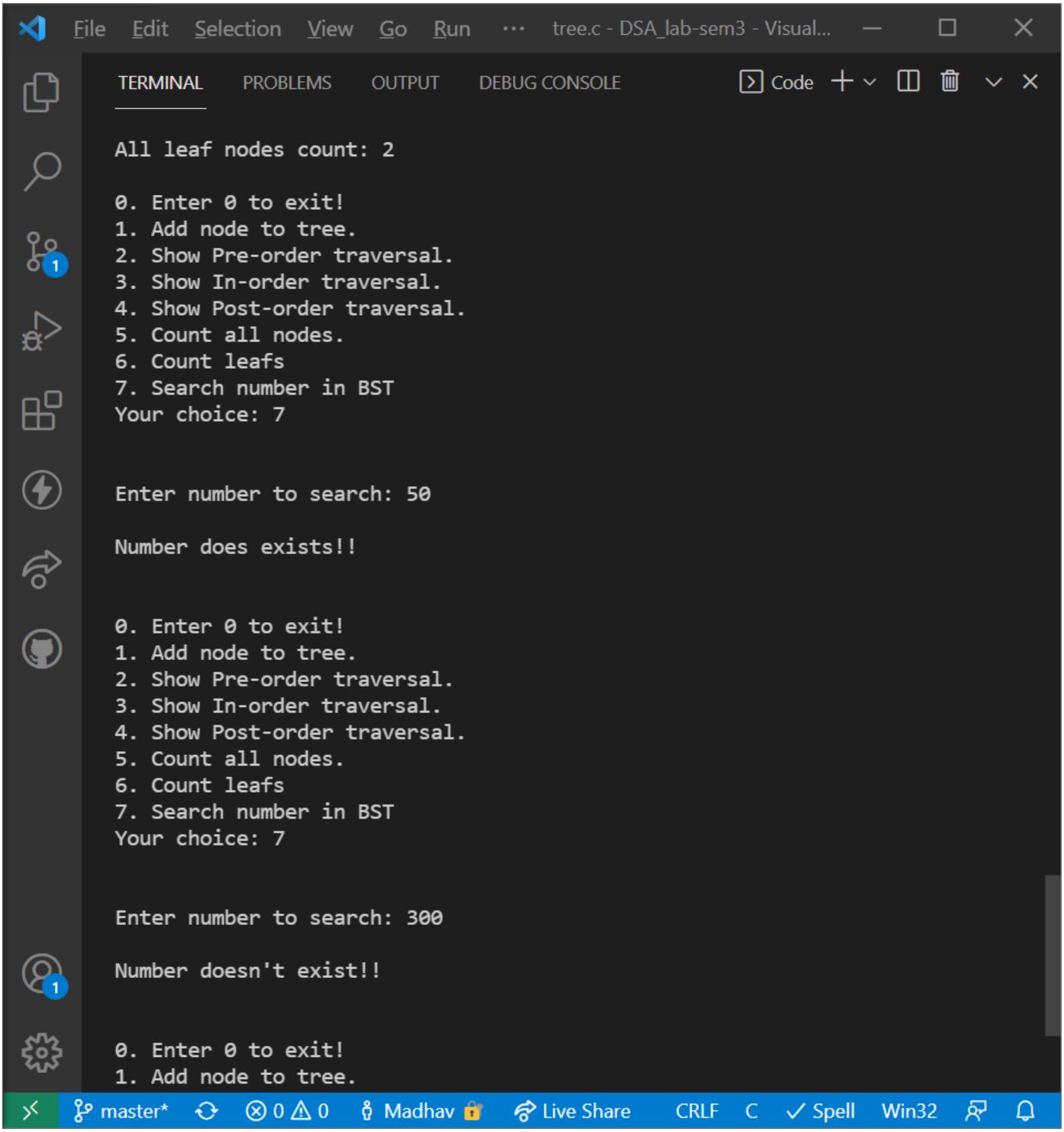
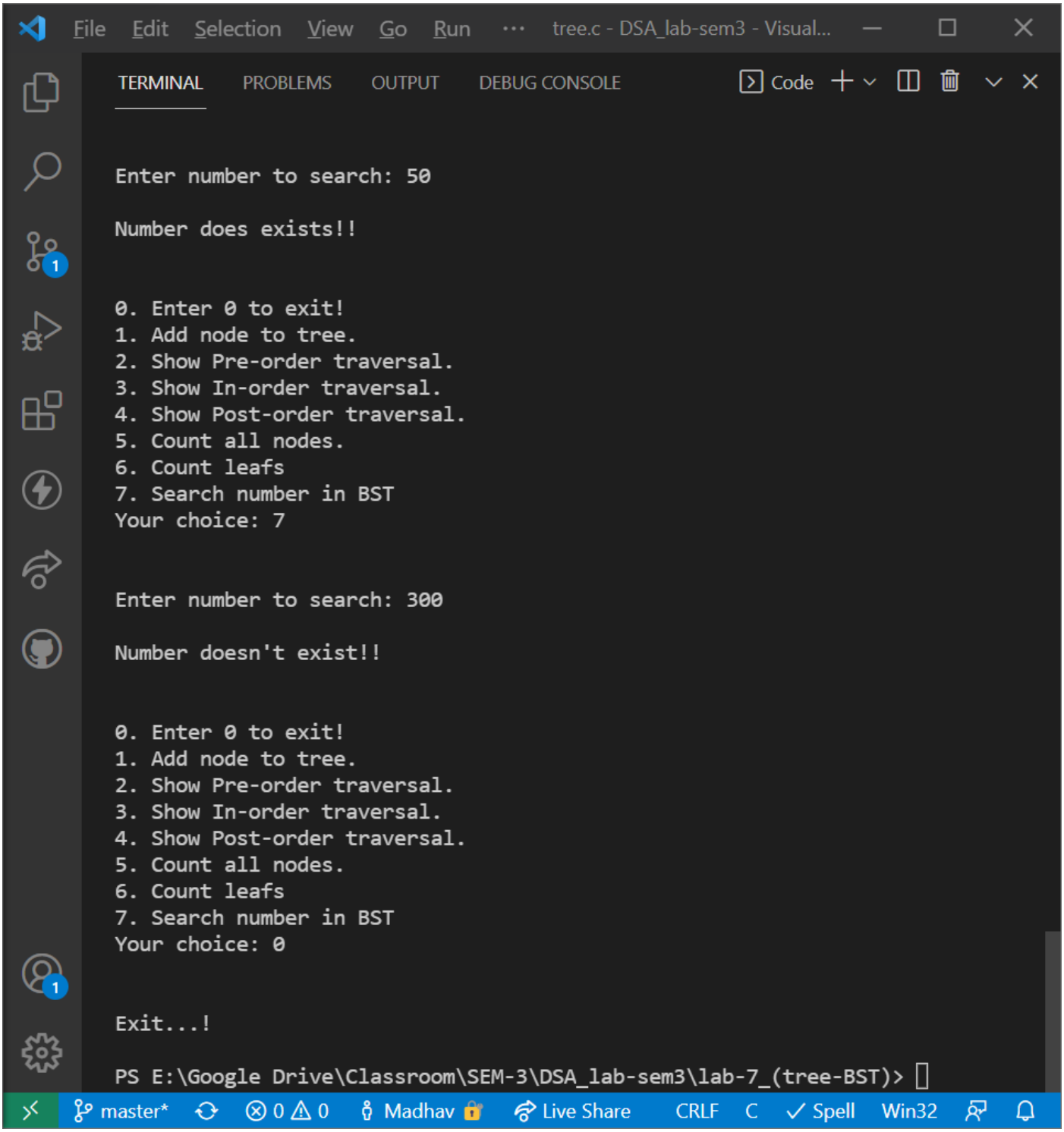

File Edit Selection View Go Run ··· tree.c - DSA_lab-sem3 - Visual...
TERMINAL PROBLEMS OUTPUT DEBUG CONSOLE
Code
All leaf nodes count: 2
0. Enter 0 to exit!
1. Add node to tree.
2. Show Pre-order traversal.
3. Show In-order traversal.
4. Show Post-order traversal.
5. Count all nodes.
6. Count leafs
7. Search number in BST
Your choice: 7
Enter number to search: 50
Number does exists!!
0. Enter 0 to exit!
1. Add node to tree.
2. Show Pre-order traversal.
3. Show In-order traversal.
4. Show Post-order traversal.
5. Count all nodes.
6. Count leafs
7. Search number in BST
Your choice: 7
Enter number to search: 300
Number doesn't exist!!
0. Enter 0 to exit!
1. Add node to tree.
master* 0 0 Madhav Live Share CRLF C Spell Win32


File Edit Selection View Go Run ··· tree.c - DSA_lab-sem3 - Visual...
TERMINAL PROBLEMS OUTPUT DEBUG CONSOLE
Code
Enter number to search: 50
Number does exists!!
0. Enter 0 to exit!
1. Add node to tree.
2. Show Pre-order traversal.
3. Show In-order traversal.
4. Show Post-order traversal.
5. Count all nodes.
6. Count leafs
7. Search number in BST
Your choice: 7
Enter number to search: 300
Number doesn't exist!!
0. Enter 0 to exit!
1. Add node to tree.
2. Show Pre-order traversal.
3. Show In-order traversal.
4. Show Post-order traversal.
5. Count all nodes.
6. Count leafs
7. Search number in BST
Your choice: 0
Exit...!
PS E:\Google Drive\Classroom\SEM-3\DSA_lab-sem3\lab-7_(tree-BST)>
master* 0 0 Madhav Live Share CRLF C Spell Win32