Assignment No. 6

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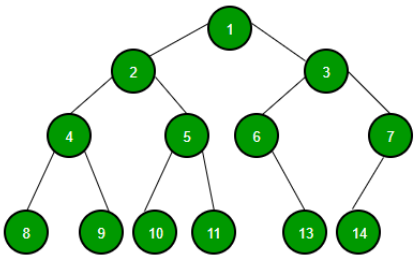
Q.1 Create Binary Tree and Find height of the tree and print leaf nodes. Find mirror image and print original and mirror image.

Binary Tree

A tree whose elements have at most 2 children is called a binary tree. Since each element in a binary tree can have only 2 children, we typically name them the left and right child.



Algorithm:

1. **Mirror of the tree Recursive:**

   Step 1: If treet! = NULL

   Step 2: temp =tree->Right

   tree->Right= tree->Left

   tree->Left=temp

   Step 3: Mirror_BST(tree->Left)

   Step 4: Mirror_BST(tree->Right)

2. **Height of the tree recursive:**

   Step 1: If (root=NULL)

   Display “tree is empty”

   stop

   Step 2: Else

   Step 3: return 1 + max(height(root->left), height(root->right))

3. **Leaf Node of tree:**

Step 1: if (r == NULL)
return 0;

Step 2: if (r->left == NULL && r->right == NULL)

printf("\t%d", r->data);

Step 3: return (leaf(r->left) + leaf(r->right))

Program:

```
#include <stdio.h>
#include <stdlib.h>
struct node *st[100];
int top = -1;
struct node
{
    int data;
    struct node *left;
    struct node *right;

} * root;
// ---------------------------------------------
struct node *create()
{
    int ch;
    struct node *temp;
    printf("\nDo you want to create a Tree ?\n(1 for yes 0 for No): ");
    scanf("%d", &ch);
    if (ch == 0)
        return NULL;
    temp = malloc(sizeof(struct node));
    printf("\nEnter the data: ");
    scanf("%d", &temp->data);
    printf("\nEnter data for left child of %d", temp->data);
    temp->left = create();
    printf("\nEnter data for right child of %d", temp->data);
    temp->right = create();
    return temp;
}
// ---------------------------------------------
struct node *search(struct node *temp, int data)
{
    if (temp == NULL)
    {
        printf("\n\tData is not present");
        return NULL;
```

```
    }
    if (temp->data == data)
    {
        printf("\n\tData is present\n");
        return temp;
    }
    if (temp->data > data)
    {
        return search(temp->left, data);
    }
    else
    {
        return search(temp->right, data);
    }
}
// -------------------------------------------
void inorder(struct node *temp)
{
    if (temp != NULL)
    {
        inorder(temp->left);
        printf("\t%d", temp->data);
        inorder(temp->right);
    }
}
void preorder(struct node *temp)
{
    if (temp != NULL)
    {
        printf("\t%d", temp->data);
        preorder(temp->left);
        preorder(temp->right);
    }
}

void postorder(struct node *temp)
{
    if (temp != NULL)
    {
        postorder(temp->left);
        postorder(temp->right);
        printf("\t%d", temp->data);
    }
}
// -------------------------------------------
void push(struct node *temp)
{
    st[++top] = temp;
```

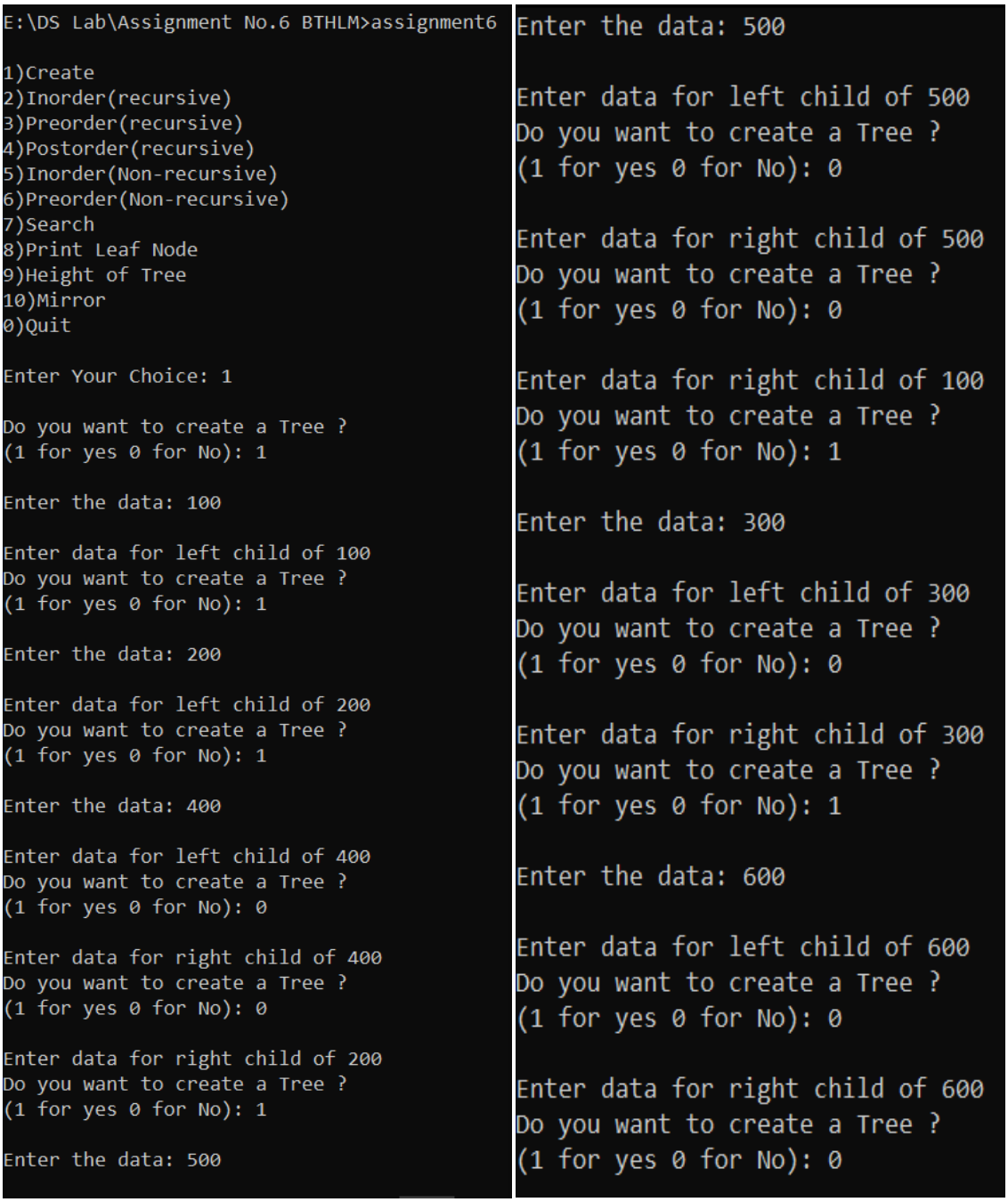
```
}

struct node *pop()
{
    return st[top--];
}

void inordernr(struct node *temp)
{
    struct node *r;
    while (temp != NULL)
    {
        push(temp);
        temp = temp->left;
    }

    while (top != -1)
    {
        r = pop();

        printf("\t%d", r->data);
        r = r->right;
        while (r != NULL)
        {
            push(r);
            r = r->left;
        }
    }
}
void preordernr(struct node *temp)
{
    struct node *r;
    while (temp != NULL)
    {
        printf("\t%d", temp->data);
        push(temp);
        temp = temp->left;
    }

    while (top != -1)
    {
        r = pop();

        r = r->right;
        while (r != NULL)
        {
            printf("\t%d", r->data);
            push(r);
```

```
            r = r->left;
        }
    }
}
// ---------------------------------------------
int leaf(struct node *r)
{
    if (r == NULL)
        return 0;

    if (r->left == NULL && r->right == NULL)
    {
        printf("\t%d", r->data);
        return 1;
    }
    return (leaf(r->left) + leaf(r->right));
}
// ---------------------------------------------
struct node *mirror(struct node *T)
{
    struct node *temp;
    if (T == NULL)
    {
        return NULL;
    }
    else
    {
        temp = T->left;
        T->left = mirror(T->right);
        T->right = mirror(temp);
        return T;
    }
}
// ---------------------------------------------
int max(int value1, int value2)
{
    return ((value1 > value2) ? value1 : value2);
}
int height(struct node *temp)
{
    if (temp == NULL)
    {
        return 0;
    }
    else if (temp->left == NULL && temp->right == NULL)
    {
        return 0;
    }
```

```
    return (max(height(temp->left), height(temp->right)) + 1);
}

void main()
{
    struct node *temp, *temp1, *temp3;
    int choice, ele;
    do
    {
        printf("\n1)Create\n2)Inorder(recursive)\n3)Preorder(recursive)\n4)Pos
torder(recursive)\n5)Inorder(Non-recursive)\n6)Preorder(Non-
recursive)\n7)Search\n8)Print Leaf Node\n9)Height of
Tree\n10)Mirror\n0)Quit\n\nEnter Your Choice: ");
        scanf("%d", &choice);
        switch (choice)
        {
        case 1:
            root = create();
            temp = root;
            break;
        case 2:
            printf("\n=====Inorder (Recursive)=====\n");
            inorder(temp);
            printf("\n================================\n");
            break;
        case 3:
            printf("\n=====Preorder (Recursive)=====\n");
            preorder(temp);
            printf("\n================================\n");
            break;
        case 4:
            printf("\n=====Postorder (Recursive)=====\n");
            postorder(temp);
            printf("\n================================\n");
            break;
        case 5:
            printf("\n=====Inorder (Non - Recursive)=====\n");
            inordernr(temp);
            printf("\n================================\n");
            break;
        case 6:
            printf("\n=====Preorder (Non - Recursive)=====\n");
            preordernr(temp);
            printf("\n================================\n");
            break;
        case 7:
            printf("\nEnter the data do you want to search: ");
            scanf("%d", &ele);
```

```
            printf("\n=====Search Result=====\n");
            search(root, ele);
            printf("\n================================\n");
            break;
        case 8:
            printf("\n=====Leafs of Tree=====\n");
            printf("\nNo. of Leaf Nodes = %d", leaf(temp));
            printf("\n================================\n");
            break;
        case 9:
            printf("\n=====Height of Tree=====\n");
            int h = height(temp);
            printf("\t%d", h);
            printf("\n================================\n");
            break;
        case 10:
            printf("Printing Original and Mirror in Inorder\n");
            temp3 = temp;
            printf("\n=====Original Tree=====\n");
            inorder(temp3);
            temp1 = mirror(temp3);
            printf("\n=====Mirror Tree=====\n");
            inorder(temp1);
            printf("\n================================\n");
            break;
        default:
            break;
        }
    } while (choice != 0);
}
```

Output:



```
E:\DS Lab\Assignment No.6 BTHLM>assignment6

1)Create
2)Inorder(recursive)
3)Preorder(recursive)
4)Postorder(recursive)
5)Inorder(Non-recursive)
6)Preorder(Non-recursive)
7)Search
8)Print Leaf Node
9)Height of Tree
10)Mirror
0)Quit

Enter Your Choice: 1

Do you want to create a Tree ?
(1 for yes 0 for No): 1

Enter the data: 100

Enter data for left child of 100
Do you want to create a Tree ?
(1 for yes 0 for No): 1

Enter the data: 200

Enter data for left child of 200
Do you want to create a Tree ?
(1 for yes 0 for No): 1

Enter the data: 400

Enter data for left child of 400
Do you want to create a Tree ?
(1 for yes 0 for No): 0

Enter data for right child of 400
Do you want to create a Tree ?
(1 for yes 0 for No): 0

Enter data for right child of 200
Do you want to create a Tree ?
(1 for yes 0 for No): 1

Enter the data: 500

Enter the data: 500

Enter data for left child of 500
Do you want to create a Tree ?
(1 for yes 0 for No): 0

Enter data for right child of 500
Do you want to create a Tree ?
(1 for yes 0 for No): 0

Enter data for right child of 100
Do you want to create a Tree ?
(1 for yes 0 for No): 1

Enter the data: 300

Enter data for left child of 300
Do you want to create a Tree ?
(1 for yes 0 for No): 0

Enter data for right child of 300
Do you want to create a Tree ?
(1 for yes 0 for No): 1

Enter the data: 600

Enter data for left child of 600
Do you want to create a Tree ?
(1 for yes 0 for No): 0

Enter data for right child of 600
Do you want to create a Tree ?
(1 for yes 0 for No): 0
```

```
Enter Your Choice: 2

=====Inorder (Recursive)=====
        400     200     500     100     300     600
================================

1)Create
2)Inorder(recursive)
3)Preorder(recursive)
4)Postorder(recursive)
5)Inorder(Non-recursive)
6)Preorder(Non-recursive)
7)Search
8)Print Leaf Node
9)Height of Tree
10)Mirror
0)Quit

Enter Your Choice: 3

=====Preorder (Recursive)=====
        100     200     400     500     300     600
================================

1)Create
2)Inorder(recursive)
3)Preorder(recursive)
4)Postorder(recursive)
5)Inorder(Non-recursive)
6)Preorder(Non-recursive)
7)Search
8)Print Leaf Node
9)Height of Tree
10)Mirror
0)Quit

Enter Your Choice: 4

=====Postorder (Recursive)=====
        400     500     200     600     300     100
================================
```

```
1)Create
2)Inorder(recursive)
3)Preorder(recursive)
4)Postorder(recursive)
5)Inorder(Non-recursive)
6)Preorder(Non-recursive)
7)Search
8)Print Leaf Node
9)Height of Tree
10)Mirror
0)Quit

Enter Your Choice: 7

Enter the data do you want to search: 100

=====Search Result=====

        Data is present

================================

1)Create
2)Inorder(recursive)
3)Preorder(recursive)
4)Postorder(recursive)
5)Inorder(Non-recursive)
6)Preorder(Non-recursive)
7)Search
8)Print Leaf Node
9)Height of Tree
10)Mirror
0)Quit

Enter Your Choice: 7

Enter the data do you want to search: 700

=====Search Result=====

        Data is not present
================================
```

```
1)Create
2)Inorder(recursive)
3)Preorder(recursive)
4)Postorder(recursive)
5)Inorder(Non-recursive)
6)Preorder(Non-recursive)
7)Search
8)Print Leaf Node
9)Height of Tree
10)Mirror
0)Quit

Enter Your Choice: 8

=====Leafs of Tree=====
        400     500     600
No. of Leaf Nodes = 3
================================

1)Create
2)Inorder(recursive)
3)Preorder(recursive)
4)Postorder(recursive)
5)Inorder(Non-recursive)
6)Preorder(Non-recursive)
7)Search
8)Print Leaf Node
9)Height of Tree
10)Mirror
0)Quit

Enter Your Choice: 9

=====Height of Tree=====
        2
================================
```

```
1)Create
2)Inorder(recursive)
3)Preorder(recursive)
4)Postorder(recursive)
5)Inorder(Non-recursive)
6)Preorder(Non-recursive)
7)Search
8)Print Leaf Node
9)Height of Tree
10)Mirror
0)Quit

Enter Your Choice: 10
Printing Original and Mirror in Inorder

=====Original Tree=====
        400     200     500     100     300     600
=====Mirror Tree=====
        600     300     100     500     200     400
================================
```