DAY 10 – BINARY SEARCH TREE

12.. Write a menu driven C program to implement a binary search tree using linked list and perform the following operations on it

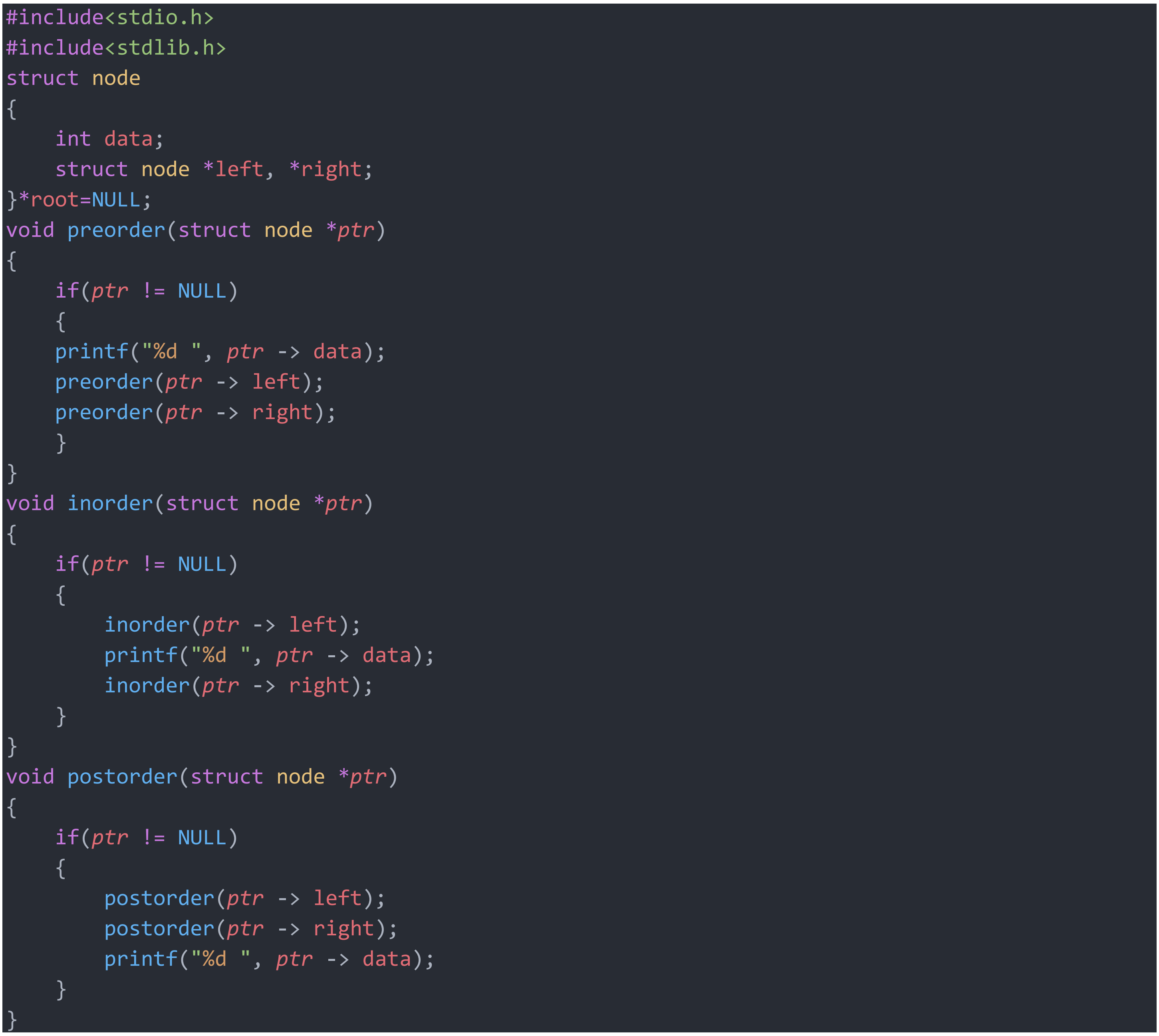
a. Insertion.

b. Deletion.

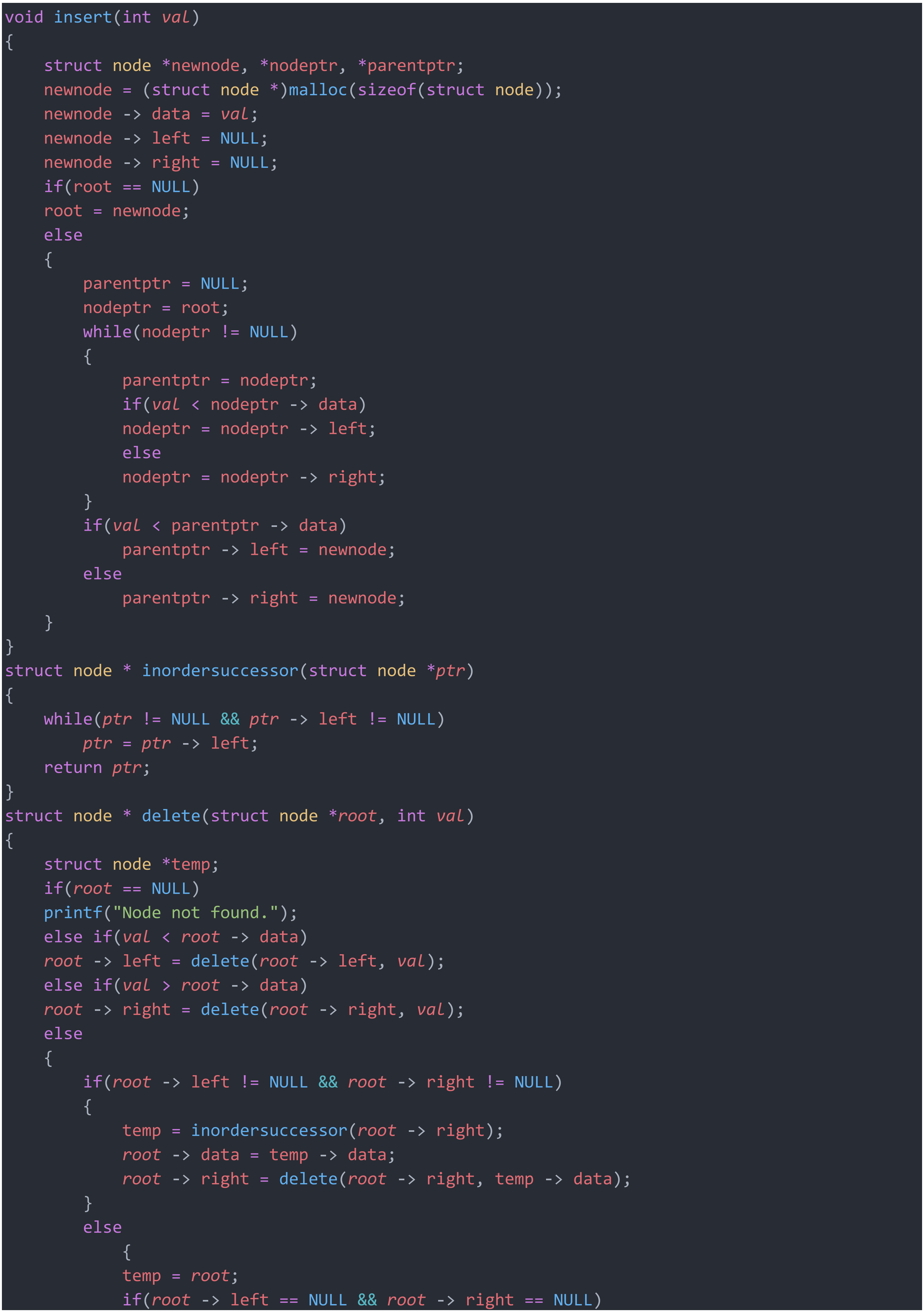
c. Traversals.

d. Search for a specified node

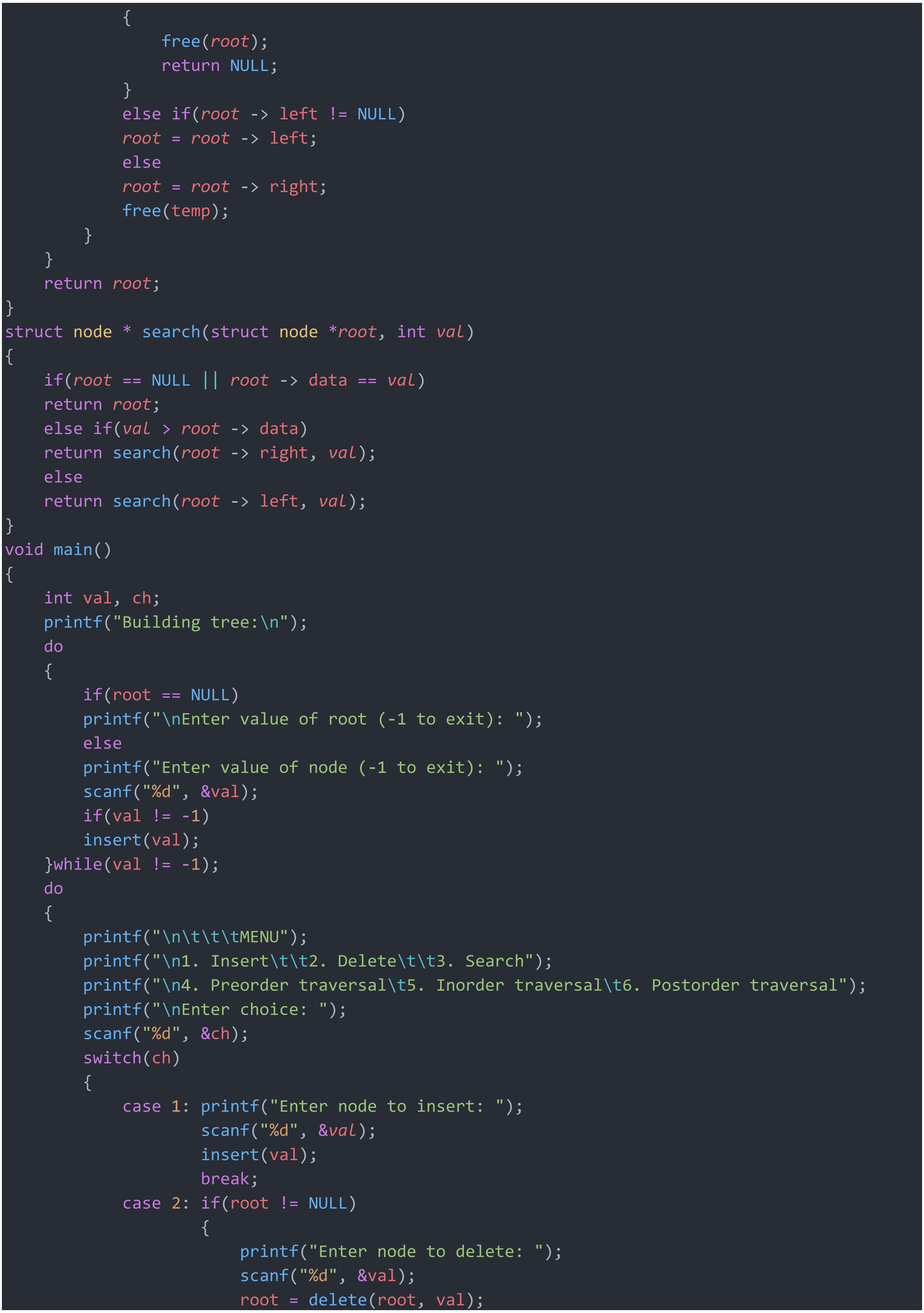
PROGRAM



```c
#include<stdio.h>
#include<stdlib.h>
struct node
{
    int data;
    struct node *left, *right;
}*root=NULL;
void preorder(struct node *ptr)
{
    if(ptr != NULL)
    {
    printf("%d ", ptr -> data);
    preorder(ptr -> left);
    preorder(ptr -> right);
    }
}
void inorder(struct node *ptr)
{
    if(ptr != NULL)
    {
        inorder(ptr -> left);
        printf("%d ", ptr -> data);
        inorder(ptr -> right);
    }
}
void postorder(struct node *ptr)
{
    if(ptr != NULL)
    {
        postorder(ptr -> left);
        postorder(ptr -> right);
        printf("%d ", ptr -> data);
    }
}
```

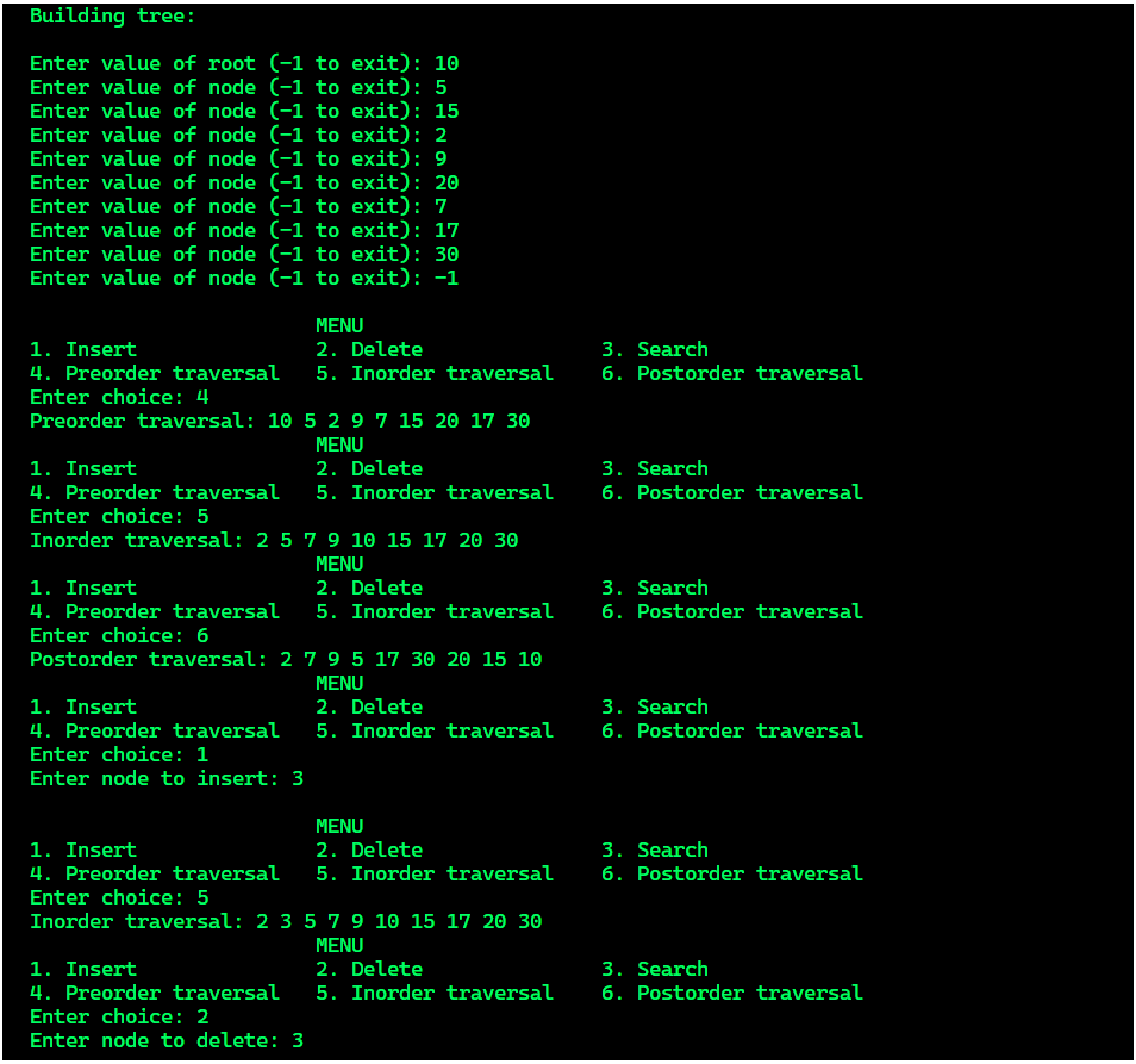


```
void insert(int val)
{
    struct node *newnode, *nodeptr, *parentptr;
    newnode = (struct node *)malloc(sizeof(struct node));
    newnode -> data = val;
    newnode -> left = NULL;
    newnode -> right = NULL;
    if(root == NULL)
    root = newnode;
    else
    {
        parentptr = NULL;
        nodeptr = root;
        while(nodeptr != NULL)
        {
            parentptr = nodeptr;
            if(val < nodeptr -> data)
            nodeptr = nodeptr -> left;
            else
            nodeptr = nodeptr -> right;
        }
        if(val < parentptr -> data)
            parentptr -> left = newnode;
        else
            parentptr -> right = newnode;
    }
}
struct node * inordersuccessor(struct node *ptr)
{
    while(ptr != NULL && ptr -> left != NULL)
        ptr = ptr -> left;
    return ptr;
}
struct node * delete(struct node *root, int val)
{
    struct node *temp;
    if(root == NULL)
    printf("Node not found.");
    else if(val < root -> data)
    root -> left = delete(root -> left, val);
    else if(val > root -> data)
    root -> right = delete(root -> right, val);
    else
    {
        if(root -> left != NULL && root -> right != NULL)
        {
            temp = inordersuccessor(root -> right);
            root -> data = temp -> data;
            root -> right = delete(root -> right, temp -> data);
        }
        else
            {
            temp = root;
            if(root -> left == NULL && root -> right == NULL)
```



```
            {
                free(root);
                return NULL;
            }
            else if(root -> left != NULL)
            root = root -> left;
            else
            root = root -> right;
            free(temp);
        }
    }
    return root;
}
struct node * search(struct node *root, int val)
{
    if(root == NULL || root -> data == val)
    return root;
    else if(val > root -> data)
    return search(root -> right, val);
    else
    return search(root -> left, val);
}
void main()
{
    int val, ch;
    printf("Building tree:\n");
    do
    {
        if(root == NULL)
        printf("\nEnter value of root (-1 to exit): ");
        else
        printf("Enter value of node (-1 to exit): ");
        scanf("%d", &val);
        if(val != -1)
        insert(val);
    }while(val != -1);
    do
    {
        printf("\n\t\t\tMENU");
        printf("\n1. Insert\t\t2. Delete\t\t3. Search");
        printf("\n4. Preorder traversal\t5. Inorder traversal\t6. Postorder traversal");
        printf("\nEnter choice: ");
        scanf("%d", &ch);
        switch(ch)
        {
            case 1: printf("Enter node to insert: ");
                    scanf("%d", &val);
                    insert(val);
                    break;
            case 2: if(root != NULL)
                    {
                        printf("Enter node to delete: ");
                        scanf("%d", &val);
                        root = delete(root, val);
                    }
                    else
                        printf("Tree is empty.");
                    break;
            case 3: printf("Enter node to search: ");
                    scanf("%d", &val);
                    if(search(root, val) != NULL)
                        printf("Node found.");
                    else
                        printf("Node not found.");
                    break;
            case 4: if(root != NULL)
                    {
                        printf("Preorder traversal: ");
                        preorder(root);
                    }
                    else
                        printf("Tree is empty.");
                    break;
            case 5: if(root != NULL)
                    {
                        printf("Inorder traversal: ");
                        inorder(root);
                    }
                    else
                        printf("Tree is empty.");
                    break;
            case 6: if(root != NULL)
                    {
                        printf("Postorder traversal: ");
                        postorder(root);
                    }
                    else
                        printf("Tree is empty.");
                    break;
        }
    }while(ch >= 1 && ch <= 6);
}
```

OUTPUT

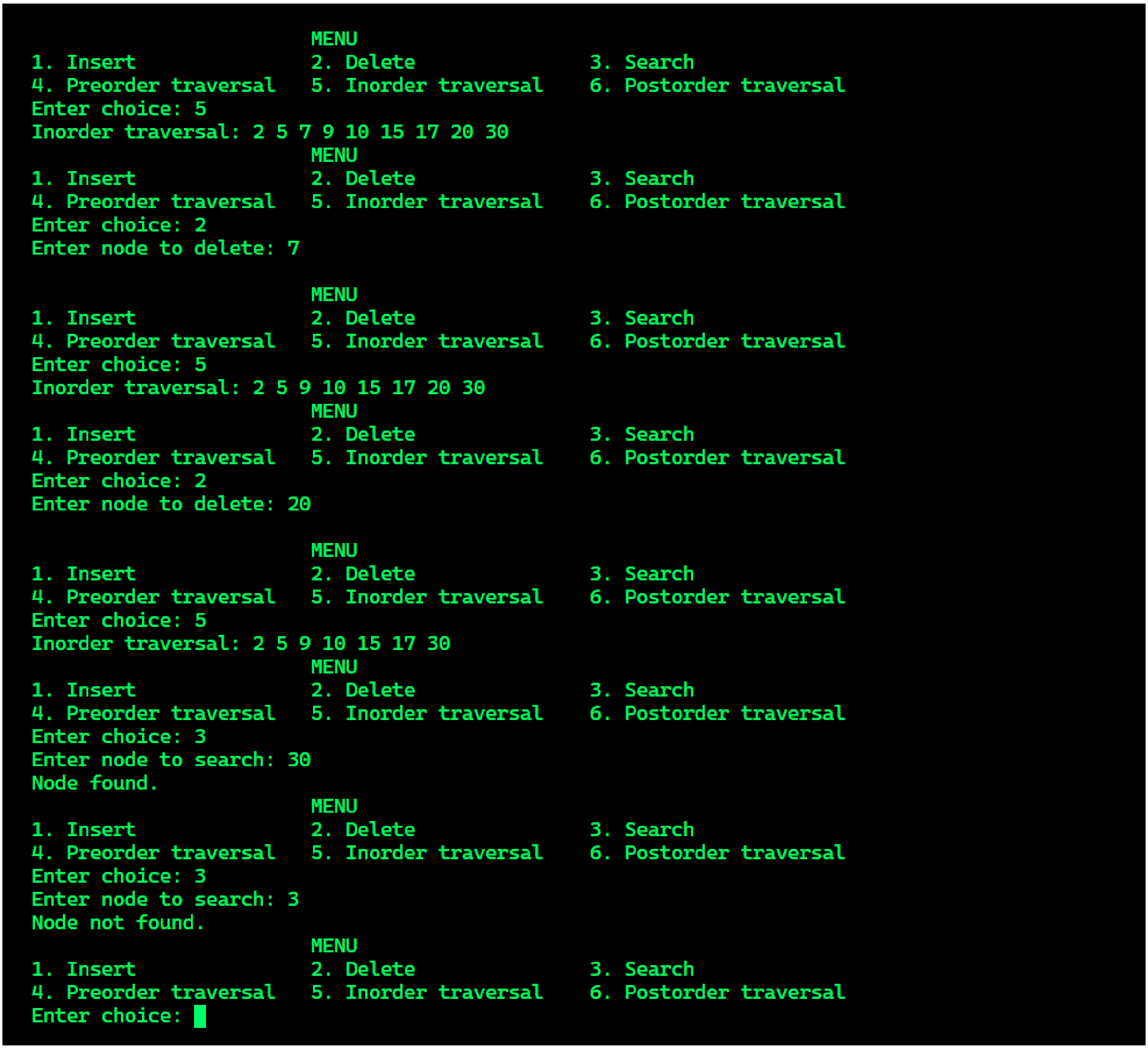


```
Building tree:

Enter value of root (-1 to exit): 10
Enter value of node (-1 to exit): 5
Enter value of node (-1 to exit): 15
Enter value of node (-1 to exit): 2
Enter value of node (-1 to exit): 9
Enter value of node (-1 to exit): 20
Enter value of node (-1 to exit): 7
Enter value of node (-1 to exit): 17
Enter value of node (-1 to exit): 30
Enter value of node (-1 to exit): -1

                        MENU
1. Insert               2. Delete               3. Search
4. Preorder traversal   5. Inorder traversal    6. Postorder traversal
Enter choice: 4
Preorder traversal: 10 5 2 9 7 15 20 17 30
                        MENU
1. Insert               2. Delete               3. Search
4. Preorder traversal   5. Inorder traversal    6. Postorder traversal
Enter choice: 5
Inorder traversal: 2 5 7 9 10 15 17 20 30
                        MENU
1. Insert               2. Delete               3. Search
4. Preorder traversal   5. Inorder traversal    6. Postorder traversal
Enter choice: 6
Postorder traversal: 2 7 9 5 17 30 20 15 10
                        MENU
1. Insert               2. Delete               3. Search
4. Preorder traversal   5. Inorder traversal    6. Postorder traversal
Enter choice: 1
Enter node to insert: 3

                        MENU
1. Insert               2. Delete               3. Search
4. Preorder traversal   5. Inorder traversal    6. Postorder traversal
Enter choice: 5
Inorder traversal: 2 3 5 7 9 10 15 17 20 30
                        MENU
1. Insert               2. Delete               3. Search
4. Preorder traversal   5. Inorder traversal    6. Postorder traversal
Enter choice: 2
Enter node to delete: 3
```



```
                        MENU
1. Insert               2. Delete               3. Search
4. Preorder traversal   5. Inorder traversal    6. Postorder traversal
Enter choice: 5
Inorder traversal: 2 5 7 9 10 15 17 20 30
                        MENU
1. Insert               2. Delete               3. Search
4. Preorder traversal   5. Inorder traversal    6. Postorder traversal
Enter choice: 2
Enter node to delete: 7

                        MENU
1. Insert               2. Delete               3. Search
4. Preorder traversal   5. Inorder traversal    6. Postorder traversal
Enter choice: 5
Inorder traversal: 2 5 9 10 15 17 20 30
                        MENU
1. Insert               2. Delete               3. Search
4. Preorder traversal   5. Inorder traversal    6. Postorder traversal
Enter choice: 2
Enter node to delete: 20

                        MENU
1. Insert               2. Delete               3. Search
4. Preorder traversal   5. Inorder traversal    6. Postorder traversal
Enter choice: 5
Inorder traversal: 2 5 9 10 15 17 30
                        MENU
1. Insert               2. Delete               3. Search
4. Preorder traversal   5. Inorder traversal    6. Postorder traversal
Enter choice: 3
Enter node to search: 30
Node found.
                        MENU
1. Insert               2. Delete               3. Search
4. Preorder traversal   5. Inorder traversal    6. Postorder traversal
Enter choice: 3
Enter node to search: 3
Node not found.
                        MENU
1. Insert               2. Delete               3. Search
4. Preorder traversal   5. Inorder traversal    6. Postorder traversal
Enter choice: 
```