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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 5_CY_Updated

Attempt : 1
Total Mark : 30
Marks Obtained : 30

Section 1 : Coding

1. Problem Statement

Jake is learning about binary search trees(BST) and their operations. He wants to implement a program that can delete a node from a BST based on the given key value and print the remaining nodes in an in-order traversal.

Assist Jake in the program.

Input Format

The first line of input consists of an integer n, representing the number of elements in BST.

The second line consists of n space-separated integers, representing the elements of the tree.

The third line consists of an integer x, representing the key value of the node to be deleted.

Output Format

The first line of output prints "Before deletion: " followed by the in-order traversal of the initial BST.

The second line prints "After deletion: " followed by the in-order traversal after the deletion of the key value.

If the key value is not present in the BST, print the original tree as it is.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 5
8 6 4 3 1
4

Output: Before deletion: 1 3 4 6 8
After deletion: 1 3 6 8

Answer

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

struct Node {
    int data;
    struct Node* left;
    struct Node* right;
};

struct Node* createNode(int data) {
    struct Node* newNode = (struct Node*)malloc(sizeof(struct Node));
    newNode->data = data;
    newNode->left = newNode->right = NULL;
    return newNode;
}

struct Node* insert(struct Node* root, int data) {
```

```
    if (root == NULL) return createNode(data);
    if (data < root->data)
        root->left = insert(root->left, data);
    else if (data > root->data)
        root->right = insert(root->right, data);
    return root;
}

struct Node* minValueNode(struct Node* node) {
    struct Node* current = node;
    while (current && current->left != NULL)
        current = current->left;
    return current;
}

struct Node* deleteNode(struct Node* root, int key) {
    if (root == NULL) return root;
    if (key < root->data)
        root->left = deleteNode(root->left, key);
    else if (key > root->data)
        root->right = deleteNode(root->right, key);
    else {
        if (root->left == NULL) {
            struct Node* temp = root->right;
            free(root);
            return temp;
        }
        else if (root->right == NULL) {
            struct Node* temp = root->left;
            free(root);
            return temp;
        }
        struct Node* temp = minValueNode(root->right);
        root->data = temp->data;
        root->right = deleteNode(root->right, temp->data);
    }
    return root;
}

void inorder(struct Node* root) {
    if (root != NULL) {
        inorder(root->left);
```

```
        printf("%d ", root->data);
        inorder(root->right);
    }
}

int main() {
    struct Node* root = NULL;
    int n, x, val;

    scanf("%d", &n);
    for (int i = 0; i < n; i++) {
        scanf("%d", &val);
        root = insert(root, val);
    }

    scanf("%d", &x);

    printf("Before deletion: ");
    inorder(root);
    printf("\n");

    root = deleteNode(root, x);

    printf("After deletion: ");
    inorder(root);
    printf("\n");

    return 0;
}
```

Status : Correct **Marks : 10/10**

2. Problem Statement

Emily is studying binary search trees (BST). She wants to write a program that inserts characters into a BST and then finds and prints the minimum and maximum values.

Guide her with the program.

Input Format

The first line of input consists of an integer N, representing the number of values to be inserted into the BST.

The second line consists of N space-separated characters.

Output Format

The first line of output prints "Minimum value: " followed by the minimum value of the given inputs.

The second line prints "Maximum value: " followed by the maximum value of the given inputs.

Refer to the sample outputs for formatting specifications.

Sample Test Case

Input: 5
Z E W T Y

Output: Minimum value: E
Maximum value: Z

Answer

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

struct Node {
    char data;
    struct Node* left;
    struct Node* right;
};

struct Node* createNode(char data) {
    struct Node* newNode = (struct Node*)malloc(sizeof(struct Node));
    newNode->data = data;
    newNode->left = newNode->right = NULL;
    return newNode;
}
```

```
struct Node* insert(struct Node* root, char data) {
    if (root == NULL) return createNode(data);
    if (data < root->data)
        root->left = insert(root->left, data);
    else if (data > root->data)
        root->right = insert(root->right, data);
    return root;
}

char findMin(struct Node* root) {
    while (root->left != NULL)
        root = root->left;
    return root->data;
}

char findMax(struct Node* root) {
    while (root->right != NULL)
        root = root->right;
    return root->data;
}

int main() {
    struct Node* root = NULL;
    int N;
    char val;

    scanf("%d", &N);
    getchar();

    for (int i = 0; i < N; i++) {
        scanf("%c", &val);
        getchar();
        root = insert(root, val);
    }

    printf("Minimum value: %c\n", findMin(root));
    printf("Maximum value: %c\n", findMax(root));

    return 0;
}
```

Status : Correct ***Marks : 10/10***

3. Problem Statement

John is building a system to store and manage integers using a binary search tree (BST). He needs to add a feature that allows users to search for a specific integer key in the BST using recursion.

Implement functions to create the BST and perform a recursive search for an integer.

Input Format

The first line of input consists of an integer representing, the number of nodes.

The second line consists of integers representing, the values of nodes, separated by space.

The third line consists of an integer representing, the key to be searched.

Output Format

The output prints whether the given key is present in the binary search tree or not.

Refer to the sample output for the exact format.

Sample Test Case

Input: 7
10 5 15 3 7 12 20
12
Output: The key 12 is found in the binary search tree

Answer

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

struct Node {
    int data;
    struct Node* left;
    struct Node* right;
```

```
};

struct Node* createNode(int data) {
    struct Node* newNode = (struct Node*)malloc(sizeof(struct Node));
    newNode->data = data;
    newNode->left = newNode->right = NULL;
    return newNode;
}

struct Node* insert(struct Node* root, int data) {
    if (root == NULL) return createNode(data);
    if (data < root->data)
        root->left = insert(root->left, data);
    else if (data > root->data)
        root->right = insert(root->right, data);
    return root;
}

int search(struct Node* root, int key) {
    if (root == NULL) return 0;
    if (root->data == key) return 1;
    if (key < root->data) return search(root->left, key);
    return search(root->right, key);
}

int main() {
    struct Node* root = NULL;
    int n, val, key;

    scanf("%d", &n);
    for (int i = 0; i < n; i++) {
        scanf("%d", &val);
        root = insert(root, val);
    }
    scanf("%d", &key);

    if (search(root, key))
        printf("The key %d is found in the binary search tree\n", key);
    else
        printf("The key %d is not found in the binary search tree\n", key);

    return 0;
```

}

Status : Correct *Marks : 10/10*