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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

Edward has a Binary Search Tree (BST) and needs to find the k-th largest element in it.

Given the root of the BST and an integer k, help Edward determine the k-th largest element in the tree. If k exceeds the number of nodes in the BST, return an appropriate message.

Input Format

The first line of input consists of integer n, the number of nodes in the BST.

The second line consists of the n elements, separated by space.

The third line consists of the value of k.

Output Format

The output prints the kth largest element in the binary search tree.

For invalid inputs, print "Invalid value of k".

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 7
8 4 12 2 6 10 14
1
Output: 14

Answer

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

typedef struct TreeNode {
   int val;
   struct TreeNode *left, *right;
} TreeNode;
TreeNode* newNode(int val) {
   TreeNode* node = (TreeNode*)malloc(sizeof(TreeNode));
   node->val = val;
   node->left = node->right = NULL;
   return node;
}

TreeNode* insertBST(TreeNode* root, int val) {
   if (root == NULL) return newNode(val);
   if (val < root->val)
      root->left = insertBST(root->left, val);
   else
      root->right = insertBST(root->right, val);
   return root;
}
void reverseInorder(TreeNode* root, int k, int* count, int* result) {
   if (root == NULL || *count >= k) return;
```

```
    reverseInorder(root->right, k, count, result);

    (*count)++;
    if (*count == k) {
        *result = root->val;
        return;
    }

    reverseInorder(root->left, k, count, result);
}
int main() {
    int n, k;
    scanf("%d", &n);

    int arr[n];
    TreeNode* root = NULL;

    for (int i = 0; i < n; i++) {
        scanf("%d", &arr[i]);
        root = insertBST(root, arr[i]);
    }

    scanf("%d", &k);

    if (k > n || k <= 0) {
        printf("Invalid value of k\n");
    } else {
        int count = 0, result = -1;
        reverseInorder(root, k, &count, &result);
        printf("%d\n", result);
    }

    return 0;
}
```

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

2. Problem Statement

Dhruv is working on a project where he needs to implement a Binary Search Tree (BST) data structure and perform various operations on it.

He wants to create a program that allows him to build a BST, traverse it in different orders (inorder, preorder, postorder), and exit the program when needed.

Help Dhruv by designing a program that fulfils his requirements.

Input Format

The first input consists of the choice.

If the choice is 1, enter the number of elements N and the elements inserted into the tree, separated by a space in a new line.

If the choice is 2, print the in-order traversal.

If the choice is 3, print the pre-order traversal.

If the choice is 4, print the post-order traversal.

If the choice is 5, exit.

Output Format

The output prints the results based on the choice.

For choice 1, print "BST with N nodes is ready to use" where N is the number of nodes inserted.

For choice 2, print the in-order traversal of the BST.

For choice 3, print the pre-order traversal of the BST.

For choice 4, print the post-order traversal of the BST.

For choice 5, the program exits.

If the choice is greater than 5, print "Wrong choice".

Refer to the sample output for the formatting specifications.

Sample Test Case

```
Input: 1
5
12 78 96 34 55
2
3
4
5
Output: BST with 5 nodes is ready to use
BST Traversal in INORDER
12 34 55 78 96
BST Traversal in PREORDER
12 78 34 55 96
BST Traversal in POSTORDER
55 34 96 78 12
```

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
        root->right = insert(root->right, data);
    return root;
}


void inorder(struct Node* root) {
    if (root == NULL)
        return;
    inorder(root->left);
    printf("%d ", root->data);
    inorder(root->right);
}


void preorder(struct Node* root) {
    if (root == NULL)
        return;
    printf("%d ", root->data);
    preorder(root->left);
    preorder(root->right);
}


void postorder(struct Node* root) {
    if (root == NULL)
        return;
    postorder(root->left);
    postorder(root->right);
    printf("%d ", root->data);
}

int main() {
    int choice, N, data;
    struct Node* root = NULL;

    while (1) {
        if (scanf("%d", &choice) == EOF)
            break;
        if (choice == 1) {
            scanf("%d", &N);
            root = NULL; // reset BST
            for (int i = 0; i < N; i++) {
                scanf("%d", &data);
                root = insert(root, data);
            }
            printf("BST with %d nodes is ready to use\n", N);
        }
        else if (choice == 2) {
            printf("BST Traversal in INORDER\n");
            inorder(root);
            printf("\n");
        }
        else if (choice == 3) {
            printf("BST Traversal in PREORDER\n");
            preorder(root);
            printf("\n");
        }
        else if (choice == 4) {
            printf("BST Traversal in POSTORDER\n");
            postorder(root);
            printf("\n");
        }
        else if (choice == 5) {
            break;
        }
        else {
            printf("Wrong choice\n");
        }
    }
    return 0;
}
```

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

3. Problem Statement

Arun is working on a Binary Search Tree (BST) data structure. His goal is to implement a program that reads a series of integers and inserts them into a BST. Once the integers are inserted, he needs to add a given integer value to each node in the tree and find the maximum value in the BST.

Your task is to help Arun implement this program.

Input Format

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

The second line consists of N space-separated integers, each representing an element to be inserted into the BST.

The third line consists of an integer add, representing the value to be added to each node in the BST.

Output Format

The output prints the maximum value in the BST after adding the add value.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 5
10 5 15 20 25
5
Output: 30

Answer

```
#include <stdio.h>
#include <stdlib.h>
typedef struct TreeNode {
   int val;
   struct TreeNode *left, *right;
} TreeNode;
TreeNode* newNode(int val) {
   TreeNode* node = (TreeNode*)malloc(sizeof(TreeNode));
   node->val = val;
   node->left = node->right = NULL;
   return node;
```

```
}
TreeNode* insertBST(TreeNode* root, int val) {
   if (root == NULL)
      return newNode(val);
   if (val < root->val)
      root->left = insertBST(root->left, val);
   else
      root->right = insertBST(root->right, val);
   return root;
}

void addToEachNode(TreeNode* root, int add) {
   if (root == NULL) return;
   root->val += add;
   addToEachNode(root->left, add);
   addToEachNode(root->right, add);
}

int findMax(TreeNode* root) {
   if (root == NULL) return -1;
   while (root->right != NULL) {
      root = root->right;
   }
   return root->val;
}
int main() {
   int N, add;
   scanf("%d", &N);

   TreeNode* root = NULL;
   int val;

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

   scanf("%d", &add);

   addToEachNode(root, add);
   int maxVal = findMax(root);
```

```
    printf("%d\n", maxVal);

    return 0;
}
```

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