Rajalakshmi Engineering College

Name: SARAVANA PERUMAL B
Email: 241901103@rajalakshmi.edu.in
Roll no: 241901103
Phone: 9342922599
Branch: REC
Department: I CSE (CS) FB
Batch: 2028
Degree: B.E - CSE (CS)

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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 5_MCQ

Attempt : 1
Total Mark : 15
Marks Obtained : 15

Section 1 : MCQ

1. Find the postorder traversal of the given binary search tree.

Answer

1, 4, 2, 18, 14, 13

Status : Correct ***Marks : 1/1***

2. How many distinct binary search trees can be created out of 4 distinct keys?

Answer

14

Status : Correct ***Marks : 1/1***

3. While inserting the elements 5, 4, 2, 8, 7, 10, 12 in a binary search tree, the element at the lowest level is _____.

Answer

12

Status : Correct ***Marks : 1/1***

4. Find the post-order traversal of the given binary search tree.

Answer

10, 17, 20, 18, 15, 32, 21

Status : Correct ***Marks : 1/1***

5. Find the preorder traversal of the given binary search tree.

Answer

9, 2, 1, 6, 4, 7, 10, 14

Status : Correct ***Marks : 1/1***

6. Which of the following operations can be used to traverse a Binary Search Tree (BST) in ascending order?

Answer

Inorder traversal

Status : Correct ***Marks : 1/1***

7. Which of the following is the correct in-order traversal of a binary search tree with nodes: 9, 3, 5, 11, 8, 4, 2?

Answer

2, 3, 4, 5, 8, 9, 11

Status : Correct ***Marks : 1/1***

8. While inserting the elements 71, 65, 84, 69, 67, 83 in an empty binary search tree (BST) in the sequence shown, the element in the lowest level is _____.

Answer

67

Status : Correct ***Marks : 1/1***

9. Which of the following is a valid preorder traversal of the binary search tree with nodes: 18, 28, 12, 11, 16, 14, 17?

Answer

18, 12, 11, 16, 14, 17, 28

Status : Correct ***Marks : 1/1***

10. Which of the following is the correct post-order traversal of a binary search tree with nodes: 50, 30, 20, 55, 32, 52, 57?

Answer

20, 32, 30, 52, 57, 55, 50

Status : Correct ***Marks : 1/1***

11. The preorder traversal of a binary search tree is 15, 10, 12, 11, 20, 18, 16, 19. Which one of the following is the postorder traversal of the tree?

Answer

11, 12, 10, 16, 19, 18, 20, 15

Status : Correct ***Marks : 1/1***

12. In a binary search tree with nodes 18, 28, 12, 11, 16, 14, 17, what is the value of the left child of the node 16?

Answer

14

Status : Correct ***Marks : 1/1***

13. Which of the following is the correct pre-order traversal of a binary search tree with nodes: 50, 30, 20, 55, 32, 52, 57?

Answer

50, 30, 20, 32, 55, 52, 57

Status : Correct ***Marks : 1/1***

14. Find the pre-order traversal of the given binary search tree.

Answer

13, 2, 1, 4, 14, 18

Status : Correct ***Marks : 1/1***

15. Find the in-order traversal of the given binary search tree.

Answer

1, 2, 4, 13, 14, 18

Status : Correct ***Marks : 1/1***

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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 5_COD_Question 1

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1. Problem Statement

John is learning about Binary Search Trees (BST) in his computer science class. He wants to create a program that allows users to delete a node with a given value from a BST and print the remaining nodes using an in-order traversal.

Implement a function to help him delete a node with a given value from a BST.

Input Format

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

The second line consists of N space-separated integers, representing the values of the BST nodes.

The third line consists of an integer V, which is the value to delete from the BST.

Output Format

The output prints the space-separated values in the BST in an in-order traversal, after the deletion of the specified value.

If the specified value is not available in the tree, print the given input values in-order traversal.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 5
10 5 15 2 7
15

Output: 2 5 7 10

Answer

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

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

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

struct TreeNode* insert(struct TreeNode* root, int key){
    if (root == NULL)
{
```

```
        struct TreeNode *newNode = (struct TreeNode*)malloc(sizeof(struct
TreeNode));
        newNode->data = key;
        newNode->left = NULL;
        newNode->right = NULL;
        return newNode;
} else if (key < root->data)

{
        root->left = insert(root->left, key);
} else if (key > root->data)

{
        root->right = insert(root->right, key);
}
    return root;
}
struct TreeNode* findMin(struct TreeNode* root)
{
    while (root && root->left)
{
        root = root->left;
}
    return root;
}
struct TreeNode* deleteNode(struct TreeNode* 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 TreeNode* temp = root->right;
        free(root);
        return temp;
} else if (root->right == NULL)
{
        struct TreeNode* temp = root->left;
        free(root);
        return temp;
}
    struct TreeNode* temp = findMin(root->right);
    root->data = temp->data;
    root->right = deleteNode(root->right, temp->data);
}
  return root;
}
void inorderTraversal(struct TreeNode* root)
{
  if (root != NULL)
{
    inorderTraversal(root->left);
    printf("%d\t", root->data);
    inorderTraversal(root->right);
}
}

int main()
{
  int N, rootValue, V;
  scanf("%d", &N);
  struct TreeNode* root = NULL;
  for (int i = 0; i < N; i++) {
    int key;
    scanf("%d", &key);
    if (i == 0) rootValue = key;
    root = insert(root, key);
  }
  scanf("%d", &V);
  root = deleteNode(root, V);
  inorderTraversal(root);
  return 0;
}
```

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

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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 5_COD_Question 2

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1. Problem Statement

Mike is learning about Binary Search Trees (BSTs) and wants to implement various operations on them. He wants to write a basic program for creating a BST, inserting nodes, and printing the tree in the pre-order traversal.

Write a program to help him solve this program.

Input Format

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

The second line consists of N space-separated integers, representing the values to insert into the BST.

Output Format

The output prints the space-separated values of the BST in the pre-order traversal.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 5
3 1 5 2 4

Output: 3 1 2 5 4

Answer

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

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

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

```
// Pre-order traversal: root -> left -> right
void printPreorder(struct Node* node) {
    if (node == NULL)
        return;

    printf("%d ", node->data);
    printPreorder(node->left);
    printPreorder(node->right);
}

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

    int n;
    scanf("%d", &n);

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

    printPreorder(root);
    return 0;
}
```

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

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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 5_COD_Question 3

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1. Problem Statement

You are required to implement basic operations on a Binary Search Tree (BST), like insertion and searching.

Insertion: Given a list of integers, construct a Binary Search Tree by repeatedly inserting each integer into the tree according to the rules of a BST.

Searching: Given an integer, search for its presence in the constructed Binary Search Tree. Print whether the integer is found or not.

Write a program to calculate this efficiently.

Input Format

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

in the binary search tree.

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

The third line consists of an integer representing, the value that is to be searched.

Output Format

The output prints, "Value <value> is found in the tree." if the given value is present, otherwise it prints: "Value <value> is not found in the tree."

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 7
8 3 10 1 6 14 23
6
Output: Value 6 is found in the tree.

Answer

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

// Define the structure of a tree node
struct Node {
    int val;
    struct Node* left;
    struct Node* right;
};

// Create a new node
struct Node* newNode(int value) {
    struct Node* node = (struct Node*)malloc(sizeof(struct Node));
    node->val = value;
    node->left = NULL;
    node->right = NULL;
    return node;
}
```

```
// Insert a value into the BST
struct Node* insert(struct Node* root, int value) {
    if (root == NULL) {
        return newNode(value);
    }
    if (value < root->val) {
        root->left = insert(root->left, value);
    } else {
        root->right = insert(root->right, value);
    }
    return root;
}

// Search for a value in the BST
int search(struct Node* root, int key) {
    if (root == NULL) {
        return 0;
    }
    if (root->val == key) {
        return 1;
    }
    if (key < root->val) {
        return search(root->left, key);
    } else {
        return search(root->right, key);
    }
}

// Main function
int main() {
    int n, key;
    scanf("%d", &n);

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

    scanf("%d", &key);

    struct Node* root = NULL;
    for (int i = 0; i < n; i++) {
```

```
        root = insert(root, values[i]);
    }

    if (search(root, key)) {
        printf("Value %d is found in the tree.\n", key);
    } else {
        printf("Value %d is not found in the tree.\n", key);
    }

    return 0;
}
```

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

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Email: 241901103@rajalakshmi.edu.in
Roll no: 241901103
Phone: 9342922599
Branch: REC
Department: I CSE (CS) FB
Batch: 2028
Degree: B.E - CSE (CS)

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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 5_COD_Question 4

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1. Problem Statement

John, a computer science student, is learning about binary search trees (BST) and their properties. He decides to write a program to create a BST, display it in post-order traversal, and find the minimum value present in the tree.

Help him by implementing the program.

Input Format

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

The second line consists of N space-separated integers data, which is the data to be inserted into the BST.

Output Format

The first line of output prints the space-separated elements of the BST in post-order traversal.

The second line prints the minimum value found in the BST.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 3
5 10 15
Output: 15 10 5
The minimum value in the BST is: 5

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;
}

void displayTreePostOrder(struct Node* root) {
```

```
    if (root == NULL) return;
    displayTreePostOrder(root->left);
    displayTreePostOrder(root->right);
    printf("%d ", root->data);
}

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

int main() {
    struct Node* root = NULL;
    int n, data;
    scanf("%d", &n);

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

    displayTreePostOrder(root);
    printf("\n");

    int minValue = findMinValue(root);
    printf("The minimum value in the BST is: %d", minValue);

    return 0;
}
```

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

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Name: SARAVANA PERUMAL B
Email: 241901103@rajalakshmi.edu.in
Roll no: 241901103
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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 5_COD_Question 5

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1. Problem Statement

In his computer science class, John is learning about Binary Search Trees (BST). He wants to build a BST and find the maximum value in the tree.

Help him by writing a program to insert nodes into a BST and find the maximum value in the tree.

Input Format

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

The second line consists of N space-separated integers, representing the values of the nodes to insert into the BST.

Output Format

The output prints the maximum value in the BST.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 5
10 5 15 2 7

Output: 15

Answer

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

struct TreeNode {
    int data;
    struct TreeNode* left;
    struct TreeNode* right;
};
struct TreeNode* createNode(int key) {
    struct TreeNode* newNode = (struct TreeNode*)malloc(sizeof(struct
TreeNode));
    newNode->data = key;
    newNode->left = newNode->right = NULL;
    return newNode;
}
struct TreeNode* insert(struct TreeNode* root, int key) {
    if (root == NULL) return createNode(key);
    if (key < root->data) root->left = insert(root->left, key);
    else if (key > root->data) root->right = insert(root->right, key);
    return root;
}

int findMax(struct TreeNode* root) {
    if (root == NULL) return -1;
    while (root->right != NULL) root = root->right;
    return root->data;
}
int main() {
```

```
    int N, rootValue;
    scanf("%d", &N);

    struct TreeNode* root = NULL;

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

    int maxVal = findMax(root);
    if (maxVal != -1) {
        printf("%d", maxVal);
    }

    return 0;
}
```

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

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Phone: 9342922599
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Department: I CSE (CS) FB
Batch: 2028
Degree: B.E - CSE (CS)

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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 5_PAH_Updated

Attempt : 1
Total Mark : 50
Marks Obtained : 40

Section 1 : Coding

1. Problem Statement

Aishu is participating in a coding challenge where she needs to reconstruct a Binary Search Tree (BST) from given preorder traversal data and then print the in-order traversal of the reconstructed BST.

Since Aishu is just learning about tree data structures, she needs your help to write a program that does this efficiently.

Input Format

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

The second line of input contains n integers separated by spaces, which represent the preorder traversal of the BST.

Output Format

The output displays n space-separated integers, representing the in-order traversal of the reconstructed BST.

Refer to the sample output for the formatting specifications.

Sample Test Case

Input: 6
10 5 1 7 40 50

Output: 1 5 7 10 40 50

Answer

```
// You are using GCC
#include <stdio.h>
#include <stdlib.h>
#include <limits.h>

// Define the structure of a BST Node
struct Node {
    int data;
    struct Node* left;
    struct Node* right;
};

// Function to create a new node
struct Node* newNode(int data) {
    struct Node* node = (struct Node*)malloc(sizeof(struct Node));
    node->data = data;
    node->left = node->right = NULL;
    return node;
}

// Function to construct BST from preorder traversal
struct Node* constructBST(int preorder[], int* index, int key, int min, int max, int n)
{
    if (*index >= n)
        return NULL;
```

```
    struct Node* root = NULL;

    // Only insert if key is in valid range
    if (key > min && key < max) {
        root = newNode(key);
        (*index)++;

        if (*index < n) {
            root->left = constructBST(preorder, index, preorder[*index], min, key, n);
        }
        if (*index < n) {
            root->right = constructBST(preorder, index, preorder[*index], key, max, n);
        }
    }

    return root;
}

// Function for in-order traversal
void printInorder(struct Node* root) {
    if (root == NULL)
        return;

    printInorder(root->left);
    printf("%d ", root->data);
    printInorder(root->right);
}

// Main function
int main() {
    int n;
    scanf("%d", &n);

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

    int index = 0;
    struct Node* root = constructBST(preorder, &index, preorder[0], INT_MIN,
INT_MAX, n);
```

```
    printInorder(root);
    printf("\n");

    return 0;
}
```

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

2. Problem Statement

Yogi is working on a program to manage a binary search tree (BST) containing integer values. He wants to implement a function that removes nodes from the tree that fall outside a specified range defined by a minimum and maximum value.

Help Yogi by writing a function that achieves this.

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, representing the elements to be inserted into the BST.

The third line consists of two space-separated integers min and max, representing the minimum value and the maximum value of the range.

Output Format

The output prints the remaining elements of the BST in an in-order traversal, after removing nodes that fall outside the specified range.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 5
10 5 15 20 12
5 15

Output: 5 10 12 15

Answer

```
// You are using GCC
#include <stdio.h>
#include <stdlib.h>

// Definition of a BST node
struct Node {
    int data;
    struct Node* left;
    struct Node* right;
};

// Create a new node
struct Node* newNode(int data) {
    struct Node* node = (struct Node*)malloc(sizeof(struct Node));
    node->data = data;
    node->left = node->right = NULL;
    return node;
}

// Insert into BST
struct Node* insert(struct Node* root, int data) {
    if (root == NULL)
        return newNode(data);
    if (data < root->data)
        root->left = insert(root->left, data);
    else
        root->right = insert(root->right, data);
    return root;
}

// Remove nodes outside the given range [min, max]
struct Node* removeOutsideRange(struct Node* root, int min, int max) {
    if (root == NULL)
        return NULL;

    // Recur for left and right subtrees
    root->left = removeOutsideRange(root->left, min, max);
    root->right = removeOutsideRange(root->right, min, max);
```

```
    // Now deal with the current node
    if (root->data < min) {
        struct Node* rightChild = root->right;
        free(root);
        return rightChild;
    }

    if (root->data > max) {
        struct Node* leftChild = root->left;
        free(root);
        return leftChild;
    }

    return root;
}

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

// Main function
int main() {
    int n;
    scanf("%d", &n);

    struct Node* root = NULL;
    int val;

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

    int min, max;
    scanf("%d %d", &min, &max);

    root = removeOutsideRange(root, min, max);
```

```
    inorder(root);
    printf("\n");

    return 0;
}
```

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

3. Problem Statement

Arun is exploring operations on binary search trees (BST). He wants to write a program with an unsorted distinct integer array that represents the BST keys and construct a height-balanced BST from it.

After constructing, he wants to perform the following operations that can alter the structure of the tree and traverse them using a level-order traversal:

InsertionDeletion

Your task is to assist Arun in completing the program without any errors.

Input Format

The first line of input consists of an integer N, representing the number of initial keys in the BST.

The second line consists of N space-separated integers, representing the initial keys.

The third line consists of an integer X, representing the new key to be inserted into the BST.

The fourth line consists of an integer Y, representing the key to be deleted from the BST.

Output Format

The first line of output prints "Initial BST: " followed by a space-separated list of keys in the initial BST after constructing it in level order traversal.

The second line prints "BST after inserting a new node X: " followed by a space-separated list of keys in the BST after inserting X n level order traversal.

The third line prints "BST after deleting node Y: " followed by a space-separated list of keys in the BST after deleting Y n level order traversal.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 5
25 14 56 28 12
34
12
Output: Initial BST: 25 14 56 12 28
BST after inserting a new node 34: 25 14 56 12 28 34
BST after deleting node 12: 25 14 56 28 34

Answer

```
// You are using GCC
#include <stdio.h>
#include <stdlib.h>

#define MAX 100

// BST node definition
struct Node {
    int data;
    struct Node* left;
    struct Node* right;
};

// Queue for level-order traversal
struct Queue {
    struct Node* data[MAX];
    int front, rear;
};

// Create new node
struct Node* newNode(int data) {
```

```
    struct Node* node = (struct Node*)malloc(sizeof(struct Node));
    node->data = data;
    node->left = node->right = NULL;
    return node;
}

// Comparator for qsort
int cmp(const void* a, const void* b) {
    return (*(int*)a - *(int*)b);
}

// Build balanced BST from sorted array
struct Node* buildBalancedBST(int arr[], int start, int end) {
    if (start > end) return NULL;
    int mid = (start + end) / 2;
    struct Node* root = newNode(arr[mid]);
    root->left = buildBalancedBST(arr, start, mid - 1);
    root->right = buildBalancedBST(arr, mid + 1, end);
    return root;
}

// Insert node in BST
struct Node* insert(struct Node* root, int key) {
    if (root == NULL) return newNode(key);
    if (key < root->data) root->left = insert(root->left, key);
    else if (key > root->data) root->right = insert(root->right, key);
    return root;
}

// Find minimum node
struct Node* findMin(struct Node* node) {
    while (node && node->left != NULL)
        node = node->left;
    return node;
}

// Delete node from BST
struct Node* deleteNode(struct Node* root, int key) {
    if (root == NULL) return NULL;
    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 = findMin(root->right);
        root->data = temp->data;
        root->right = deleteNode(root->right, temp->data);
    }
    return root;
}

// Queue functions for level-order
void initQueue(struct Queue* q) {
    q->front = q->rear = 0;
}
int isEmpty(struct Queue* q) {
    return q->front == q->rear;
}
void enqueue(struct Queue* q, struct Node* node) {
    if (q->rear < MAX)
        q->data[q->rear++] = node;
}
struct Node* dequeue(struct Queue* q) {
    if (!isEmpty(q))
        return q->data[q->front++];
    return NULL;
}

// Level-order traversal
void levelOrder(struct Node* root) {
    if (root == NULL) return;
    struct Queue q;
    initQueue(&q);
    enqueue(&q, root);
    while (!isEmpty(&q)) {
```

```
        struct Node* temp = dequeue(&q);
        printf("%d ", temp->data);
        if (temp->left) enqueue(&q, temp->left);
        if (temp->right) enqueue(&q, temp->right);
    }
    printf("\n");
}

// Main
int main() {
    int n;
    scanf("%d", &n);
    int arr[20];

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

    // Sort the array for building balanced BST
    qsort(arr, n, sizeof(int), cmp);

    // Build initial BST
    struct Node* root = buildBalancedBST(arr, 0, n - 1);
    printf("Initial BST: ");
    levelOrder(root);

    // Insert new key
    int x;
    scanf("%d", &x);
    root = insert(root, x);
    printf("BST after inserting a new node %d: ", x);
    levelOrder(root);

    // Delete given key
    int y;
    scanf("%d", &y);
    root = deleteNode(root, y);
    printf("BST after deleting node %d: ", y);
    levelOrder(root);

    return 0;
}
```

Status : Wrong *Marks : 0/10*

4. Problem Statement

Joseph, a computer science student, is interested in understanding binary search trees (BST) and their node arrangements. He wants to create a program to explore BSTs by inserting elements into a tree and displaying the nodes using post-order traversal of the tree.

Write a program to help Joseph implement the program.

Input Format

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

The second line consists of N space-separated integers data, which is the data to be inserted into the BST.

Output Format

The output prints N space-separated integer values after the post-order traversal.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 4
10 15 5 3
Output: 3 5 15 10

Answer

```
// You are using GCC
#include <stdio.h>
#include <stdlib.h>

// Define the structure of a BST node
struct Node {
```

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

// Function to create a new node
struct Node* newNode(int data) {
    struct Node* node = (struct Node*)malloc(sizeof(struct Node));
    node->data = data;
    node->left = node->right = NULL;
    return node;
}

// Insert a node into the BST
struct Node* insert(struct Node* root, int data) {
    if (root == NULL)
        return newNode(data);
    if (data < root->data)
        root->left = insert(root->left, data);
    else if (data > root->data)
        root->right = insert(root->right, data);
    return root;
}

// Post-order traversal function
void postOrder(struct Node* root) {
    if (root == NULL)
        return;
    postOrder(root->left);
    postOrder(root->right);
    printf("%d ", root->data);
}

// Main function
int main() {
    int n, val;
    scanf("%d", &n);

    struct Node* root = NULL;

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

```
        root = insert(root, val);
    }

    postOrder(root);
    printf("\n");

    return 0;
}
```

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

5. Problem Statement

Viha, a software developer, is working on a project to automate searching for a target value in a Binary Search Tree (BST). She needs to create a program that takes an integer target value as input and determines if that value is present in the BST or not.

Write a program to assist Viha.

Input Format

The first line of input consists of integers separated by spaces, which represent the elements to be inserted into the BST. The input is terminated by entering -1.

The second line consists of an integer target, which represents the target value to be searched in the BST.

Output Format

If the target value is found in the BST, print "[target] is found in the BST".

Else, print "[target] is not found in the BST"

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 5 3 7 1 4 6 8 -1
4

Output: 4 is found in the BST

Answer

```
// You are using GCC
#include <stdio.h>
#include <stdlib.h>

// Define the BST node
struct Node {
    int data;
    struct Node* left;
    struct Node* right;
};

// Create a new node
struct Node* newNode(int data) {
    struct Node* node = (struct Node*)malloc(sizeof(struct Node));
    node->data = data;
    node->left = node->right = NULL;
    return node;
}

// Insert into BST
struct Node* insert(struct Node* root, int data) {
    if (root == NULL)
        return newNode(data);

    if (data < root->data)
        root->left = insert(root->left, data);
    else if (data > root->data)
        root->right = insert(root->right, data);

    return root;
}

// Search in BST
int search(struct Node* root, int target) {
    if (root == NULL)
        return 0;
    if (root->data == target)
        return 1;
    if (target < root->data)
```

```
        return search(root->left, target);
    else
        return search(root->right, target);
}

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

    // Read BST elements
    while (1) {
        scanf("%d", &val);
        if (val == -1)
            break;
        root = insert(root, val);
    }

    int target;
    scanf("%d", &target);

    if (search(root, target))
        printf("%d is found in the BST\n", target);
    else
        printf("%d is not found in the BST\n", target);

    return 0;
}
```

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

Rajalakshmi Engineering College

Name: SARAVANA PERUMAL B
Email: 241901103@rajalakshmi.edu.in
Roll no: 241901103
Phone: 9342922599
Branch: REC
Department: I CSE (CS) FB
Batch: 2028
Degree: B.E - CSE (CS)

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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

Kishore is studying data structures, and he is currently working on implementing a binary search tree (BST) and exploring its basic operations. He wants to practice creating a BST, inserting elements into it, and performing a specific operation, which is deleting the minimum element from the tree.

Write a program to help him perform the delete operation.

Input Format

The first line of input consists of an integer N, representing the number of elements Kishore wants to insert into the BST.

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

Output Format

The output prints the remaining elements of the BST in ascending order (in-order traversal) after deleting the minimum element.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 6
5 3 8 2 4 6
Output: 3 4 5 6 8

Answer

```
// You are using GCC
#include <stdio.h>
#include <stdlib.h>

// Define a node structure for the BST
struct Node {
    int key;
    struct Node* left;
    struct Node* right;
};

// Function to create a new node
struct Node* createNode(int key) {
    struct Node* newNode = (struct Node*)malloc(sizeof(struct Node));
    newNode->key = key;
    newNode->left = newNode->right = NULL;
    return newNode;
}

// Function to insert a key into the BST
struct Node* insert(struct Node* root, int key) {
    if (root == NULL)
        return createNode(key);
    if (key < root->key)
```

```
        root->left = insert(root->left, key);
    else
        root->right = insert(root->right, key);
    return root;
}

// Function to delete the minimum node in BST
struct Node* deleteMin(struct Node* root) {
    if (root == NULL)
        return NULL;
    if (root->left == NULL) {
        struct Node* rightChild = root->right;
        free(root);
        return rightChild;
    }
    root->left = deleteMin(root->left);
    return root;
}

// Function for in-order traversal of BST
void inorder(struct Node* root) {
    if (root != NULL) {
        inorder(root->left);
        printf("%d ", root->key);
        inorder(root->right);
    }
}

int main() {
    int N;
    scanf("%d", &N);
    int i, key;
    struct Node* root = NULL;

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

    // Delete the minimum element
    root = deleteMin(root);
```

```
    // Print the in-order traversal
    inorder(root);
    printf("\n");

    return 0;
}
```

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

2. 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

```
// You are using GCC
#include <stdio.h>
#include <stdlib.h>

// Define a structure for BST nodes
struct Node {
    int key;
    struct Node* left;
    struct Node* right;
};

// Create a new node
struct Node* createNode(int key) {
    struct Node* newNode = (struct Node*)malloc(sizeof(struct Node));
    newNode->key = key;
    newNode->left = newNode->right = NULL;
    return newNode;
}

// Insert a key into the BST
struct Node* insert(struct Node* root, int key) {
    if (root == NULL)
        return createNode(key);
    if (key < root->key)
        root->left = insert(root->left, key);
    else
        root->right = insert(root->right, key);
    return root;
}

// Recursively search for a key in the BST
int search(struct Node* root, int key) {
    if (root == NULL)
        return 0; // Not found
    if (key == root->key)
        return 1; // Found
    if (key < root->key)
        return search(root->left, key);
    else
```

```
    return search(root->right, key);
}

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

    // Read number of elements
    scanf("%d", &n);

    // Insert elements into BST
    for (i = 0; i < n; i++) {
        scanf("%d", &val);
        root = insert(root, val);
    }

    // Read key to be searched
    scanf("%d", &key);

    // Search the key and print result
    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**

3. 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

```
// You are using GCC
#include <stdio.h>
#include <stdlib.h>

// Define a structure for BST nodes
struct Node {
    char data;
    struct Node* left;
    struct Node* right;
};

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

```
// Insert a character into the BST
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
        root->right = insert(root->right, data);
    return root;
}

// Find minimum value (leftmost node)
char findMin(struct Node* root) {
    while (root->left != NULL)
        root = root->left;
    return root->data;
}

// Find maximum value (rightmost node)
char findMax(struct Node* root) {
    while (root->right != NULL)
        root = root->right;
    return root->data;
}

int main() {
    int N, i;
    char ch;
    struct Node* root = NULL;

    // Read number of characters
    scanf("%d", &N);

    // Insert each character into BST
    for (i = 0; i < N; i++) {
        scanf(" %c", &ch);  // Space before %c to skip whitespaces
        root = insert(root, ch);
    }

    // Print minimum and maximum values
    printf("Minimum value: %c\n", findMin(root));
    printf("Maximum value: %c\n", findMax(root));
```

```
    return 0;
}
```

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