**Exercise 13: Implement recursive and non-recursive tree traversing methods inorder, preorder and postorder traversal.**

**Ex 11 – BST – Inorder, Preorder, Postorder**

#include <stdio.h>

#include <stdlib.h>

struct btnode

{

int value;

struct btnode \*l;

struct btnode \*r;

}\*root = NULL, \*temp = NULL, \*t2, \*t1;

void delete1();

void insert();

void delete();

void inorder(struct btnode \*t);

void create();

void search(struct btnode \*t);

void preorder(struct btnode \*t);

void postorder(struct btnode \*t);

void search1(struct btnode \*t,int data);

int smallest(struct btnode \*t);

int largest(struct btnode \*t);

int flag = 1;

void main()

{

int ch;

printf("\nOPERATIONS ---");

printf("\n1 - Insert an element into tree\n");

printf("2 - Delete an element from the tree\n");

printf("3 - Inorder Traversal\n");

printf("4 - Preorder Traversal\n");

printf("5 - Postorder Traversal\n");

printf("6 - Exit\n");

while(1)

{

printf("\nEnter your choice : ");

scanf("%d", &ch);

switch (ch)

{

case 1:

insert();

break;

case 2:

delete();

break;

case 3:

inorder(root);

break;

case 4:

preorder(root);

break;

case 5:

postorder(root);

break;

case 6:

exit(0);

default :

printf("Wrong choice, Please enter correct choice ");

break;

}

}

}

/\* To insert a node in the tree \*/

void insert()

{

create();

if (root == NULL)

root = temp;

else

search(root);

}

/\* To create a node \*/

void create()

{

int data;

printf("Enter data of node to be inserted : ");

scanf("%d", &data);

temp = (struct btnode \*)malloc(1\*sizeof(struct btnode));

temp->value = data;

temp->l = temp->r = NULL;

}

/\* Function to search the appropriate position to insert the new node \*/

void search(struct btnode \*t)

{

if ((temp->value > t->value) && (t->r != NULL)) /\* value more than root node value insert at right \*/

search(t->r);

else if ((temp->value > t->value) && (t->r == NULL))

t->r = temp;

else if ((temp->value < t->value) && (t->l != NULL)) /\* value less than root node value insert at left \*/

search(t->l);

else if ((temp->value < t->value) && (t->l == NULL))

t->l = temp;

}

/\* recursive function to perform inorder traversal of tree \*/

void inorder(struct btnode \*t)

{

if (root == NULL)

{

printf("No elements in a tree to display");

return;

}

if (t->l != NULL)

inorder(t->l);

printf("%d -> ", t->value);

if (t->r != NULL)

inorder(t->r);

}

/\* To check for the deleted node \*/

void delete()

{

int data;

if (root == NULL)

{

printf("No elements in a tree to delete");

return;

}

printf("Enter the data to be deleted : ");

scanf("%d", &data);

t1 = root;

t2 = root;

search1(root, data);

}

/\* To find the preorder traversal \*/

void preorder(struct btnode \*t)

{

if (root == NULL)

{

printf("No elements in a tree to display");

return;

}

printf("%d -> ", t->value);

if (t->l != NULL)

preorder(t->l);

if (t->r != NULL)

preorder(t->r);

}

/\* To find the postorder traversal \*/

void postorder(struct btnode \*t)

{

if (root == NULL)

{

printf("No elements in a tree to display ");

return;

}

if (t->l != NULL)

postorder(t->l);

if (t->r != NULL)

postorder(t->r);

printf("%d -> ", t->value);

}

/\* Search for the appropriate position to insert the new node \*/

void search1(struct btnode \*t, int data)

{

if ((data>t->value))

{

t1 = t;

search1(t->r, data);

}

else if ((data < t->value))

{

t1 = t;

search1(t->l, data);

}

else if ((data==t->value))

{

delete1(t);

}

}

/\* To delete a node \*/

void delete1(struct btnode \*t)

{

int k;

/\* To delete leaf node \*/

if ((t->l == NULL) && (t->r == NULL))

{

if (t1->l == t)

{

t1->l = NULL;

}

else

{

t1->r = NULL;

}

t = NULL;

free(t);

return;

}

/\* To delete node having one left hand child \*/

else if ((t->r == NULL))

{

if (t1 == t)

{

root = t->l;

t1 = root;

}

else if (t1->l == t)

{

t1->l = t->l;

}

else

{

t1->r = t->l;

}

t = NULL;

free(t);

return;

}

/\* To delete node having right hand child \*/

else if (t->l == NULL)

{

if (t1 == t)

{

root = t->r;

t1 = root;

}

else if (t1->r == t)

t1->r = t->r;

else

t1->l = t->r;

t == NULL;

free(t);

return;

}

/\* To delete node having two child \*/

else if ((t->l != NULL) && (t->r != NULL))

{

t2 = root;

if (t->r != NULL)

{

k = smallest(t->r);

flag = 1;

}

else

{

k =largest(t->l);

flag = 2;

}

search1(root, k);

t->value = k;

}

}

/\* To find the smallest element in the right sub tree \*/

int smallest(struct btnode \*t)

{

t2 = t;

if (t->l != NULL)

{

t2 = t;

return(smallest(t->l));

}

else

return (t->value);

}

/\* To find the largest element in the left sub tree \*/

int largest(struct btnode \*t)

{

if (t->r != NULL)

{

t2 = t;

return(largest(t->r));

}

else

return(t->value);

}