**PROGRAM 7)**

**Write a C program to create Binary Tree and provide insertion and deletion operations and to traverse the tree using In-order, Preorder and Post order (recursively)**

**PROGRAM :**

#include <stdio.h>

#include <stdlib.h>

#include <string.h>

struct node

{

int data;

struct node \*left\_child;

struct node \*right\_child;

};

typedef struct node \*NODE;

NODE getnode()

{

NODE p;

p = (NODE)malloc(sizeof(struct node));

if (p == NULL)

{

printf("Insufficient Memory");

}

p->left\_child = NULL;

p->right\_child = NULL;

return p;

}

int InOrderSucc(NODE p)

{

NODE q;

if (p == NULL)

{

printf(" ERROR !");

exit(0);

}

q = p->right\_child;

while (q->left\_child != NULL)

q = q->left\_child;

return q->data;

}

NODE BSTInsert(NODE root, int x)

{

NODE p, q, parent;

q = getnode();

q->data = x;

if (root == NULL)

return q;

p = root;

while (p != NULL)

{

parent = p;

if (x == p->data)

{

printf("Duplicate Entry");

free(q);

return root;

}

if (x < p->data)

p = p->left\_child;

else

p = p->right\_child;

}

if (x < parent->data)

parent->left\_child = q;

else

parent->right\_child = q;

return root;

}

NODE BSTDelete(NODE tp, int x)

{

int y;

NODE r;

if (tp == NULL)

{

printf(" Element %d Not Present", x);

return NULL;

}

if (x == tp->data)

{

if (tp->left\_child == NULL && tp->right\_child == NULL)

{

free(tp);

return NULL;

}

if (tp->left\_child == NULL)

{

r = tp->right\_child;

free(tp);

return r;

}

if (tp->right\_child == NULL)

{

r = tp->left\_child;

free(tp);

return r;

}

y = InOrderSucc(tp);

tp->data = y;

tp->right\_child = BSTDelete(tp->right\_child, y);

return tp;

}

if (x < tp->data)

tp->left\_child = BSTDelete(tp->left\_child, x);

else

tp->right\_child = BSTDelete(tp->right\_child, x);

return tp;

}

void InOrder(NODE p)

{

if (p)

{

InOrder(p->left\_child);

printf("%d ", p->data);

InOrder(p->right\_child);

}

}

void PreOrder(NODE p)

{

if (p)

{

printf("%d ,", p->data);

PreOrder(p->left\_child);

PreOrder(p->right\_child);

}

}

void PostOrder(NODE p)

{

if (p)

{

PostOrder(p->left\_child);

PostOrder(p->right\_child);

printf("%d ,", p->data);

}

}

int main()

{

int choice, x;

NODE root = NULL;

printf("Demonstration of BST Insert ,Delete, Display");

while (1)

{

printf("\n1:Insert\n2:Delete\n3:Inorder Display\n4:Preorder Display\n5:Postorder Display\n6:exit ");

printf("\nEnter the Choice :");

scanf("%d", &choice);

switch (choice)

{

case 1:

printf("\nEnter the element to be Inserted ");

scanf("%d", &x);

root = BSTInsert(root, x);

break;

case 2:

printf("\nEnter the element to be Deleted ");

scanf("%d", &x);

root = BSTDelete(root, x);

break;

case 3:

printf("\nTraversal of BST : Inorder");

InOrder(root);

break;

case 4:

printf("\nTraversal of BST : Preorder");

PreOrder(root);

break;

case 5:

printf("\nTraversal of BST : Postorder");

PostOrder(root);

break;

case 6:

exit(0);

}

}

return 0;

}

**OUTPUTS :**

**OUTPUT 1 :**

Demonstration of BST Insert ,Delete, Display

1:Insert

2:Delete

3:Inorder Display

4:Preorder Display

5:Postorder Display

6:exit

Enter the Choice :1

Enter the element to be Inserted 10

1:Insert

2:Delete

3:Inorder Display

4:Preorder Display

5:Postorder Display

6:exit

Enter the Choice :1

Enter the element to be Inserted 20

1:Insert

2:Delete

3:Inorder Display

4:Preorder Display

5:Postorder Display

6:exit

Enter the Choice :1

Enter the element to be Inserted 30

1:Insert

2:Delete

3:Inorder Display

4:Preorder Display

5:Postorder Display

6:exit

Enter the Choice :1

Enter the element to be Inserted 40

1:Insert

2:Delete

3:Inorder Display

4:Preorder Display

5:Postorder Display

6:exit

Enter the Choice :1

Enter the element to be Inserted 50

1:Insert

2:Delete

3:Inorder Display

4:Preorder Display

5:Postorder Display

6:exit

Enter the Choice :3

Traversal of BST : Inorder10 20 30 40 50

1:Insert

2:Delete

3:Inorder Display

4:Preorder Display

5:Postorder Display

6:exit

Enter the Choice :4

Traversal of BST : Preorder10 ,20 ,30 ,40 ,50 ,

1:Insert

2:Delete

3:Inorder Display

4:Preorder Display

5:Postorder Display

6:exit

Enter the Choice :5

Traversal of BST : Postorder50 ,40 ,30 ,20 ,10 ,

1:Insert

2:Delete

3:Inorder Display

4:Preorder Display

5:Postorder Display

6:exit

Enter the Choice :2

Enter the element to be Deleted 20

1:Insert

2:Delete

3:Inorder Display

4:Preorder Display

5:Postorder Display

6:exit

Enter the Choice :3

Traversal of BST : Inorder10 30 40 50

1:Insert

2:Delete

3:Inorder Display

4:Preorder Display

5:Postorder Display

6:exit

Enter the Choice :4

Traversal of BST : Preorder10 ,30 ,40 ,50 ,

1:Insert

2:Delete

3:Inorder Display

4:Preorder Display

5:Postorder Display

6:exit

Enter the Choice :6

**OUTPUT 2 :**

Demonstration of BST Insert ,Delete, Display

1:Insert

2:Delete

3:Inorder Display

4:Preorder Display

5:Postorder Display

6:exit

Enter the Choice :2

Enter the element to be Deleted 100

Element 100 Not Present

1:Insert

2:Delete

3:Inorder Display

4:Preorder Display

5:Postorder Display

6:exit

Enter the Choice :1

Enter the element to be Inserted 100

1:Insert

2:Delete

3:Inorder Display

4:Preorder Display

5:Postorder Display

6:exit

Enter the Choice :1

Enter the element to be Inserted 200

1:Insert

2:Delete

3:Inorder Display

4:Preorder Display

5:Postorder Display

6:exit

Enter the Choice :1

Enter the element to be Inserted 300

1:Insert

2:Delete

3:Inorder Display

4:Preorder Display

5:Postorder Display

6:exit

Enter the Choice :1

Enter the element to be Inserted 400

1:Insert

2:Delete

3:Inorder Display

4:Preorder Display

5:Postorder Display

6:exit

Enter the Choice :3

Traversal of BST : Inorder100 200 300 400

1:Insert

2:Delete

3:Inorder Display

4:Preorder Display

5:Postorder Display

6:exit

Enter the Choice :4

Traversal of BST : Preorder100 ,200 ,300 ,400 ,

1:Insert

2:Delete

3:Inorder Display

4:Preorder Display

5:Postorder Display

6:exit

Enter the Choice :5

Traversal of BST : Postorder400 ,300 ,200 ,100 ,

1:Insert

2:Delete

3:Inorder Display

4:Preorder Display

5:Postorder Display

6:exit

Enter the Choice :2

Enter the element to be Deteted 300

1:Insert

2:Delete

3:Inorder Display

4:Preorder Display

5:Postorder Display

6:exit

Enter the Choice :4

Traversal of BST : Preorder100 ,200 ,400 ,

1:Insert

2:Delete

3:Inorder Display

4:Preorder Display

5:Postorder Display

6:exit

Enter the Choice :1

Enter the element to be Inserted 500

1:Insert

2:Delete

3:Inorder Display

4:Preorder Display

5:Postorder Display

6:exit

Enter the Choice :3

Traversal of BST : Inorder100 200 400 500

1:Insert

2:Delete

3:Inorder Display

4:Preorder Display

5:Postorder Display

6:exit

Enter the Choice :6

**OUTPUT 3 :**

Demonstration of BST Insert ,Delete, Display

1:Insert

2:Delete

3:Inorder Display

4:Preorder Display

5:Postorder Display

6:exit

Enter the Choice :1

Enter the element to be Inserted 1

1:Insert

2:Delete

3:Inorder Display

4:Preorder Display

5:Postorder Display

6:exit

Enter the Choice :1

Enter the element to be Inserted 2

1:Insert

2:Delete

3:Inorder Display

4:Preorder Display

5:Postorder Display

6:exit

Enter the Choice :1

Enter the element to be Inserted 3

1:Insert

2:Delete

3:Inorder Display

4:Preorder Display

5:Postorder Display

6:exit

Enter the Choice :1

Enter the element to be Inserted 4

1:Insert

2:Delete

3:Inorder Display

4:Preorder Display

5:Postorder Display

6:exit

Enter the Choice :1

Enter the element to be Inserted 5

1:Insert

2:Delete

3:Inorder Display

4:Preorder Display

5:Postorder Display

6:exit

Enter the Choice :5

Traversal of BST : Postorder5 ,4 ,3 ,2 ,1 ,

1:Insert

2:Delete

3:Inorder Display

4:Preorder Display

5:Postorder Display

6:exit

Enter the Choice :2

Enter the element to be Deleted 2

1:Insert

2:Delete

3:Inorder Display

4:Preorder Display

5:Postorder Display

6:exit

Enter the Choice :2

Enter the element to be Deleted 4

1:Insert

2:Delete

3:Inorder Display

4:Preorder Display

5:Postorder Display

6:exit

Enter the Choice :3

Traversal of BST : Inorder1 3 5

1:Insert

2:Delete

3:Inorder Display

4:Preorder Display

5:Postorder Display

6:exit

Enter the Choice :2

Enter the element to be Deleted 3

1:Insert

2:Delete

3:Inorder Display

4:Preorder Display

5:Postorder Display

6:exit

Enter the Choice :6