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LAB:10

Write a program
a) To construct a binary Search tree.
b) To traverse the tree using all the methods i.e., in-order, preorder and post order c) To display the elements in the tree.

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

struct node
{
        int info;
        struct node *lchild;
        struct node *rchild;
}*root;

void find(int item,struct node **par,struct node **loc)
{
        struct node *ptr,*ptrsave;

        if(root==NULL)  /*tree empty*/
        {
                *loc=NULL;
                *par=NULL;
                return;
        }
        if(item==root->info) /*item is at root*/
        {
                *loc=root;
                *par=NULL;
                return;
        }
        /*Initialize ptr and ptrsave*/
        if(item<root->info)
                ptr=root->lchild;
        else
                ptr=root->rchild;
```

```
        ptrsave=root;

        while(ptr!=NULL)
        {
                if(item==ptr->info)
                {       *loc=ptr;
                        *par=ptrsave;
                        return;
                }
                ptrsave=ptr;
                if(item<ptr->info)
                        ptr=ptr->lchild;
                else
                        ptr=ptr->rchild;
         }/*End of while */
         *loc=NULL;   /*item not found*/
         *par=ptrsave;
}

void insert(int item)
{       struct node *tmp,*parent,*location;
        find(item,&parent,&location);
        if(location!=NULL)
        {
                printf("Item already present");
                return;
        }

        tmp=(struct node *)malloc(sizeof(struct node));
        tmp->info=item;
        tmp->lchild=NULL;
        tmp->rchild=NULL;

        if(parent==NULL)
                root=tmp;
        else
                if(item<parent->info)
                        parent->lchild=tmp;
                else
                        parent->rchild=tmp;
}

void case_a(struct node *par,struct node *loc )
{
        if(par==NULL) /*item to be deleted is root node*/
                root=NULL;
```

```
        else
                if(loc==par->lchild)
                        par->lchild=NULL;
                else
                        par->rchild=NULL;
}

void case_b(struct node *par,struct node *loc)
{
        struct node *child;

        /*Initialize child*/
        if(loc->lchild!=NULL) /*item to be deleted has lchild */
                child=loc->lchild;
        else            /*item to be deleted has rchild */
                child=loc->rchild;

        if(par==NULL )   /*Item to be deleted is root node*/
                root=child;
        else
                if( loc==par->lchild)   /*item is lchild of its parent*/
                        par->lchild=child;
                else                    /*item is rchild of its parent*/
                        par->rchild=child;
}
void case_c(struct node *par,struct node *loc)
{
        struct node *ptr,*ptrsave,*suc,*parsuc;

        /*Find inorder successor and its parent*/
        ptrsave=loc;
        ptr=loc->rchild;
        while(ptr->lchild!=NULL)
        {
                ptrsave=ptr;
                ptr=ptr->lchild;
        }
        suc=ptr;
        parsuc=ptrsave;

        if(suc->lchild==NULL && suc->rchild==NULL)
                case_a(parsuc,suc);
        else
                case_b(parsuc,suc);

        if(par==NULL) /*if item to be deleted is root node */
```

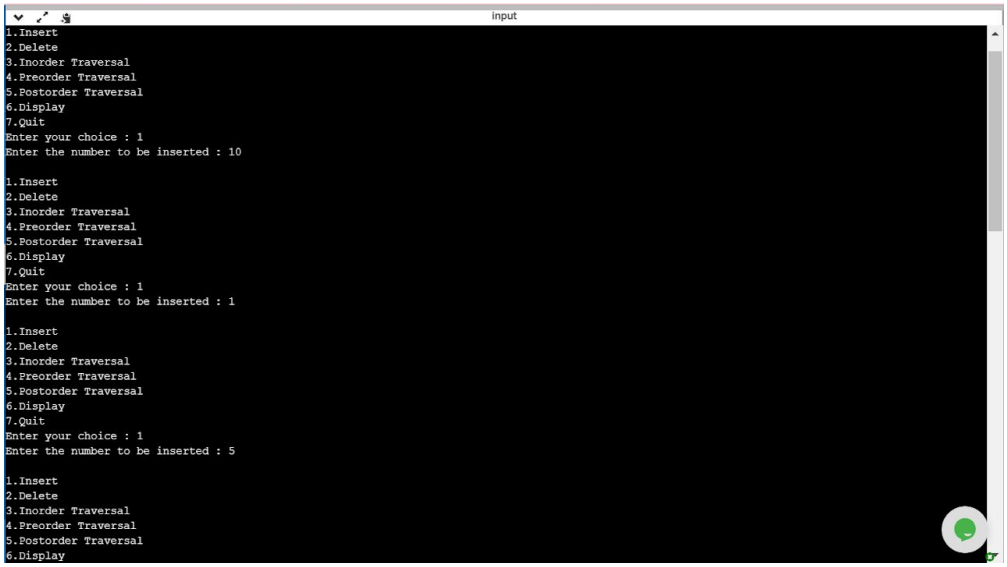
```
                root=suc;
        else
                if(loc==par->lchild)
                        par->lchild=suc;
                else
                        par->rchild=suc;

        suc->lchild=loc->lchild;
        suc->rchild=loc->rchild;
}
int del(int item)
{
        struct node *parent,*location;
        if(root==NULL)
        {
                printf("Tree empty");
                return 0;
        }

        find(item,&parent,&location);
        if(location==NULL)
        {
                printf("Item not present in tree");
                return 0;
        }

        if(location->lchild==NULL && location->rchild==NULL)
                case_a(parent,location);
        if(location->lchild!=NULL && location->rchild==NULL)
                case_b(parent,location);
        if(location->lchild==NULL && location->rchild!=NULL)
                case_b(parent,location);
        if(location->lchild!=NULL && location->rchild!=NULL)
                case_c(parent,location);
        free(location);
}

int preorder(struct node *ptr)
{
        if(root==NULL)
        {
                printf("Tree is empty");
                return 0;
        }
        if(ptr!=NULL)
        {
```

```
                printf("%d  ",ptr->info);
                preorder(ptr->lchild);
                preorder(ptr->rchild);
        }
}/*End of preorder()*/

void inorder(struct node *ptr)
{
        if(root==NULL)
        {
                printf("Tree is empty");
                return;
        }
        if(ptr!=NULL)
        {
                inorder(ptr->lchild);
                printf("%d  ",ptr->info);
                inorder(ptr->rchild);
        }
}
void postorder(struct node *ptr)
{
        if(root==NULL)
        {
                printf("Tree is empty");
                return;
        }
        if(ptr!=NULL)
        {
                postorder(ptr->lchild);
                postorder(ptr->rchild);
                printf("%d  ",ptr->info);
        }
}/*End of postorder()*/

void display(struct node *ptr,int level)
{
        int i;
        if ( ptr!=NULL )
        {
                display(ptr->rchild, level+1);
                printf("\n");
                for (i = 0; i < level; i++)
                        printf("    ");
                printf("%d", ptr->info);
                display(ptr->lchild, level+1);
```

```
        }
}
main()
{
        int choice,num;
        root=NULL;
        while(1)
        {
                printf("\n");
                printf("1.Insert\n");
                printf("2.Delete\n");
                printf("3.Inorder Traversal\n");
                printf("4.Preorder Traversal\n");
                printf("5.Postorder Traversal\n");
                printf("6.Display\n");
                printf("7.Quit\n");
                printf("Enter your choice : ");
                scanf("%d",&choice);

                switch(choice)
                {
                 case 1:
                        printf("Enter the number to be inserted : ");
                        scanf("%d",&num);
                        insert(num);
                        break;
                 case 2:
                        printf("Enter the number to be deleted : ");
                        scanf("%d",&num);
                        del(num);
                        break;
                 case 3:
                        inorder(root);
                        break;
                 case 4:
                        preorder(root);
                        break;
                 case 5:
                        postorder(root);
                        break;
                 case 6:
                        display(root,1);
                        break;
                 case 7:
        break;
                 default:
```

```
                printf("Wrong choice\n");
            }
        }
}
```

THE OUTPUT:




5.Postorder Traversal
6.Display
7.Quit
Enter your choice : 4
10 1 5 3 8
1.Insert
2.Delete
3.Inorder Traversal
4.Preorder Traversal
5.Postorder Traversal
6.Display
7.Quit
Enter your choice : 5
3 8 5 1 10
1.Insert
2.Delete
3.Inorder Traversal
4.Preorder Traversal
5.Postorder Traversal
6.Display
7.Quit
Enter your choice : 6
10
8
5
3
1