

Assignment no 9

Input:

```
#include<iostream>
using namespace std;

class node
{
public:
    string key;
    string meaning;
    node *left;
    node *right;
};

class AVL
{
    node *root;
public:
    AVL()
    {
        root=NULL;
    }

    void create();
    node* insert(node *cur,node *temp);
    node* balance(node *temp);
    int dif(node *temp);
    int height(node *temp);
    int maximum(int a,int b);

    node* LL(node *par);
    node* RR(node *par);
    node* LR(node *par);
    node* RL(node *par);

    void ascending(node *temp);
    node* delete_n(node *root,string key1);
    void deleten();

    node* extractmin(node *t);
    void descending(node *temp);
    void display();
    bool search(node *cur,string key1);
    void search_value();
};
```

```

void AVL::create()
{
    char answer;
    node *temp;
    do
    {
        temp=new node();
        cout<<"\n Enter the keyword:";
        cin>>temp->key;
        cout<<"\n Enter the meaning:";
        cin>>temp->meaning;
        temp->left=temp->right=NULL;

        root=insert(root,temp);

        cout<<"\n Do you want to add another word?(y/n)";
        cin>>answer;
    }
    while(answer=='y'||answer=='Y');
}

```

```

node* AVL::insert(node *cur,node *temp)
{
    if(cur==NULL)
    {
        return temp;
    }
    if(temp->key<cur->key)
    {
        cur->left=insert(cur->left,temp);
        cur=balance(cur);
    }
    else if(temp->key>cur->key)
    {
        cur->right=insert(cur->right,temp);
        cur=balance(cur);
    }
    return cur;
}

```

```

node* AVL::balance(node *temp)
{
    int bal;
    bal=dif(temp);
}

```

```

    if(bal>=2)
    {
        if(dif(temp->left)<0)
            temp=LR(temp);
        else
            temp=LL(temp);
    }
    else if(bal<=-2)
    {
        if(dif(temp->right)<0)
            temp=RR(temp);
        else
            temp=RL(temp);
    }
    return temp;
}

```

```

int AVL::dif(node *temp)
{
    int l,r;
    l=height(temp->left);
    r=height(temp->right);
    return(l-r);
}

```

```

int AVL::height(node *temp)
{
    if(temp==NULL)
        return(-1);
    else
        return(max(height(temp->left),height(temp->right))+1);
}

```

```

int AVL::maximum(int a,int b)
{
    if(a>b)
        return a;
    else
        return b;
}

```

```

node* AVL::LL(node *par)
{
    node *temp,*temp1;
    temp=par->left;

```

```

        temp1=temp->right;
        temp->right=par;
        par->left=temp1;
        return temp;
    }

node* AVL::RR(node *par)
{
    node *temp,*temp1;
    temp=par->right;
    temp1=temp->left;
    temp->left=par;
    par->right=temp1;
    return temp;
}

node* AVL::LR(node *par)
{
    par->left=RR(par->left);
    return(LL(par));
}

node* AVL::RL(node *par)
{
    par->right=LL(par->right);
    return(RR(par));
}

void AVL::ascending(node *temp)
{
    if(temp!=NULL)
    {
        ascending(temp->left);
        cout<<"\n\t"<<temp->key<<" : "<<temp->meaning;
        ascending(temp->right);
    }
}

void AVL::descending(node *temp)
{
    if(temp!=NULL)
    {
        descending(temp->right);
        cout<<"\n\t"<<temp->key<<" : "<<temp->meaning;
        descending(temp->left);
    }
}

```

```
}
```

```
void AVL::display()
```

```
{
    cout<<"\n The keywords in ascending order are : \n";
    ascending(root);
    cout<<"\n The keywords in descending order are : \n";
    descending(root);
}
```

```
bool AVL::search(node *cur,string key1)
```

```
{
    if(cur)
    {
        if(cur->key==key1)
            return true;
        if(cur->key>key1)
            return search(cur->left,key1);
        else
            return search(cur->right,key1);
    }
    return false;
}
```

```
void AVL::search_value()
```

```
{
    string key2;
    cout<<"\n Enter the keyword you wish to search : ";
    cin>>key2;
    if(search(root,key2))
        cout<<"\n The entered keyword is present in the AVL tree";
    else
        cout<<"\n The entered keyword is not present in the AVL tree";
}
```

```
node* AVL::delete_n(node* cur,string key1)
```

```
{
    if ( !cur)
        return cur;
    if ( key1 < cur->key )
        cur->left = delete_n(cur->left, key1);

    else if( key1 > cur->key )
        cur->right = delete_n(cur->right, key1);
}
```

```

else
{
    node *l = cur->left;
    node *r = cur->right;
    delete cur;
    if ( !r )
        return l;
    node *m=r;

    while(m->left)
        m=m->left;
    m->right = extractmin(r);
    m->left = l;
    return balance(m);
}
return balance(cur);
}

node* AVL::extractmin(node *t)
{
    if ( !t->left )
        return t->right;
    t->left = extractmin(t->left);
    return balance(t);
}

void AVL::deleten()
{
    string key;
    cout<<"\n Enter the keyword to be deleted : ";
    cin>>key;
    root=delete_n(root,key);
}

int main()
{
    char c;
    int ch;
    AVL a;
    do
    {
        cout<<"*****";
        cout<<"\n 1.Insert a keyword in AVL tree.";
        cout<<"\n 2.Display the AVL tree.";
        cout<<"\n 3.Search a keyword";
    }

```

```

        cout<<"\n 4.Delete a keyword.";
        cout<<"\n Enter your choice : ";
        cin>>ch;
        switch(ch)
        {
        case 1 : a.create();
            break;
        case 2 : a.display();
            break;
        case 3 : a.search_value();
            break;
        case 4 : a.deleten();
            break;
        default : cout<<"\n Wrong choice ! ";
        }
        cout<<"\n Do you want to continue? (y/n): ";
        cin>>c;
        }
        while(c=='y'||c=='Y');
    return 0;
}

```

Output:

```

1.Insert a keyword in AVL tree.
2.Display the AVL tree.
3.Search a keyword
4.Delete a keyword.
Enter your choice : 1
Enter the keyword:54
Enter the meaning:I
Do you want to add another word?(y/n)y
Enter the keyword:66
Enter the meaning:am
Do you want to add another word?(y/n)y
Enter the keyword:89 Indian
Enter the meaning:
Do you want to add another word?(y/n)n
Do you want to continue? (y/n): y

```

```

1.Insert a keyword in AVL tree.
2.Display the AVL tree.
3.Search a keyword
4.Delete a keyword.
Enter your choice : 2
The keywords in ascending order are :

```

54 : I

66 : am

89 : Indian

The keywords in descending order are :

89 : Indian

66 : am

54 : I

Do you want to continue? (y/n): y

1.Insert a keyword in AVL tree.

2.Display the AVL tree.

3.Search a keyword

4.Delete a keyword.

Enter your choice : 3

Enter the keyword you wish to search : 89

The entered keyword is present in the AVL tree

Do you want to continue? (y/n): y

1.Insert a keyword in AVL tree.

2.Display the AVL tree.

3.Search a keyword

4.Delete a keyword.

Enter your choice : 4

Enter the keyword to be deleted : 54

Do you want to continue? (y/n): y

1.Insert a keyword in AVL tree.

2.Display the AVL tree.

3.Search a keyword

4.Delete a keyword.

Enter your choice : 2

The keywords in ascending order are :

66 : am

89 : Indian

The keywords in descending order are :

89 : Indian

66 : am

Do you want to continue? (y/n): n