**/\* Practical No 9**

**Problem Statement:** A Dictionary stores keywords and its meanings. Provide facility for adding new keywords, deleting keywords, updating values of any entry. Provide facility to display whole data sorted in ascending/ Descending order. Also find how many maximum comparisons may require for finding any keyword. Use Height balance tree and find the complexity for finding a keyword. \*/

**Input:-**

Keywords and Its meaning.

**Output:-**

Height Balanced Tree

**Program code:**

#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;

}