CSS-114- FUNDAMENTALS OF PROGRAMMING

LAB MANUAL #9

HOME TASK

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Home Task:

1. Write a C++ program to take inverse of a 3x3 matrix using its determinant and adjoint.

CODE:

```cpp
#include<iostream>
using namespace std;
   //function to find the transpose of a matrix
 void transpose(float arr3[3][3],
                float arr4[3][3])
{
    int i, j;
    for (i = 0; i < 3; i++)
        for (j = 0; j < 3; j++)
            arr4[i][j] = arr3[j][i];
}

int main(){
    cout<<"Lab Manual 8, Home Task."<<endl;
    int n,det;
    float arr1[3][3];
    cout<<"Enter of Elements of the matrix whose inverse you wish to find:"<<endl; //input a 2D 3x3 array from the user
    for(int i =0;i<3;i++){
        for(int j=0; j<3;j++){
        cin>>n;
            arr1[i][j]=n;
        }
    }
    cout<<endl;
        cout<<"The Matrix is:"<<endl;
    for(int i =0;i<3;i++){
        for(int j=0; j<3;j++){
            cout<<arr1[i][j]<<" ";
            }
         cout<<endl;
        }
        cout<<endl;
        //to find the determinant of the input matrix using the known mathematical formula
        det = arr1[0][0]*( (arr1[1][1]*arr1[2][2]) - (arr1[2][1]*arr1[1][2]) )
            - arr1[0][1]*( (arr1[1][0]*arr1[2][2]) - (arr1[2][0]*arr1[1][2]) )
            + arr1[0][2]*( (arr1[1][0]*arr1[2][1]) - (arr1[2][0]*arr1[1][1]) ) ;
        cout<<"The determinant of the matrix is: "<<det<<endl; //output the determinant
        cout<<endl;
        //to find the ADJOINT, minor, co-factor of minor, and then transposition of co-factor must be found
        //to find the minor of the input matrix using the known mathematical formula
        float arr2[3][3];
        arr2[0][0]= (arr1[1][1]*arr1[2][2]) - (arr1[1][2]*arr1[2][1]);
        arr2[0][1]= (arr1[1][0]*arr1[2][2]) - (arr1[1][2]*arr1[2][0]);
        arr2[0][2]= (arr1[1][0]*arr1[2][1]) - (arr1[1][1]*arr1[2][0]);
        arr2[1][0]= (arr1[0][1]*arr1[2][2]) - (arr1[0][2]*arr1[2][1]);
        arr2[1][1]= (arr1[0][0]*arr1[2][2]) - (arr1[0][2]*arr1[2][0]);
        arr2[1][2]= (arr1[0][0]*arr1[2][1]) - (arr1[0][1]*arr1[2][0]);
        arr2[2][0]= (arr1[0][1]*arr1[1][2]) - (arr1[0][2]*arr1[1][1]);
        arr2[2][1]= (arr1[1][2]*arr1[0][0]) - (arr1[0][2]*arr1[1][0]);
        arr2[2][2]= (arr1[1][1]*arr1[0][0]) - (arr1[0][1]*arr1[1][0]);

        //to find the co-factor of the minor of the original matrix
        float arr3[3][3];
        arr3[0][0] =  arr2[0][0];
        arr3[0][1] = -arr2[0][1];
        arr3[0][2] =  arr2[0][2];
        arr3[1][0] = -arr2[1][0];
        arr3[1][1] =  arr2[1][1];
        arr3[1][2] = -arr2[1][2];
        arr3[2][0] =  arr2[2][0];
        arr3[2][1] = -arr2[2][1];
        arr3[2][2] =  arr2[2][2];
```

```
    //to find adjoint, call the transposition function and transpose the cofactor of the minor of the original matrix
float arr4[3][3];
transpose(arr3, arr4);

 cout << "The Adjoint of the Matrix:"<<endl; //output the adjoint
for (int i = 0; i < 3; i++) {
    for (int j = 0; j < 3; j++)
       cout << " " << arr4[i][j];
    cout<<endl;  }
    cout<<endl;
    //to find inverse, divide each element of the adjoint with the determinant
float arr5[3][3];
 for (int i = 0; i < 3; i++){
    for (int j = 0; j < 3; j++){
    arr5[i][j]= arr4[i][j] / det;
}
    }
    cout<<"The Inverse of the Matrix is:"<<endl; //output the inverse of the matrix
for(int i =0;i<3;i++){
    for(int j=0; j<3;j++){
        cout<<arr5[i][j]<<"  ";
       }
     cout<<endl;
    }

        return 0;
}
```

OUTPUT:

```
C:\Users\HP\Desktop\Cpp Projects\Lab Manual 9, Home Task .exe
Lab Manual 8, Home Task.
Enter of Elements of the matrix whose inverse you wish to find:
-3
2
3
1
4
1
5
7
6

The Matrix is:
-3 2 3
1 4 1
5 7 6

The determinant of the matrix is: -92

The Adjoint of the Matrix:
 17 9 -10
 -1 -33 6
 -13 31 -14

The Inverse of the Matrix is:
-0.184783  -0.0978261  0.108696
0.0108696  0.358696  -0.0652174
0.141304  -0.336957  0.152174

--------------------------------
Process exited after 9.857 seconds with return value 0
Press any key to continue . . .
```