SSN COLLEGE OF ENGINEERING
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
UCS1712 – GRAPHICS AND MULTIMEDIA LAB
EX NO: 6A-2D Composite Transforamtion

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AIM

To write a program in C++ using openGL to perform the following 2Dimensional composite transformations.

ALGORITHM:

- Read the no. of edges of the polygon from the user.
- Read the vertices of the polygon.
- Plot the original polygon.
- Read the transformation from the user given the menu
- If the choice is rotation and scaling

Get the rotation axis, pivot point and scaling factor from the user Perform rotation and save it to the polygon

Perform scaling and plot the polygon

- If the choice is reflection and shearing

Get the reflection axis and shearing factor from the user perform reflection save it to the polygon

Perform shearing and plot the polygon

CODE:

```
#include <stdio.h>

#include <math.h>

#include <iostream>

#include <vector>

#include <GL/glut.h>

using namespace std;

int pntX1, pntY1, op = 0, edges, op1, op2;

int shearingX, shearingY;
```

```
vector<int> pntX, tempX;

vector<int> pntY, tempY;

int transX, transY;

double scaleX, scaleY;

double angle, angleRad;

char reflectionAxis;

double round(double d)

{

    return floor(d + 0.5);

}

void drawPolygon()

{

    glBegin(GL_POLYGON);

    glColor3f(0.4, 0.6, 0.0);

    for (int i = 0; i < edges; i++)

    {

        glVertex2i(pntX[i], pntY[i]);

    }

    glEnd();

}

void translate(int x, int y)

{
```

```
    glBegin(GL_POLYGON);
    glColor3f(0.7, 0.3, 0.4);
    for (int i = 0; i < edges; i++)
    {
        pntX[i] += x;
        pntY[i] += y;
        //glVertex2i(pntX[i], pntY[i]);
    }
    glEnd();
}
void scale(double x, double y)
{
    glBegin(GL_POLYGON);
    glColor3f(0.7, 0.3, 0.4);
    for (int i = 0; i < edges; i++)
    {
        pntX[i] = round(pntX[i] * x) + 300;
        pntY[i] = round(pntY[i] * y);
        glVertex2i(pntX[i], pntY[i]);
    }
    glEnd();
}
```

```
void rotate(double theta)

{

    glBegin(GL_POLYGON);

    glColor3f(0.88, 0.1, 1.0);

    for (int i = 0; i < edges; i++)

    {

        int pntX1 = pntX[i];

        int pntY1 = pntY[i];

        pntX[i] = round((pntX1 * cos(theta)) - (pntY1 * sin(theta))); pntY[i] =
round((pntX1 * sin(theta)) + (pntY1 * cos(theta))); //glVertex2i(pntX[i],pntY[i]);

    }

    glEnd();

}

void reflectX()

{

    for (int i = 0; i < edges; i++)

    {

        pntY[i] = pntY[i] * -1;

    }

}

void reflectY()

{

    for (int i = 0; i < edges; i++)
```

```
    {
        pntX[i] = pntX[i] * -1;
    }
}
void reflectOrigin()
{
    for (int i = 0; i < edges; i++)
    {
        pntX[i] = pntX[i] * -1;
        pntY[i] = pntY[i] * -1;
    }
}
void reflectDiag()
{
    for (int i = 0; i < edges; i++)
    {
        int temp = pntX[i];
        pntX[i] = pntY[i];
        pntY[i] = temp;
    }
    glEnd();
}
```

```
void shearX()

{

    glBegin(GL_POLYGON);

    glColor3f(0.3, 0.3, 0.3);

    glVertex2i(pntX[0] + 150, pntY[0]);

    glVertex2i(pntX[1] + shearingX + 150, pntY[1]);

    glVertex2i(pntX[2] + shearingX + 150, pntY[2]);

    glVertex2i(pntX[3] + 150, pntY[3]);

    glEnd();

}

void shearY()

{

    glBegin(GL_POLYGON);

    glColor3f(0.3, 0.3, 0.3);

    glVertex2i(pntX[0] + 150, pntY[0]);

    glVertex2i(pntX[1] + 150, pntY[1]);

    glVertex2i(pntX[2] + 150, pntY[2] + shearingY); glVertex2i(pntX[3] + 150, pntY[3]
+ shearingY); glEnd();

}

void myInit(void)

{

    glClearColor(0.0, 0.0, 0.0, 0.0);
```

```
    glColor3f(0.0f, 0.0f, 0.0f);
    glPointSize(4.0);
    glMatrixMode(GL_PROJECTION);
    glLoadIdentity();
    gluOrtho2D(-500, 500, -500, 500);
}
void myDisplay(void)
{
    while (true) {
        glClear(GL_COLOR_BUFFER_BIT);
        glColor3f(0.0, 0.0, 0.0);
        drawPolygon();
        cout << "\nSelect the required Composite Transformation:\n";
        cout << "1. Rotation & Scaling\n";
        cout << "2. Reflection & Shearing\n";
        cout << "3. Exit\n";
        cout << "Enter your choice : ";
        cin >> op;
        if (op == 3) {
            break;
        }
        if (op == 1)
```

```
        {
            cout << "Enter the angle for rotation: "; cin >> angle;
            angleRad = angle * 3.1416 / 180;
            cout << "Enter fixed point: "; cin >> transX >> transY;
            translate(-transX, -transY);
            rotate(angleRad);
            translate(transX, transY);
            cout << "Enter the scaling factor for X and Y: "; cin >> scaleX  >>
scaleY;
            scale(scaleX, scaleY);
        }
        else if (op == 2)
        {
            cout << "\nChoose reflection axis: \n";
            cout << "1. Reflect along X axis\n";
            cout << "2. Reflect along Y axis\n";
            cout << "3. Reflect about origin\n";
            cout << "4. Reflect along X=Y\n";
            cout << "Enter your choice : ";
            cin >> op1;
            if (op1 == 1)
            {
                reflectX();
```

```
        }
        else if (op1 == 2)
        {
            reflectY();
        }
        else if (op1 == 3)
        {
            reflectOrigin();
        }
        else if (op1 == 4)
        {
            reflectDiag();
        }
        cout << "\nChoose shearing axis: \n";
        cout << "1. Shear along X axis\n";
        cout << "2. Shear along Y axis\n";
        cout << "Enter your choice : ";
        cin >> op2;
        if (op2 == 1)
        {
            cout << "Enter the shearing factor for X: "; cin >>
            shearingX;
```

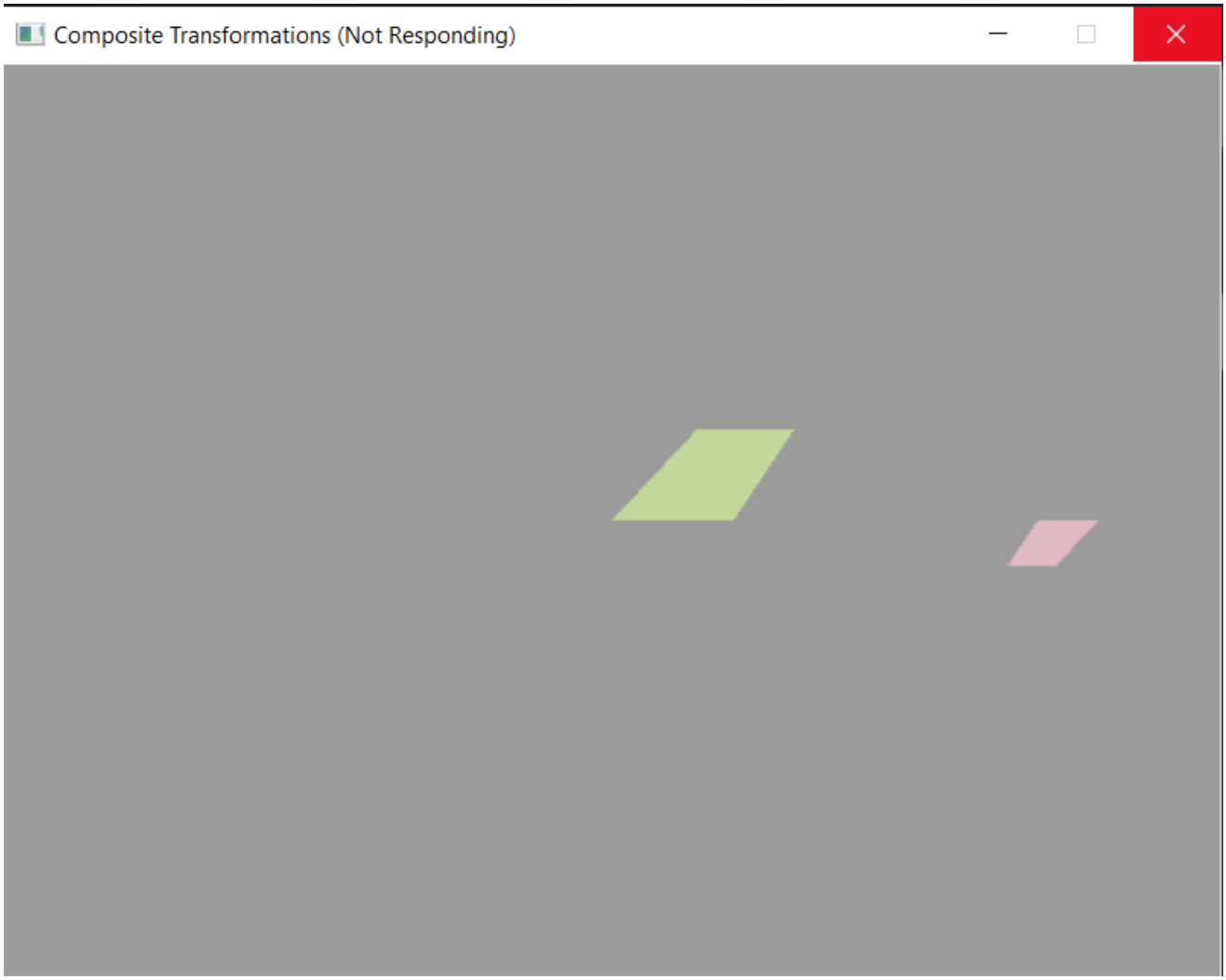
```
                shearX();
            }
            else if (op2 == 2)
            {
                cout << "Enter the shearing factor for Y: "; cin >>
                shearingY;
                shearY();
            }
        }
        pntX = tempX;
        pntY = tempY;
        glFlush();
    }
}
int main(int argc, char** argv)
{
    cout << "\n2D-Transformations\n" << endl;
    cout << "\nFor Polygon:\n" << endl;
    cout << "Enter no of edges: "; cin >> edges;
    cout << "\nEnter Polygon Coordinates : \n";
    for (int i = 0; i < edges; i++) {
```

```
        cout << "Vertex " << i + 1 << " : "; cin >> pntX1 >> pntY1;
pntX.push_back(pntX1);

        tempX.push_back(pntX1);

        pntY.push_back(pntY1);

        tempY.push_back(pntY1);

    }

    glutInit(&argc, argv);

    glutInitDisplayMode(GLUT_SINGLE | GLUT_RGB);

    glutInitWindowSize(640, 480);

    glutInitWindowPosition(100, 150);

    glutCreateWindow("Composite Transformations");

    glutDisplayFunc(myDisplay);

    myInit();

    glutMainLoop();

    return 0;

}
```

OUTPUT:

ROTATION AND SCALING:

```
"App Running"

E:\7th sem\graphics lab\Ex6a>main.exe

2D-Transformations


For Polygon:

Enter no of edges: 4

Enter Polygon Coordinates :
Vertex 1 : 100 0
Vertex 2 : 150 100
Vertex 3 : 70 100
Vertex 4 : 0 0

Select the required Composite Transformation:
1. Rotation & Scaling
2. Reflection & Shearing
3. Exit
Enter your choice : 1
Enter the angle for rotation: 180
Enter fixed point: 100 0
Enter the scaling factor for X and Y: 0.5 0.5
```


Composite Transformations (Not Responding)

REFLECTION AND SHEARING:

```
E:\7th sem\graphics lab\Ex6a>main.exe

2D-Transformations


For Polygon:

Enter no of edges: 4

Enter Polygon Coordinates :
Vertex 1 : 100 0
Vertex 2 : 100 100
Vertex 3 : 0 100
Vertex 4 : 0 0

Select the required Composite Transformation:
1. Rotation & Scaling
2. Reflection & Shearing
3. Exit
Enter your choice : 2

Choose reflection axis:
1. Reflect along X axis
2. Reflect along Y axis
3. Reflect about origin
4. Reflect along X=Y
Enter your choice : 1

Choose shearing axis:
1. Shear along X axis
2. Shear along Y axis
Enter your choice : 1
Enter the shearing factor for X: 50
```


Composite Transformations (Not Responding)