Computer Graphics, Lab Assignment 3

Handed out: April 7, 2024

due: 24:00, April 18, 2024 **(NO SCORE for late submissions!)**

Submit a single zip **[studentID]-[assignment#].**zip file containing two source files.

1. Write down a Python program to draw a transformed triangle in a 2D space.

   A. Set the window title to **[studentID]-[assignment#]-[prob#]** and the window size to (480,480).

   B. Draw a triangle using render() function below (DO NOT modify it!).

```
def render(T):
    glClear(GL_COLOR_BUFFER_BIT)
    glLoadIdentity()
    # draw cooridnate
    glBegin(GL_LINES)
    glColor3ub(255, 0, 0)
    glVertex2fv(np.array([0.,0.]))
    glVertex2fv(np.array([1.,0.]))
    glColor3ub(0, 255, 0)
    glVertex2fv(np.array([0.,0.]))
    glVertex2fv(np.array([0.,1.]))
    glEnd()
    # draw triangle
   glBegin(GL_TRIANGLES)
    glColor3ub(255, 255, 255)
    glVertex2fv( (T @ np.array([.0,.5,1.]))[:-1] )
    glVertex2fv( (T @ np.array([.0,.0,1.]))[:-1] )
    glVertex2fv( (T @ np.array([.5,.0,1.]))[:-1] )
    glEnd()
```

   C. If you press or repeat a key, the triangle should be transformed as shown in the Table:

Key	Transformation
Q	Translate by -0.1 in x direction **w.r.t global coordinate**
E	Translate by 0.1 in x direction **w.r.t global coordinate**
A	Rotate by 10 degrees counterclockwise **w.r.t local coordinate**
D	Rotate by 10 degrees clockwise **w.r.t local coordinate**
1	Reset the triangle with identity matrix

   D. Transformations should be accumulated (composed with previous one) unless you press '1'.

      i. You'll need a global variable to store current accumulated transformation.

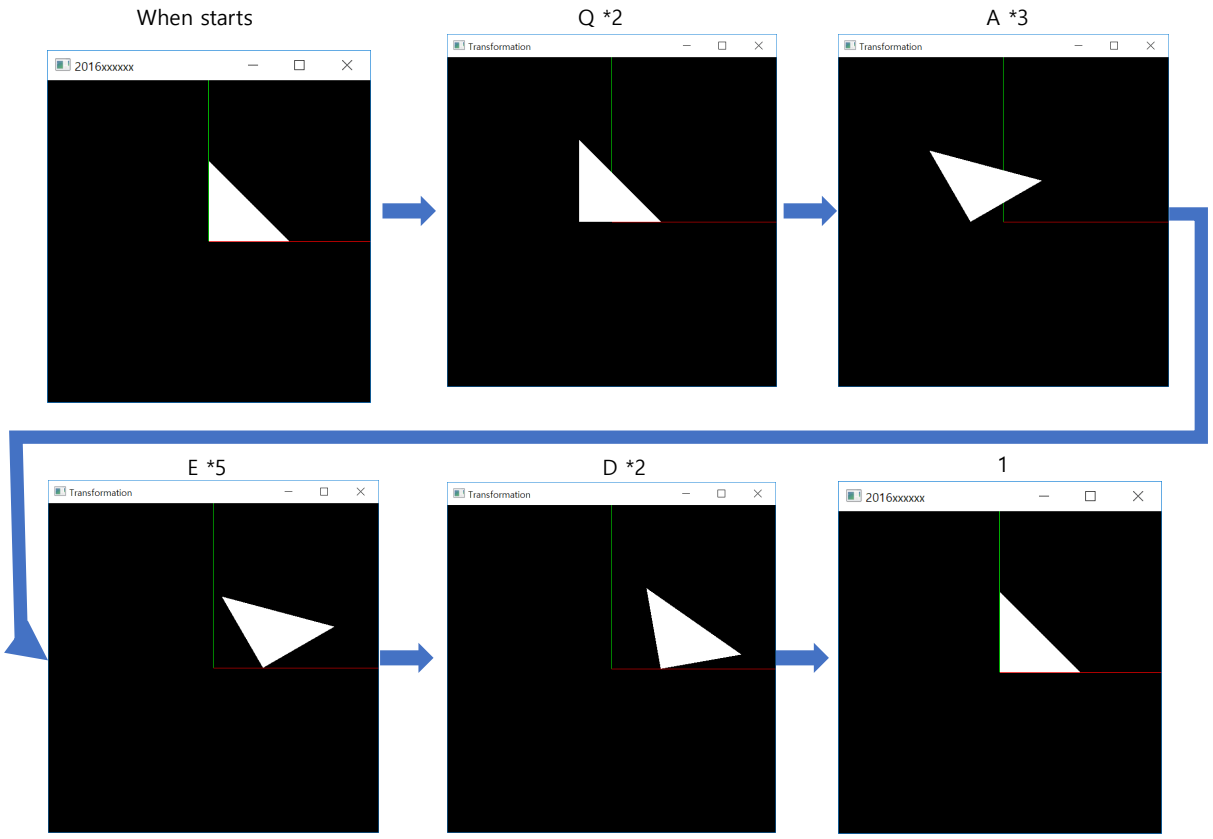
      ii. For example:

gComposedM = newM @ gComposedM; or gComposedM = gComposedM @ newM ;

E. Do not use OpenGL transformation functions.

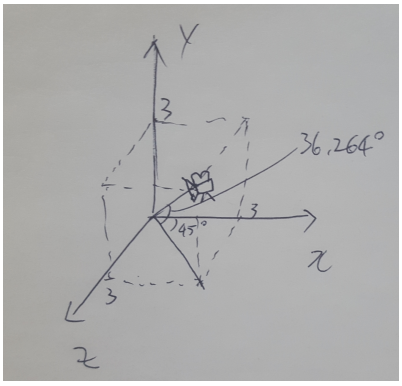
F. Use a single .py file - **[studentID]-[assignment#]-[prob#].py**

G. Expected result:

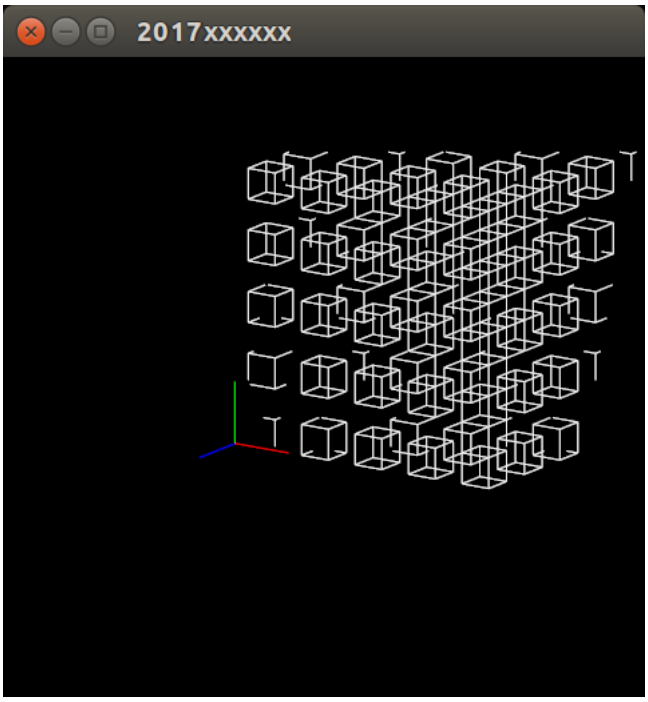


2. As mentioned in the lecture, "moving camera" and "moving world" are two equivalent operations. Based on the following figure, replace the gluLookAt call() in the following code (and also in the attached LabAssignment3-2.py) with **two glRotatef() calls and one glTranslatef() call** and complete the program.

```
def render():
    glClear(GL_COLOR_BUFFER_BIT | GL_DEPTH_BUFFER_BIT)
    glEnable(GL_DEPTH_TEST)
    glPolygonMode( GL_FRONT_AND_BACK, GL_LINE )
    glLoadIdentity()
    glOrtho(-5,5, -5,5, -8,8)

   # Replace this call with two glRotatef() calls and one
glTranslatef() call
    gluLookAt(3,3,3, 0,0,0, 0,1,0)

    drawFrame()

    glColor3ub(255, 255, 255)
    drawCubeArray()
```



A. Your program should render the following scene:



B. The use of the gluLookAt function should be removed throughout the code, including comments.