

## Computer Graphics, Lab Assignment 3

Handed out: March 16, 2021

**Due: 23:59, March 16, 2021 (NO SCORE for late submissions!)**

- Only accept answers submitted via git push to this course project for you at <https://hconnect.hanyang.ac.kr> (<Year>\_<Course no.>\_<Class code>/<Year>\_<Course no.>\_<Student ID>.git).
- Place your files under the directory structure <Assignment name>/<Problem no.>/<your file> just like the following example.

```
+ 2021_ITE0000_2019000001
+ LabAssignment3/
+ 1/
+   - 1.py
+ 2/
+   - 2.py
+ 3/
+   - 3.py
```

- The submission time is determined not when the commit is made but when the git push is made.

1. Write down a Python program to draw a rotating triangle.
  - A. Set the window title to **your student ID** 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 coordinate
    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. Expected result: Uploaded LabAssignment3-1.mp4
- i. Do not mind the initial angle of the triangle.
- D. The triangle should be  $t$  rad rotated when  $t$  seconds have elapsed since the program was executed.
- E. You need to somehow combine a rotation matrix and a translation matrix to produce the expected result.
- F. Files to submit: A Python source file (Name the file whatever you want (in English). Extension should be .py)
2. Write down a Python program to draw a transformed triangle.
- A. Set the window title to **your student ID** and the window size to (480,480).
- B. Draw a triangle using render() function of prob 1 (DO NOT modify it!).
- C. If you press or repeat a key, the triangle should be transformed as shown in the Table:

Key	Transformation
W	Scale by 0.9 times in y direction
E	Scale by 1.1 times in y direction
S	Rotate by 10 degrees counterclockwise
D	Rotate by 10 degrees clockwise
X	Translate by 0.1 in x direction

C	Translate by -0.1 in x direction
R	Reflection across the origin
1	Reset the triangle with identity matrix

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

i. Be sure:  $\text{gComposedM} = \text{newM} @ \text{gComposedM}$

ii. You'll need to make 'gComposedM' as a global variable.

E. Files to submit: A Python source file (Name the file whatever you want (in English).  
Extension should be .py)

F. Expected result

