Computer Graphics, Lab Assignment 6

Handed out: April 10, 2019

Recommended due: 15:00, April 10, 2019

Hard due: 23:59, April 10, 2019 **(NO SCORE for late submissions!)**

Submit your assignment only GitLab root folder.

1. Write your own myLookAt() and myOrtho() functions (of the following form) that behaves exactly same as gluLookAt() and glOrtho().

   A.
```
def myLookAt(eye, at, up): # eye, at, up are 1D numpy array of length 3
def myOrtho(left, right, bottom, top, zNear, zFar):
```

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

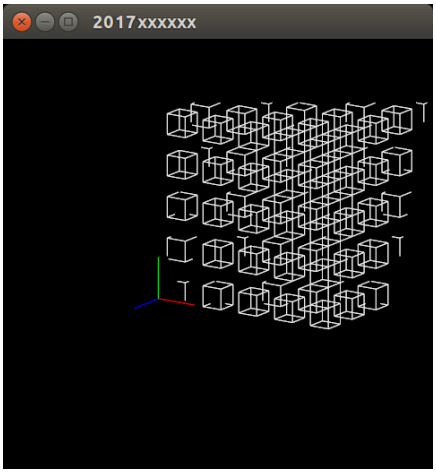
   C. Code skeleton

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

    myOrtho(-5,5, -5,5, -8,8)
    myLookAt(np.array([5,3,5]), np.array([1,1,-1]), np.array([0,1,0]))

    # Above two lines must behaves exactly same as the below two lines

    #glOrtho(-5,5, -5,5, -8,8)
    #gluLookAt(5,3,5, 1,1,-1, 0,1,0)

    drawFrame()

    glColor3ub(255, 255, 255)
    drawCubeArray()

def myOrtho(left, right, bottom, top, near, far):
    # implement here

def myLookAt(eye, at, up):
    # implement here
```

   D. Find code for drawFrame(), drawCubeArray() from *6-Viewing,Projection* slides.

   E. DO NOT use gluLookAt() inside myLookAt() and glOrtho() inside myOrtho()!

   F. Your program should render the following scene:

i. 

G. Hint:

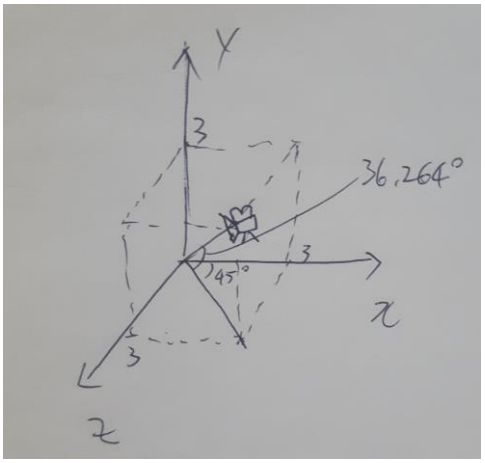
1. Everything you need to write code is in *6-Viewing,Projection* slides.
2. l2 norm of **v** : ||**v**|| = np.sqrt(np.dot(**v**, **v**))
3. **a** x **b** (cross product) : np.cross(**a**, **b**)
4. **a** · **b** (inner product) : np.dot(**a**, **b**) or **a**@**b**
5. Use glMultMatrixf() to multiply your projection matrix and viewing matrix to the current transformation matrix.

H. Submit a single .py file - **[studentID]-[assignment#]-[prob#].py**

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 with **two glRotatef() calls and one glTranslatef() call** and complete the program.

A.

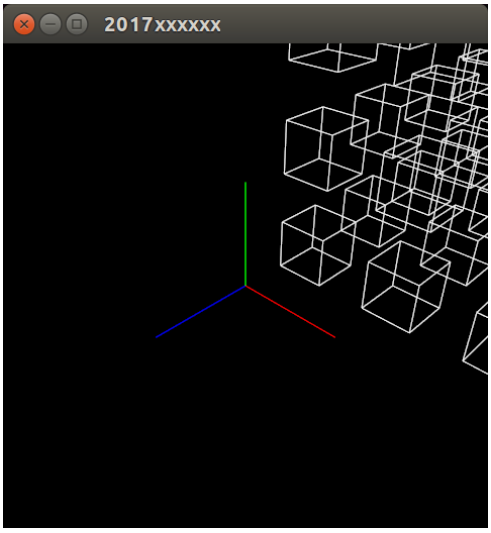
```
def render():
    glClear(GL_COLOR_BUFFER_BIT | GL_DEPTH_BUFFER_BIT)
    glEnable(GL_DEPTH_TEST)
    glPolygonMode( GL_FRONT_AND_BACK, GL_LINE )
    glLoadIdentity()

    gluPerspective(45, 1, 1,10)

    # 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()
```

B. 

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

D. Find code for drawFrame(), drawCubeArray() from 5-RenderingPipeline slides.

E. Your program should render the following scene:

i. 

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