Computer Graphics, Lab Assignment 6

Handed out: April 11, 2021

Due: 23:59, April 11, 2021 (NO SCORE for late submissions!)

- *Only files submitted by **git push to this course project at** https://hconnect.hanyang.ac.kr (<Year>_<Course no.>_<Class code>/<Year>_<Course no.>_<Student ID>.git) will be scored.*
- *Place your files under the directory structure **<Assignment name>/<Problem no.>/<your files>** just like the following example.*

```
+ 2021_ITE0000_2019000001
  + LabAssignment2/
    + 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**.*
- *Your files must be committed to the **master branch**. Otherwise, it will not be scored.*

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 **your student ID** and the window size to (480,480).

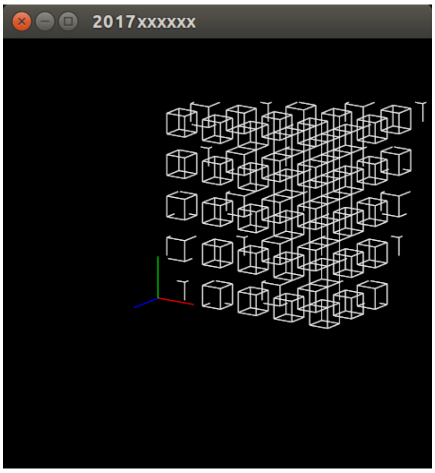
   C. Code skeleton

```
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 the lecture slides.

   2. l2 norm of **v** : ||**v**|| = np.sqrt(np.dot(**v**, **v**))

   3. **a** x **b** (cross product) : np.cross(**a**, **b**)

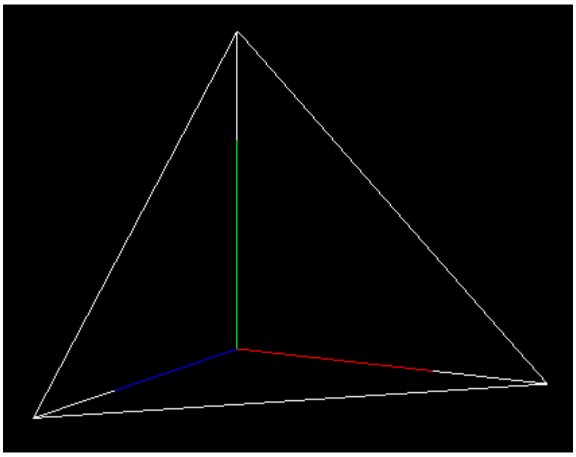
   4. **a** · **b** (inner product) : np.dot(**a**, **b**) or **a@b**

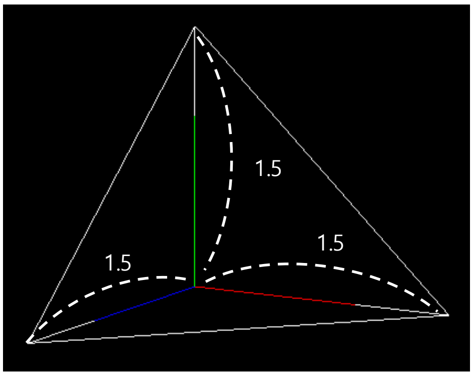
5. Use glMultMatrixf() to multiply your projection matrix and viewing matrix to the current transformation matrix.

H. 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 following triangular pyramid (삼각뿔) by using separate triangles representation and glDrawArrays().

A.





B. Start from the code in the lecture slides. Make sure camera manipulation shortcuts '1', '3', '2', 'w' work.

C. Set the window title to **your student ID** and the window size to (480,480).

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