Assignment 3: Shader Programming

1. Due Date

Assignment 3 is due on **Tuesday 03/15, 11:59pm.**

2. Introduction

This project is about adding the lighting and shading functions to the vertex and fragment shaders. An executable of this assignment (*.exe*) created by the instructor has been uploaded to Mycourses. Please run it and get a feel of the work you should deliver. You will work with GLSL shader programs and use the example code uploaded in Mycourses (*VertFragShader.zip*).

3. Requirements

1) **(20 pts)** Create two point lights. Each should be represented as a primitive object which can be drawn in the scene. They should be at the positions of the light sources so that you can see where the light comes from. The program should allow users to select a light source by pressing a key on the keyboard. For example, pressing '1' selects the first light source, and pressing '2' selects the second light source. The selected one should be drawn as a solid geometry (e.g., *glutSolidSphere()*), and the one not selected should be drawn as a wireframe geometry (e.g., *glutWireSphere()*).
2) **(20 pts)** Use the keyboard to move the selected light. For example, pressing 'w' and 's' moves it along the z axis, pressing 'a' and 'd' moves it along the x axis, and pressing 'u' and 'j' moves it along the y axis. As the light moves, the lighting and shading effects should change accordingly.
3) **(50 pts)** Load two teapots into the scene from the *teapot.obj*. The teapots should be rendered by the Phong shading model (including ambient, Lambert, and Phong equations). Please look at the lecture note *L07_Ligting+Shading.pdf* for the details of the Phong shading model. One teapot should be rendered by the per-vertex lighting implementation, and the other teapot should be rendered by the per-fragment lighting implementation.
4) **(10pts)** To simplify the implementation, you program only need to consider the light's ambient, diffuse, specular colors. When applying the lighting and shading effects to the meshes, the two lights' color contributions are equal (50% - 50%). Parameter values for the scene are:
    a. Light 1:
        i. Ambient color: (0.0, 0.15, 0.0)
        ii. Diffuse color: (1.0, 1.0, 0.0)
        iii. Specular color: (1.0, 0.0, 0.0)
        iv. Fall-off power coefficient (α): 20
        v. Initial light position: (3.0, 3.0, 3.0)
    b. Light 2:
        i. Ambient color: (0.0, 0.0, 0.15)
        ii. Diffuse color: (1.0, 0.0, 1.0)
        iii. Specular color: (1.0, 0.0, 0.0)
        iv. Fall-off power coefficient (α): 20
        v. Initial light position: (1.0, 0.0, -2.0)
    c. Teapot 1:
        i. Translate: (0.0, 2.0, 0.0)
        ii. Scale: (0.5, 0.5, 0.5)
    d. Teapot 2:
        i. Translate: (3.0, 2.0, 0.0)
        ii. Scale: (0.5, 0.5, 0.5)
    e. Camera:

i. Initial eye position: (3.0, 4.0, 14.0)
ii. Initial lookat position: (0.0, 1.0, -0.5)

f. You can hard code any other values as you see needed.

4. What to Submit

(Make sure your code can be compiled and run in Visual Studio.)
Submit the following items to *mycoures*:

- A document explaining how to use your program.
- A zip file containing all source files (*.h* and *.cpp* files).