ME/HCI/CS/CprE 557 - Computer Graphics
Assignment 3
Light and Material

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The goal of this assignment is to build a virtual scene with four sphere, each sphere is illuminated with a different light source and simulates a different surface material. Your learning goal is to understand how the different light and material models and how they affect the rendering of the scene. You should further understand how the different light, material, and and material parameters affect the visual appearance of the spheres in order to obtain a high-quality rendering.

The parameter we have to deal with are:

- light source including position, direction, color, intensity, attenuation. Note, the parameters depend on the type of light you wish to implement.
- material (color) and reflection parameters
- geometry of the mesh model including number of triangles, size of the object.
- topology of the scene.

Keep in mind, the quality of the illumination and reflection depends on right balanced between light and material parameters.

Figure 1: The 3D model that you need to create

Task

Create one rendering containing four sphere as shown in Figure 1. In detail:

1. Read and understand the code!
2. Write shader code that applies the reflection and light models. Edit the file sphere_01.vs and follow the instructions in this file. Note, you do not need to edit the file with the fragment shader code, sphere_01.fs.
3. Select light sources and material parameters as well as geometry parameters to create a scene similar to the scene shown in Figure 1.
4. Balance the parameters, observe and discuss the effect. Your objects should appear as the ones that you see in this document.
5. MAKE SCREENSHOTS.

Deliverable

The following deliverables must be submitted via canvas:

- Upload your entire source code, all .cpp and .h files that your edit..
- Upload screenshots showing your solution.

Due data: Thursday, Oct. 26th, 2018, 8:00 pm
Late submissions will not be accepted!

Grading

Two basic conditions:
First, the code and documentation (=screenshots) is complete (code, shader code, document with screenshots).
Second, the code is readable and I am able to find all the important lines. You may add a document that guides me through your code.

- You implemented the diffuse reflection as shader code, 1pt
- You implemented the specular reflection as shader code, 1pt
- You implemented the ambient reflection as shader code, 1pt
- You implemented the attenuation as shader code, 1pt
- You implemented the geometric relations (e.g. light to vertex vector) as shader code, 1pt
- You implemented the a light model correctly as shader code, 1pt
- The red sphere appears as expected without artifacts, 1pt
- The blue sphere appears as expected without artifacts, 1pt
- The green sphere appears as expected without artifacts, 1pt
- The yellow sphere appears as expected without artifacts, 1pt

Further notes

You can use the template that is provided to solve the homework. The file **main_assignment3.cpp** contains the main source code. The shader program files **homework_shader.vs** and **homework_shader.fs** provide a baseline shader. If you compile and run the template code, you should see four spheres as shown in Figure 2. Note that the normal vectors are used as per-vertex-color values; so what you see are normal vectors. You must replace the normal vector color with the color components that you calculate.

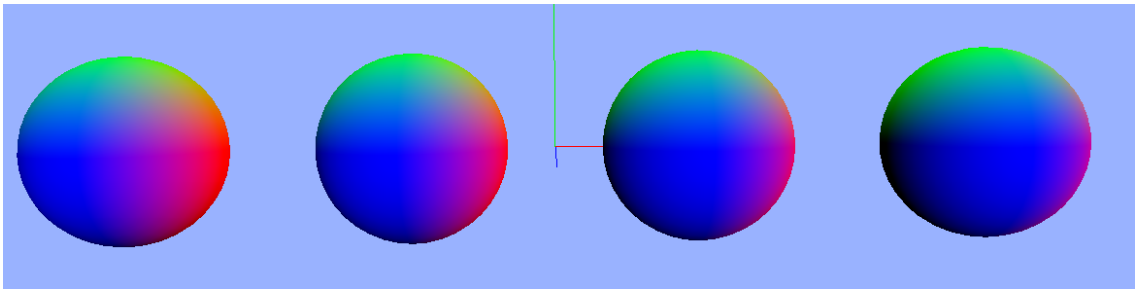

Figure 2: The blank template renders four spheres.

The main file comes with four functions, void CreateSphere$i$(int shader_program_index), where i runs from 1-4. Each function creates one sphere. You have to add variables to each sphere so that you see the right output. **Change whatever you need to change in this code**, including (and for instance).

- Add more shader files if necessary (Currently all spheres use the same shader).
- Add all variables that you need to achieve the outcome.
- Change the sphere parameters to improve rendering.