Computer Graphics Fall 2020

Assignment – Scene3 (S3)

Due on, Nov. 13, 2020.

Assignment Instructions:

1. Please read carefully the instructions for assignment S2 and strictly follow these instructions. Failure to follow the instructions might result in penalty (rather than getting a grade of 1 and a chance to remedy).
2. Please note that you must use your set of individual parameters given below (as in the midterm) for questions parameters.
3. You can only use GL functions and CANNOT use any GLU or GLUT functions (you can use the sphere snippet posted on TRACS).
4. From this assignment and on, I will be giving extra points (4 this time) to students that exceed the requirements posed in the assignments. For example, adding animation, texture mapping, fractals, or other "nice" features.

Individual Parameters:

	u_x	u_y	u_z	v_x	v_y	v_z	w_x	w_y	w_z	α	θ	ϕ	d
0	2	2	4	7	3	7	3	6	4	20	50	50	4
1	4	8	6	3	8	3	5	6	8	30	70	60	5
2	7	9	8	2	7	6	6	5	7	40	50	70	4
3	5	4	2	2	3	5	2	8	9	70	60	60	3
4	8	9	6	7	4	7	6	4	4	40	80	70	2
5	3	5	2	3	4	5	5	2	6	45	30	20	2
6	5	8	7	6	2	3	3	6	7	30	30	70	7
7	4	1	7	2	6	7	5	8	3	20	45	50	6
8	7	5	3	4	4	4	5	7	3	70	40	45	8
9	6	5	4	6	8	4	3	6	4	50	40	6	7

Assignment Instructions

The goal of assignment S3 is to expand the scene you produced in assignment S2. The main additional requirements are to draw a sphere and exercise GL lighting, shading, and shadowing.

In specific:

1. Use perspective projection with the camera placed at the center of the scene and capable of "seeing" the entire set of objects you have generated in assignment S2.
    a. Add a sphere to the library of objects created in assignment S1 / S2.
    b. Add at least 4 light sources
        i. Use different types of light sources including:
            1. point light-source at a finite location $(u_x, u_y, u_z, 1)$.
            2. point light-source at infinite with angel of θ.
            3. spotlight-source at location $(v_x, v_y, v_z, 1)$ with cut-off angel of α and attenuation parameter θ
            4. ambient light source
        ii. For each of the light sources, please use different RGB intensities in the ambient, diffuse, and specular space. You can only use combinations of your U, V, W, parameters divided by 10 and their one's complement for RGB values of intensity. For example, if your parameter are as in row 0. That is, U=(2, 2, 4), V=(7, 3, 7), and W=(3, 6, 4) then you can use any and only combination[s] of 0.2, 0.8, 0.4, 0.6, 0.7, and 0.3. Try to use as many different combinations as possible.
        iii. At least one light source should be visible

2. Associate material properties with each object in the scene:
    a. For each of the objects, please use different RGB reflection coefficients in the ambient, diffuse, and specular space. You can only use combinations of your U, V, W, parameters divided by 10 and their one's complement (in triplets) for reflection coefficients. For example, if your parameter are as in row 0. That is, U=(2, 2, 4), V=(7, 3, 7), and W=(3, 6, 4) then you can use any and only combination[s] of 0.2, 0.8, 0.4, 0.6, 0.7, and 0.3. Try to use as many different combinations as possible.
    b. Use $d/10$ or $(1 - \frac{d}{10})$ for your transparency parameter. For example, for V=(7, 3, 7) and $d = 4$ you can use RGBK values of (0.7, 0.3, 0.7, 0.4) for reflection coefficients.
    c. Define the shininess factor to be your α
    d. Define normals and use flat shading as well as smooth, shading.
    e. Use the Gourad method to find the normals of common vertices on the cube.
3. Take at least 4 snapshots of the scene with the light sources moving from one location to another. To move the light sources from the initial position to the next use translations of (w_x, w_y, w_z), $(2 \times w_x, 2 \times w_y, 2 \times w_z)$, and $(4 \times w_x, 4 \times w_y, 4 \times w_z)$.
    a. Draw all the snapshots in one window using different view ports.

4. A shadow is a polygon that is "attached" to a geometry object (e.g., a cube) and reflects the effect of a shadow caused by the light emitted on the object. Add shadowing (shadows that are due to the lighting) effects to the following objects from your scene:
    a. The cube,
    b. The sphere