Worksheet VII

Answer all the problems completely on a separate sheet of paper. Read all the problems closely, and ask if you have any questions on what a problem means. This worksheet is due at the start of class on Mon, Nov 10.

Problem 1 (3 pts)

What is a *shared vertex mesh*, and why is it useful? How is such a mesh represented by a Wavefront `.obj` file?

Problem 2 (2 pts)

How are spot lights like directional lights? How are they like point lights?

Problem 3 (6 pts)

Consider the Phong Reflection Model that we have discussed in class, and restated below:

$$I = k_a L_a + \frac{1}{a+bd+cd^2}(k_d L_d \max(l \cdot n, 0) + k_s L_s \max((r \cdot v)^\alpha, 0))$$

(a) What is meant by the k_a and the L_a terms in this equation? What is the difference between the two?

(b) What is the difference between the diffuse and specular components of the lighting model? What are the assumptions about how light reflects off objects? Note that diagrams and equations can help! Hint: you might consider how these components are calculated.

(c) What is the purpose of the Phong exponent (the α) in the equation? If you were rendering a sphere, what change would you see from increasing this value?

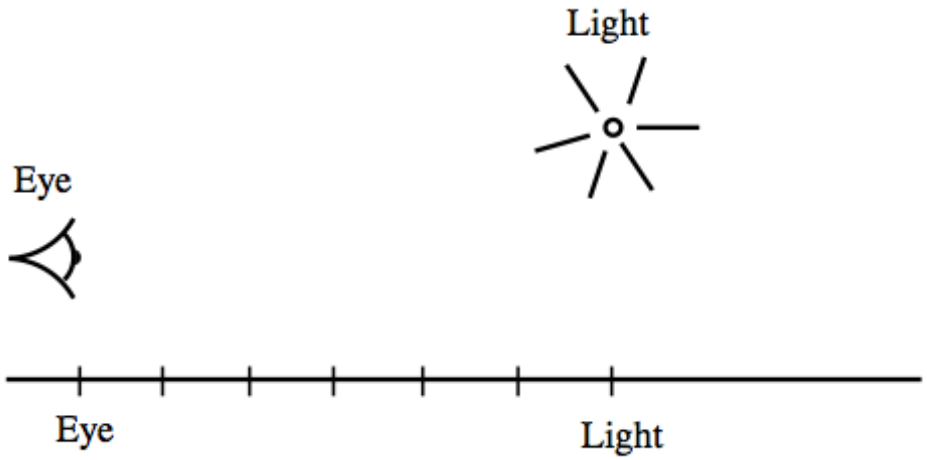
Problem 4 (6 pts)

A new machine arrives in the graphics lab. You know that it renders shaded polygons, but the manuals don't specify whether they are flat shaded, Gouraud shaded, or Phong shaded.

Give a test (or series of tests) to determine which shading method is used. You may specify the vertex positions and normals of polygons, the surface materials of each polygon, the location of the light source(s), and the viewing position and direction. *Be specific about the scene itself*, and what you would look for in the resulting image to determine which shading method is used.

Problem 5 (4 pts)

In the 2D figure below, we have the eye located on the left, a plane (line) along the bottom, and a point light source towards the right; the light is twice as far from the plane/line as the eye is from the plane/line. The marked and labeled locations on the plane/line indicate the closest point of the eye and the light to the plane/line. For the purposes of this question, the dot at the front of the eye is used as the eye point, and the intensity of the light does NOT attenuate with distance.



(a) Assume the plane/line only has a diffuse material reflectance component. Mark with a D on the figure where the plane/line will appear brightest to the viewer, and give a brief (1 sentence) justification of your answer.

(b) Assume instead that the plane/line only has a specular material reflectance component. Mark with an S on the figure where the plane/line will appear brightest to the viewer, and give a brief (1 sentence) justification of your answer.