Homework #4: Rendering

Assigned: October 20, 2017
Due: November 2, 2017

A vertical octagonal cylinder is illuminated by a parallel light source placed at infinity. The direction of the parallel rays is horizontal as shown in the figure. The brightest surface of the object (perpendicular to the light source) has an apparent flat neutral gray color represented by its three RGB color components (200, 200, 200).

1. Assume that surface A is perfectly diffuse. Using Gouraud shading, what are the RGB color components of surface A? Note that in this view surface A is not visible to you but it is to the light source.

2. Assume that surface B is partly diffuse (75%) and partly specular (25%). In addition to its diffuse shading, it is illuminated by a different colored light source at the same position and is represented by its RGB components (256, 0, 64). Assume the camera is at infinity at a 18-degree angle from the axis as shown on the image. The camera height is one-half the height of the cylinder. The glossiness factor, n, is 12. What are the RGB components of surface B when illuminated by the colored light source?

3. Assume the camera was moved closer to the object at the same height to position C. Note that both figures are not drawn to scale. The cameras are at infinity for questions 1 and 2 but the camera is moved much closer for question 3. Explain how you would compute the color of each pixel covered by polygon B using Phong shading. (Do not numerically compute the results.) Use clear diagrams to explain!
4. As shown in the laboratory, the Cornell Box is a cube with five totally diffuse surfaces and open on one side. Its illumination comes from one diffuse area light source in the center of the ceiling as shown.

Placed inside the cube is a 100% specular rectangular solid and a yellow cubic solid as shown. It is necessary to render this simple environment using one of three possible rendering approaches: ray tracing, radiosity, and path tracing.

For each method, comment on the advantages and disadvantages of each method. Criteria should include the expected quality of the final image, the appropriateness of the algorithm, and the relative expected times for computation.