CS4160 – Fall 2004
Introduction to Computer Graphics - Ravi Ramamoorthi
Released: 11-15-04, 4:00pm Due: 11-17-04, 2:40pm (in class)

Instructions: This is an individual assignment. Fill in the answers to the following questions on this handout. You may consult any notes, texts, or lecture material. You may not collaborate with other people.

1.Briefly describe each of the following, making sure to note the differences between them. State whether each shading model is implemented by OpenGL and why or why not: (10 points)

a) flat shading
describe:

implemented by OpenGL? yes / no
Why or why not?:

b) gouraud shading
describe:

implemented by OpenGL? yes / no
Why or why not?:

c) phong shading
describe:

implemented by OpenGL? yes / no
Why or why not?:

2. Define each of the following terms and give its units: (3 points)

i) Radiance

ii) Irradiance

iii) BRDF

3. Write down the formula (integral) for irradiance at a point in terms of the illumination, $L(\omega)$, incident from all directions ω. (3 points)

4) If the radiance from every point in the upper hemisphere is 1 W/m^2sr, what is the irradiance at a point? (use correct units) (3 points)

5) Write down the local reflectance equation, i.e. express the net reflected radiance in a given direction as an integral over the incident illumination. Prominently label the main terms of the equation such as the BRDF. (3 points)

6) Write down a formula for each of the following BRDFs. State whether you can use OpenGL for each model, and if so, describe what OpenGL commands you would use (including example values for parameters). (4 points)

a) Lambertian surfaces

formula:

openGL:

b) Mirror surfaces

formula:

openGL:

c) Dark glossy materials?

formula:

openGL:

7) For each of the examples in (6) above, consider the situation of (4), where the radiance from every point in the hemisphere is 1 W /m^2sr. Using the reflectance equation (5), write down the reflected radiance (use proper units) along the normal direction, i.e. for viewing the surface head on. (4 points)

a) Lambertian surfaces

b) Mirror surfaces

c) Dark glossy materials?