Assignment 5: Ray

Comp175: Introduction to Computer Graphics – Spring 2020

Algorithm due: Friday April 3rd noon at 11:59am
Project due: Monday April 13th midnight at 11:59pm

Your Names: _____________________________
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Your CS Logins: _________________________
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1 Instructions

Complete this assignment only with your teammate. When a numerical answer is required, provide a reduced fraction (i.e. 1/3) or at least three decimal places (i.e. 0.333). Show all work; write your answers on this sheet. This algorithm handout is worth 3% of your final grade for the class.

2 Rays

[2 points] The high-level view of our ray tracer is exactly the same as for intersect, except for a few additions. Below is the high-level pseudocode for Intersect. What needs to be changed/added to make this a full-fledged ray-tracer? Explain in English.

```plaintext
for point ∈ Canvas do
    if ray intersects an object then
        for each light do
            Cast a ray to the light and evaluate the lighting equation
            Canvas[pt] = Canvas[pt] + color with only diffuse/ambient components
        end for
        else
            Canvas[pt] = background color
        end if
    end for
```

[2 points] Given a vector \( \vec{v} \) and a surface normal \( \vec{n} \), find the equation for the vector \( \vec{r} \) which is the reflection of \( \vec{v} \) about \( \vec{n} \) (i.e. in the equal and opposite direction). Write your equation in terms of vector operations. How do you compute the color contributed by the reflected ray? Give a brief description.
[1 point] Is ray tracing a local or global illumination algorithm? Why?

[1 point] For a particular ray that intersects with an object, when do you not consider contribution from a given light source? How do you computationally determine when this scenario occurs?

[2 points] Recall that we can think of texture mapping in two steps. First, mapping from the object to the unit square, and second, mapping from the unit square to the texture map. Let \( u \) and \( v \) be the \( x \) and \( y \) values in the unit square that a particular point on an object gets mapped to in the first step. Note that \( u \) and \( v \) are calculated differently depending on the object. From here, how do you find the coordinates \((s, t)\) to look up in a texture map in terms of \( u, v, i, j, w \) and \( h \), where \( i \) and \( j \) are the number of repetitions in the \( x \) and \( y \) directions, respectively, \( w \) is the texture width, and \( h \) is the texture height?

[1 point] How do you use the color from the texture map and the blend value in the lighting equation?

[1 point] What is the Phong lighting model used for? What is the purpose of its exponent?

3 How to Submit

Hand in a PDF version of your solutions using the following command:

```
provide comp175 a5-alg
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