CSCI 3260 Written Assignment 2, 1st term 2015-2016

Issued Date: 25th, November (Wednesday)

Due Time: 15:00, 11th, December (Friday)

The assignment should be submitted to the dropping box on the 10th floor of Ho Sin-hang Engineering Building before the deadline; no late submission will be accepted.

1. **Ray Tracing (25%)**

   As illustrated in the Fig. 1, the coordinate of camera is (0,0,0) and the image plane is placed at (10,0,0) with the normal vector as (1,0,0). Let (10,1,0.5) denote the selected pixel *p*, please answer the below questions

   (a) Please write down the ray equation starting from the camera to the pixel *p*.

   (b) If there is red ball placed at (20,0,0) with radius as 2, please answer which color of the pixel *p* will be labeled.

   (c) Given the same red ball placed at (20,0,0) with radius as 2, please answer which the color of the *p* is when the normal vector of image plane is changed as (1,1,1).

   (d) Continuing with the problem (c), please write down the parametric form of the shape showed in the image plane.

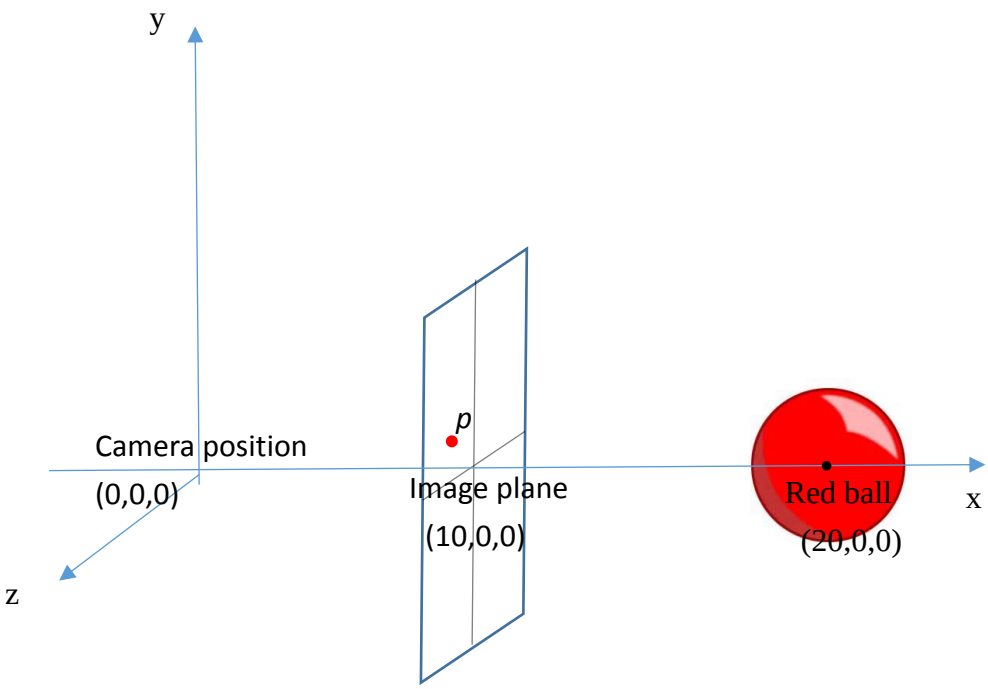

Figure 1

2. **Distributed Ray Tracing (20%)**

   (a) For each pixel, we can conduct ray tracing shown in Q. 1. Please explain the

limitations of such method when applied to the practical applications.

(b) To tackle there limitations, Cook has proposed a distributed ray tracing method, please develop a strategy to show the motion blur effect based on cook's method.

(c) As shown in Fig. 1, please develop a strategy to introduce the depth of filed effect into the animated image.

3. Shadow (20%)

(a) Please point out the penumbra and umbra areas respectively for Figure 2.

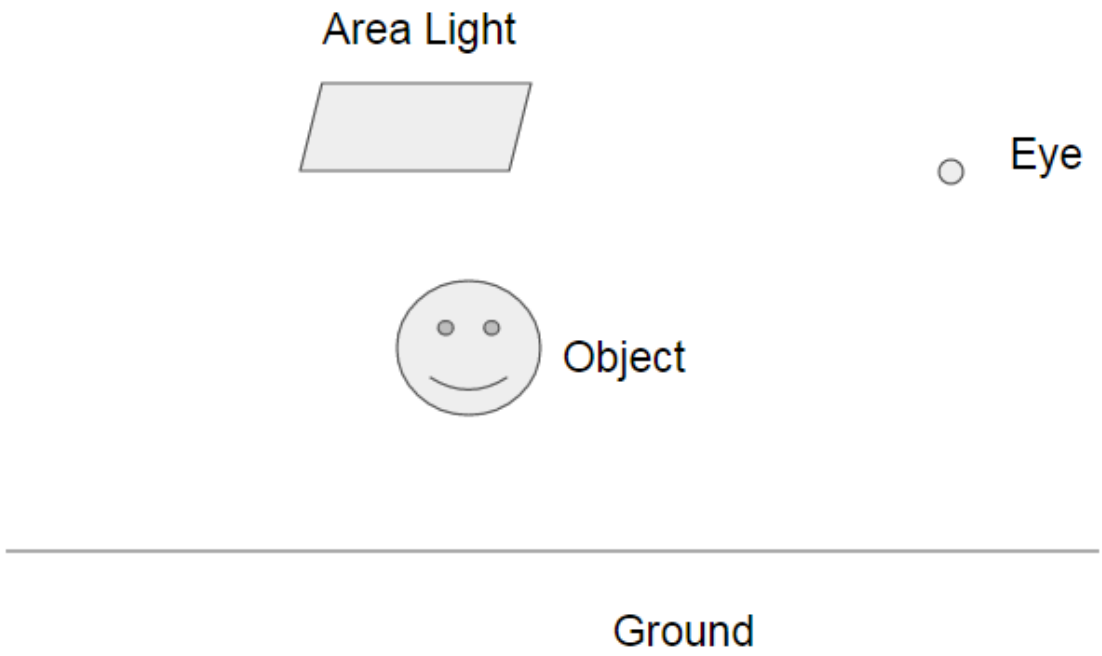

Figure 2

(b) An important issue of shadow maps is the "field of view" problem. A method to address this problem is to limit the light source to be a "spot light". Given a light source in (0, 0, 0) and the texture map is a square with vertices (3, 3, 3), (3, -3, 3), (-3, 3, 3), (-3, -3, 3). Then what is the largest angle of the spot light to ensure the "field of view" problem will not happen?

4. Animations (15%)

(a) Please list the four major types of motion capture devices. Do Kinect belong to any of them?

(b) How to blend two motions A and B?

(c) In particle system, what are the two categories of methods to render liquid? Which is better in modeling waterfall? What about spray?

(d) How to constrain the particles for rendering cloth?

5. Virtual Reality (10%)

(a) List three considerations for VR software architectures and explain their importance.

(b) What is the difference between the augmented reality and the virtual reality?

6. Visualization (10%)

(a) Please list the 6 steps for the marching cube algorithm. Illustrate an example that causes ambiguity when generating triangle.

(b) Explain the difference between the 2D-textured object-aligned slicing and the 3D-textured view-aligned slicing. State the advantages and disadvantages of the two methods respectively.