Assignment 3

Thursday, March 8, 2018 3:09 PM

1. $(1,1,0)$

$$w = \frac{a}{\|a\|}$$

$$w = \frac{(1,1,0)}{\sqrt{1+1}} = \left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}, 0\right)$$

$$t = (0,0,1)$$

$$u = \frac{t \times w}{\|t \times w\|} = \frac{\left(-\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}, 0\right)}{\left\|\left(-\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}, 0\right)\right\|} = \left(-\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}, 0\right)$$

$$v = \left(-\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}, 0\right) \times \left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}, 0\right) = (0, 0, -1)$$

2. The three possible cases are:
   a. No intersection → the ray does not actually intersect the sphere
   b. Tangent → the ray touches the sphere at a single point,
   c. Intersection → the ray intersects the sphere and there are two solutions → when the ray enters, and when it exits the sphere.

3. No real-life object is perfectly smooth and can perfectly reflect the light around it.

4. $o + td = a + \beta(b-a) + \gamma(c-a)$

$o: (1,1,1)$
$d: (-1,-1,-1)$
$a: (1,0,0)$
$b: (0,1,0)$
$c: (0,0,1)$

$$(0,1,1) + t(-1,-1,-1) = \beta(-1,1,0) + \gamma(-1,0,1)$$

$$-\beta - \gamma = -t$$
$$\beta = 1 - t$$

$$-1 + t - \gamma = -t$$
$$-\gamma - 1 = -2t$$
$$\gamma = 2t - 1$$

$$1 - t - \gamma$$

$$2t - 1 = 1 - t$$
$$3t = 2$$
$$t = \frac{2}{3}$$

$$t = \frac{3}{2}$$

$$\beta = -\frac{1}{2}$$
$$\gamma = 2$$

$$\alpha + \beta + \gamma = 1$$
$$\alpha - \frac{1}{2} + 2 = 1$$
$$\alpha = -\frac{1}{2}$$

5. Velvet has a very special effect in that it is highly reflective despite having a very aggressive micro-texture. As a result, traditional lighting models often fall flat.