

Homework 7

7-1) Lighting components

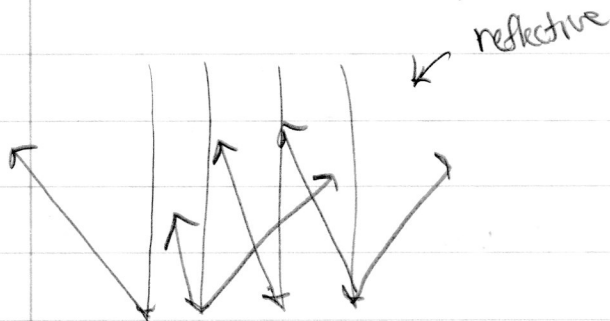
There are 3 light components that make up Phong Lighting.

The first picture is Ambient light

- omnidirectional
- fixed intensity
- Uniform throughout scene
- hits all faces equally
- alone, creates flat / monocular appearance

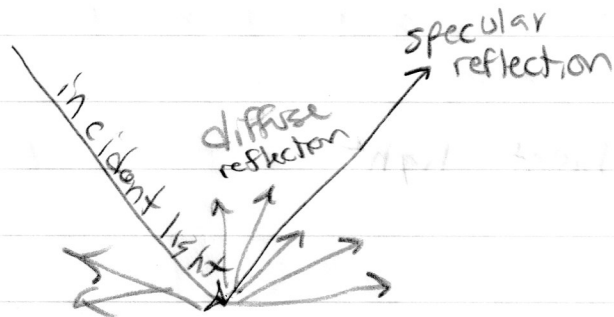
The second picture is Diffuse

- directional
- light scattered by reflection
- higher intensity of reflection on surfaces hit directly
- hints at shapes of models



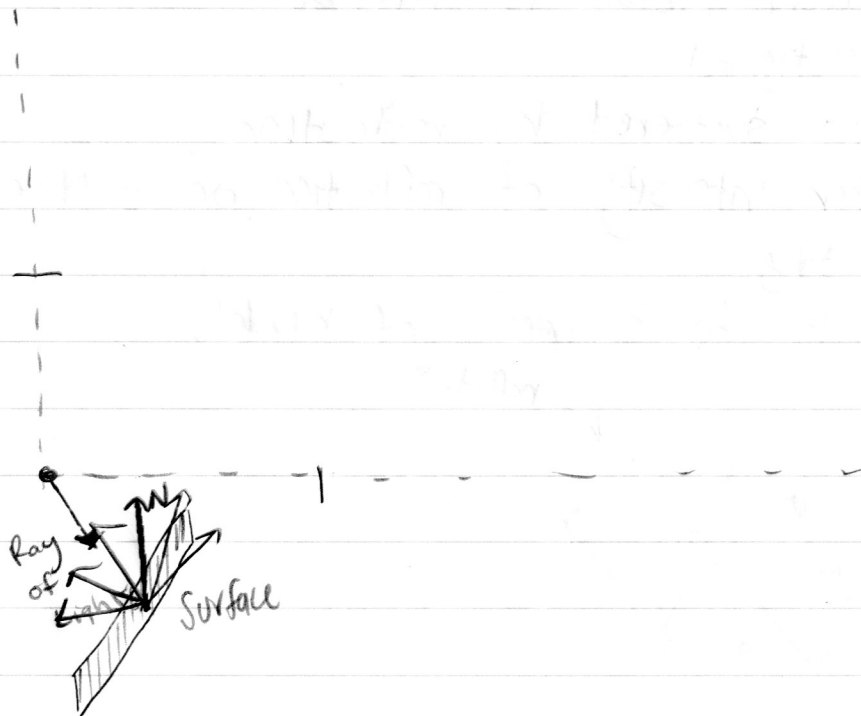
The last picture is Specular

- light reflected near-perfectly off a surface
- not scattered
- near-perfect specular reflection is mirror-like



7-2) Perfect Reflection

a)

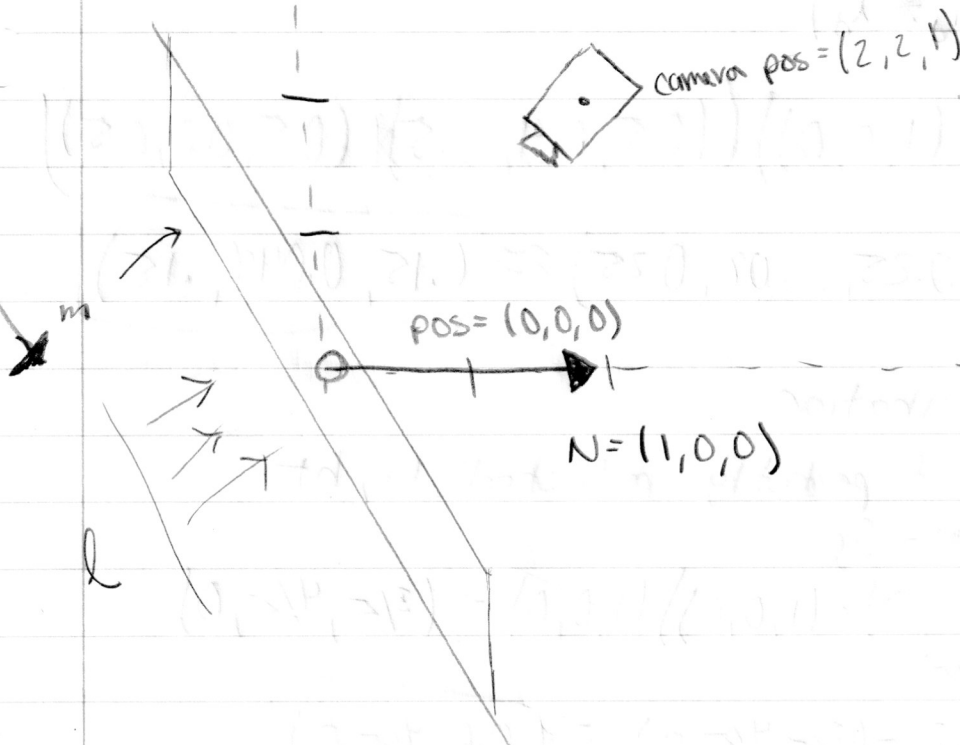


b) It can be seen reflecting around the normal, the normal line divides the angle between the incident ray and the reflected ray into two equal parts.

73) a)

$$\begin{cases} m_a = (0.8, 0.8, 0.8) \\ m_d = (0.5, 0.4, 0.5) \\ m_s = (0.0, 0.7, 0.0) \\ \alpha = 0.3 \end{cases}$$

position = $\langle 0, 0, 0 \rangle$ surface normal = $\langle 1, 0, 0 \rangle$



b) Ambient Illumination

$$m_a = (0.8, 0.8, 0.8)$$

$$\text{ambient light intensity} = (0.2, 0.2, 0.3)$$

$$I_a = m_a * a = (0.8, 0.8, 0.8) * (0.2, 0.2, 0.3) = (0.16, 0.16, 0.24)$$

c) Diffuse Illumination

$$m_d = (0.5, 0.4, 0.5)$$

$$l_p = (-3/5, -4/5, 0)$$

$$l_d = (0.5, 0.2, 0.5)$$

$$S_i = (0.3, 0.5, 0.5)$$

$$S_r = (3/5, 4/5, 0)$$

$$I_d = (S_r \cdot N) (m_d * l_d) =$$

$$((3/5, 4/5, 0) \cdot (1, 0, 0)) (0.5, 0.4, 0.5) * (0.5, 0.2, 0.5)$$

$$3/5 (0.25, 0.08, 0.25) \approx (0.15, 0.048, 0.15)$$

d) Specular Illumination

R_r = direction of perfectly reflected light

$$= 2 (S_r \cdot N) N - S_r$$

$$= 2 \frac{((3/5, 4/5, 0) \cdot (1, 0, 0))}{2(3/5)} (1, 0, 0) - (3/5, 4/5, 0)$$

$$1.2 - (3/5, 4/5, 0) = (0.6, 4/5, 0)$$

$$I_s = (R_r \cdot V)^2 (m_s * l_s)$$

$$((0.6, 0.8, 0) \cdot (2, 2, 1))^2$$

$$(1.2, 1.6, 0)^2 (0.0, 0.8, 0.6) * (0.3, 0.5, 0.5)$$

$$(1.44, 2.56, 0) \cdot (0, 0.35, 0) = (0, 0.896, 0)$$

c) Total illumination

$$I = I_a + I_d + I_s$$

$$(0.16, 0.16, 0.24) + (.15, 0.048, .15) + (0, 0.896, 0) =$$

$$(0.31, 1, 1.04)$$