

Homework Assignment # 1

Due date: May 22 at the beginning of the class

I am interested in numerical answers. Very little credit will be given for general formulas. I need to know whether you can *apply* these general formulas properly. I need to know how you arrived at the answers. You need to show me ALL your work.

1. Lighting:

Suppose there is a surface in a room with some ambient light and a light source.

The following triplets refer to (red,green,blue).

Ambient Light = (.5,.2,.3).

Light Intensity of a light source = (.4,.1,.2).

$k_a = (0, 1, 0)$ = coefficient of ambient lighting for the surface.

$k_d = (1, 0, 1)$ = coefficient of diffuse lighting for the surface.

$k_s = (0, 1, 1)$ = coefficient of specular lighting for the surface.

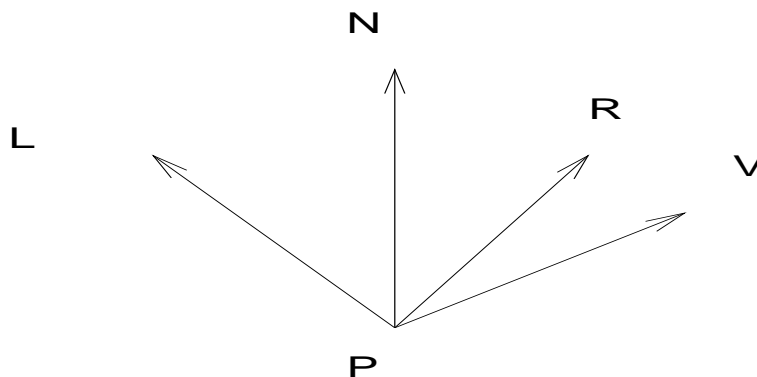
The following triplets refer to (x, y, z) .

Normal \mathbf{N} to surface S at a point $P = (0, 1, 0)$.

Direction \mathbf{L} from P to the light source = $(0, \frac{1}{2}, \frac{\sqrt{3}}{2})$.

Direction \mathbf{V} from P to the eye = $(0, 1, 0)$.

Assume that there are no distance effects.



- What is the ambient color of the surface at P?
- What is the diffuse color of the surface at P?
- What is the reflection vector \mathbf{R} at P?

- (d) What is the specular color of the surface at P? Assume that the glossiness or shininess factor (or the exponent) is 2.
- (e) What is the overall color of the surface at P?

2. **Shading:**

Consider the unit cube by the eight vertices as follows: $A = (0, 0, 0)$;

$$B = (1, 0, 0);$$

$$F = (1, 0, 1);$$

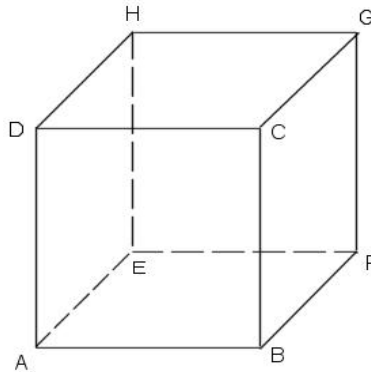
$$E = (0, 0, 1);$$

$$D = (0, 1, 0);$$

$$C = (1, 1, 0),$$

$$G = (1, 1, 1),$$

$$H = (0, 1, 1).$$



- (a) Use Cross-Product to compute the outwardly pointing *unit* normal to BCGF?
- (b) Use any method to compute the outwardly pointing *unit* normal to the face FGHE and to ABFE.
- (c) What is the *unit* normal that you will associate to the vertex F for *Gouraud* shading of the cube?
- (d) What is the *unit* normal you will associate to the point $(1, 0, .25)$ on the edge BF for *Phong* shading of the cube? (Assume that the normal associated to the vertex B is $(\frac{1}{\sqrt{3}}, \frac{-1}{\sqrt{3}}, \frac{-1}{\sqrt{3}})$).