Computer Graphics
CSE 557, Winter 1997

Week 5 study sheet: The Human Visual System and Color Theory

Problem 1 True or false:

a) As an object moves closer, the ciliary muscles of the eye must contract to keep the object in focus.

b) Far-sightedness results if the eye is too elongated from front to back.

c) Rods are responsible for color vision.

d) The "blind spot" contains cones but no rods.

e) Monochromatic yellow light has higher energy than monochromatic green light.

f) For every monochromatic color A, there exists a complementary monochromatic color $\overline{A}$, such that some mixture of A and $\overline{A}$ makes white.

Problem 2 Why are lenticular halos seen only under dark conditions?

Problem 3 Why might there be fewer types of color receptors at the center of the fovea?

Problem 4 We perceive relative light intensities on a logarithmic scale. Therefore, to display $n+1$ successive intensity levels with equal perceived brightness, the intensity levels on the monitor should be spaced so that the ratio of successive intensities is constant:

$$\frac{I_1}{I_0} = \frac{I_2}{I_1} = \cdots = \frac{I_n}{I_{n-1}}$$

Suppose the lowest level that can be displayed on the monitor is I_0 and the highest is $I_n = 1$. Write an expression for the intensity I_k that ensures uniform perceived brightness, in terms of I_0, k, and n.

Problem 5 Label the six outer vertices of the RGB cube and of the HSV hexcone, with each one viewed along the line from black to white:

Problem 6 How would you display the color (X, Y, Z) on a monitor whose red, green, and blue phosphors have colors (X_r, Y_r, Z_r), (X_g, Y_g, Z_g), and (X_b, Y_b, Z_b) respectively?