(Assigned on 1/25, due on 2/1)

2.2 When you enter a dark theater on a bright day, it takes an appreciable interval of time before you can see well enough to find an empty seat. Which of the visual processes explained in Section 2.1 is at play in this situation?

 2.7 Suppose that a flat area with center at (x0,y0) is illuminated by a light source with intensity distribution

$$i(x,y) = Ke^{-[(x-x0)^2 + (y-y0)^2]}$$

Assume for simplicity that the reflectance of the area is constant and equal to 1.0, and let K=255. If the resulting image is digitized with k bits of intensity resolution, and the eye can detect an abrupt change of eight shades of intensity between adjacent pixels, what values of k will cause visible false contouring?

2.10 High-definition television (HDTV) generated images with 1125 horizontal TV lines interlaced (where every other line is painted on the tube face in each of two fields, each field being 1/60th of a second in duration). The width-to-height aspect ratio of the images is 16:9. The fact that the number of horizontal lines is fixed determines the vertical resolution of the images. A company has designed an image capture system that generates digital images from HDTV images. The resolution of each TV (horizontal) line in their system is in proportion to vertical resolution, with the proportion being the width-to-height ratio of the images. Each pixel in the color image has 24 bits of intensity resolution, 8 bits each for a red, green, and a blue image. These three "primary" images form a color image. How many bits would it take to store a 2-hour HDTV movie?

2.22 Image subtraction is used often in industrial applications for detecting missing components in product assembly. The approach is to store a "golden" image that corresponds to a correct assembly; this image is then subtracted from incoming images of the same product. Ideally, the differences would be zero if the new products with missing components would be zero in the area where they differ from the golden image. What conditions do you think have to be met in practice for this method to work?

2.25 Prove that the Fourier kernels in Eqs. (2.6-34) and (2.6-35) are separable and symmetric.