Homework 3: DueMarch 16, 2005

1. Define the following terms. Also describe how a filter that is looking for such terms may look like:
    a. An edge
    b. Texture
    c. A corner
2. Imagine a room 10 by 20 meters with a ceiling 5 meters high. The room has no windows, and there is a light bulb shining at one corner of the ceiling. The light bulb has a radiant intensity of 10 W/sr. Consider a circular patch at the center of the floor with a 10 cm diameter.
    a. What is the solid angle from the bulb to the patch?
    b. What is the irradiance of the patch of floor? (Assume there is no reflection from the wall and from the ceiling.)
3. Perspective effects can be significant when a wide-angle lens is used, while images obtained with a telephoto lens tends to approximate orthographic projection. Explain why these rules of thumb are generally valid. When will they be violated?
4. Write a matrix that will rotate an image by an angle θ and translate it by an amount t_x and t_y along the *x* and *y* directions respectively. Write a matlab function that does this job and apply it to the 'flowers.tif' image. Show your output for two values of the parameters.
5. Pencil and Paper Exercises for Hough Transform

    Recall (Forsyth and Ponce p. 330) that we can write the equation for a line as:

    $x\cos(\theta) + y\sin(\theta) + r = 0$ with $r >= 0$, $0 <= \theta < 2\pi$. Draw a 10 x 10 grid, which divides θ into 10 equally spaced ranges, and divides r into equally spaced ranges from 0 to 10. That is, the square in the lower left of your grid represents θ between 0 and $(2\pi/10)$, and r between 0 and 1.

    a) In red, lightly shade in all squares that contain the parameters of lines passing through the origin (0,0).
    b) In blue, lightly shade in all squares that contain the parameters of lines passing through the point (4,4).
    c) In green, lightly shade in all squares that contain the parameters of points passing through the origin (6,7).