Questions

1. Consider the situation where you want to put a camera in a car, looking towards the front of the car. A car is roughly 2.5m wide. You have a camera with a 1cm wide sensor with 2000 horizontal pixels.

1. If you want the car to be at least 50 pixels wide at 100m, what does your focal length need to be? Give the answer in mm. Be sure to identify which equation is relevant to the question before starting.
2. How many pixels would a car be in the image at 12.5m with the same focal length?
3. Given a 10mm lens, do you need to make any adjustments for the scene to be in focus from 20-100m? (Clarification: you might need to make an adjustment if the change is bigger than 1 in 100.) Identify which equation is relevant to the problem before answering.

2. Do an internet search to find information about the response distributions for human rods and cones.

1. What percentage of our cones are sensitive to long wavelength (red), medium wavelength (green), and short wavelength (blue)?
2. When you look at the response curves for the red, green, and blue cones, how would you describe the differences between the three?
3. Given the information above, explain why the Bayer pattern on camera sensors has two green sensors for every one blue or red sensor.

(Hint: a good website is http://hyperphysics.phy-astr.gsu.edu/hbase/vision/rodcone.html)

3. Do some research on Bayer Patterns / Bayer Filter (the wikipedia site is pretty good).

1. What are some issues that might arise because of the interpolation of colors to get RGB values at each pixel?
2. What is the benefit of saving RAW images and doing interpolation off the camera?
3. Why might you want to use Cyan-Magenta-Yellow (CMY) instead of RGB filters? How would you get RGB values?

4. Color Spaces

1. When would it be important to use the CIE-Luv color space?
2. For the YUV color space, the U channel is often called Blue - Yellow, and the V channel is often called Red - Cyan. Given the RGB to YUV conversion matrix, explain why U and V have those labels (you can find the matrix on Wikipedia or in my lecture notes).
3. Is there any connection between the UV definitions and the human visual system?