Name:_____

Computer Vision, Quiz 1

Topics:

1. The Pinhole Camera model (The five unknowns that define the intrinsic camera calibration, the six unknowns that define the extrinsic calibration)
2. Definition of Homogenous Coordinates, and an example of why they are useful
3. Definition of a homography, and examples of images that are related by a homography
4. Image filtering, what it can do? examples of how to define a filter to blur, to detect vertical edges, or horizontal edges, etc. Choices about what to do on boundaries. What are properties of Linear Filters? What is the cost of applying linear filters of a given size to an image. What does it mean for an image filter to be separable.
5. What is an image pyramid?
6. Fourier Domain. What is the cost of computing the FFT of an image. Why is it sometimes useful to do image filtering using the FFT?
7. PCA. PCA composes a set of images into what two things (Principle components and coefficients). What are properties of the principle components? In what way is PCA optimal? What are example image sets where PCA works well? What are example image sets where PCA is not good?
8. Intrinsic Images: What is the intrinsic image decomposition? Why is it useful to think of images in terms of the logarithm of pixel values?

Example Questions:

1. Which of the following factor does not affect the intrinsic parameters of a camera model?
   (a) Focal length
   (b) Offset of optical center
   (c) Exposure
   (d) Image resolution
2. A pinhole camera takes a picture of the world.
3. `(T F) The mask shown below is appropriate for detecting horizontal edges.`

```
-1 -1 -1
 0  0  0
 1  1  1
```

4. Filtering. The image below is an image of a 3 pixel thick vertical line.

   (a) Show the resulting image obtained after convolution of the original with the following approximation of the derivative filter [1, 0, 1] in the horizontal direction.

```
0 0 0 1 1 1 0 0 0
0 0 0 1 1 1 0 0 0
0 0 0 1 1 1 0 0 0
0 0 0 1 1 1 0 0 0
0 0 0 1 1 1 0 0 0
0 0 0 1 1 1 0 0 0
0 0 0 1 1 1 0 0 0
0 0 0 1 1 1 0 0 0
0 0 0 1 1 1 0 0 0
```

   (b) Suggest a filter which when convolved with the same image would yield a single maximum in the middle of the line. Demonstrate the result of the convolution on the original image.

```
0 0 0 1 1 1 0 0 0
0 0 0 1 1 1 0 0 0
0 0 0 1 1 1 0 0 0
0 0 0 1 1 1 0 0 0
0 0 0 1 1 1 0 0 0
0 0 0 1 1 1 0 0 0
0 0 0 1 1 1 0 0 0
0 0 0 1 1 1 0 0 0
0 0 0 1 1 1 0 0 0
```

   Solution Convolving the image with the following filter will yield single maximum in the middle of the line g = [1, 2, 1]T .