Exam 1

c306

Oct 16, 9:00-9:50

Last Name:

First Name:

Student ID:

Instructions: Read through all questions first. You can write on the back of the sheets if you need more space and make an appropriate reference. But note that the space provided is a hint to the length of the answer needed. Short and concise answers are preffered.

Allowed: 2 single sided sheets 8 1/2 by 11 inches with your own handwritten notes. Calculator.

1 True or false? 8%

Circle each true statement

1. In uncompressed form the following formats require the least storage:

   a A grey scale image
   b An RGB color image
   c An indexed color image
   d A matlab (double) matrix representation of a greyscale image

2. Using discrete histogram equalization we always

   a Achieve a uniform histogram
   b Change the image contrast
   c Make image structure easy to see.
   d Get a perceptually better picture

3. Which of the following are linear brightness transforms

   a gamma correction
   b image inversion
   c contrast
   d histogram equalization

4. The following are true about perspective projection

   a The projected image is smaller than the 3D scene
   b Size relationships are preserved
   c If two lines intersect in 3D they also intersect in the image
   d The midpoint of a 3D line projects to the midpoint of the 2D line.

5. The following are true about parallel (orthographic) projection

   a The projected image is smaller than the 3D scene
   b Size relationships are preserved
   c If two lines intersect in 3D they also intersect in the image
   d The midpoint of a 3D line projects to the midpoint of the 2D line.

6. The purpose of the retinal neural processing is mainly

   a To transmit the raw light intensity registered by each photoreceptor to the brain
   b To perform spatial filtering on the retinal image.
   d To adapt the eye to different light levels.
   d To activate the photoreceptors.

7. In the LGN...

   a Neural signals from the left eye are sent to the right brain lobe and vice versa.
   b Retinal ganglion cells synapse.
   c There are neurons sensitive to lines.
   d Signals from the left and right eye are integrated for the first time.

8. Which colorspace best represent human perception of color?

   a RGB
   b HSI
   c CMY
   d YUV

2 Color (2%)

While filming indoors under flourecent light (with a 4 pixel camera!) the following image was digitized. Each pixel has (R, G, B) quantized in levels 0..10. The image was judged as too blue (due to the cool-white light) White balance the image. Show your steps and the resulting image.

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(3,4,7) (5,3,5)
(4,5,6) (3,5,5)
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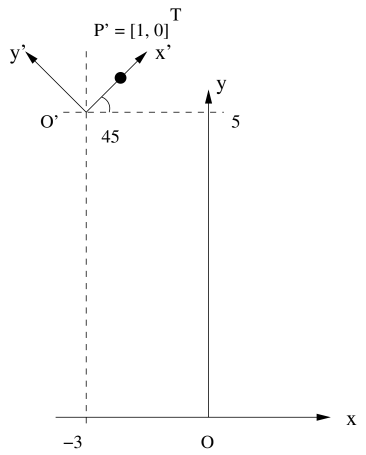
3 Non-realistic art (2%)

Identify the geometrically impossible structures in the picture below. Explain why it is not photo-realistic.

4 Geometric transforms (4%)

The point P' has coordinates $P' = (1, 0)^T$ in the coordinates O'. The coordinate system O' is related to O by a 45° rotation and $(-3, 5)^T$ translation as shown in the figure. Formulate the 3x3 homogeneous transforms which express P' in the coordinate system O.



5 Stereo (4%)

Consider the stereo setup in the figure, where two imaging plane is placed 5m along the x and y axis respectively and each camera has unit focal length (f=1). Write the equations that relate the position of any world point $P = (X, Y)$ expressed in the coordinate system O to the image positions u (for camera centered at Ox along x-axis) and v (camera at Oy along y-axis). Solve for the postion P from u and v