Sample Exam

MJ 2005

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?

Circle each true statement (note none or more than one can be true).

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. 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.

3. 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.

2 Euclidean upgrade of 2D projective structure

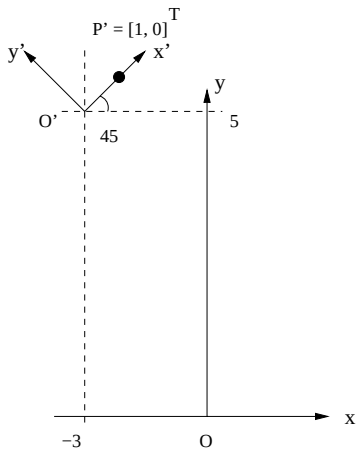
Illustrate and describe how a 2D projective image can be upgraded to a Euclidean. Comment on what information we need to find in the image and draw schematically how the image changes.

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