Homework Assignment #1
EECS 487
Winter 2004
Due: February 4th 2004

DO NOT use any electronic devices to do Problem 1.

SHOW ALL YOUR WORK!!

Problem #1.

Find the Composite Rotation Matrix given the rotation order: (Just the equations!)

$$[R] = [Trans][Roll][Pitch][Yaw][Trans]$$

$$
\begin{bmatrix} x''' \\ y''' \\ z''' \\ 1 \end{bmatrix} =
\begin{bmatrix} 1 & 0 & 0 & \Delta x \\ 0 & 1 & 0 & \Delta y \\ 0 & 0 & 1 & \Delta z \\ 0 & 0 & 0 & 1 \end{bmatrix}
\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & \cos\theta & -\sin\theta & 0 \\ 0 & \sin\theta & \cos\theta & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}
\begin{bmatrix} \cos\phi & 0 & \sin\phi & 0 \\ 0 & 1 & 0 & 0 \\ -\sin\phi & 0 & \cos\phi & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}
\begin{bmatrix} \cos\lambda & -\sin\lambda & 0 & 0 \\ \sin\lambda & \cos\lambda & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}
\begin{bmatrix} 1 & 0 & 0 & -\Delta x \\ 0 & 1 & 0 & -\Delta y \\ 0 & 0 & 1 & -\Delta z \\ 0 & 0 & 0 & 1 \end{bmatrix}
\begin{bmatrix} x \\ y \\ z \\ 1 \end{bmatrix}
$$

Show your work!

Problem #2.

If you are given a 4 x 4 Matrix that looks like:

$$\begin{bmatrix} x''' \\ y''' \\ z''' \\ 1 \end{bmatrix} = \begin{bmatrix} \cos\lambda & -\sin\lambda & 0 & \Delta x \\ \sin\lambda & \cos\lambda & 0 & \Delta y \\ 0 & 0 & 1 & \Delta z \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \\ 1 \end{bmatrix}$$

$$R = \begin{bmatrix} \cos\lambda & -\sin\lambda & 0 & 0 \\ \sin\lambda & \cos\lambda & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad T = \begin{bmatrix} 1 & 0 & 0 & \Delta x \\ 0 & 1 & 0 & \Delta y \\ 0 & 0 & 1 & \Delta z \\ 0 & 0 & 0 & 1 \end{bmatrix}$$
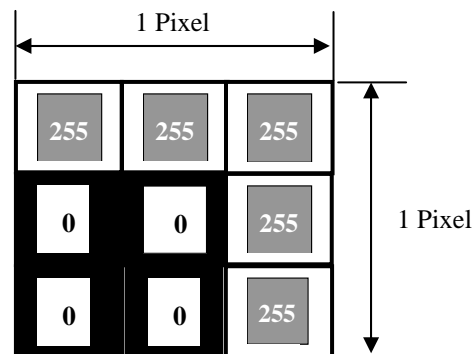
And we know that this is a composite matrix of Translation and Rotation and order is important.

       a. What is the order that the Translation and Rotation get multiplied to get this composite Matrix?

       b. What does this tell you about what happens First in a Composite Matrix?

Problem #3.

1. Given the following sub-sampled pixel,

	1 Pixel		
255	255	255	
0	0	255	1 Pixel
0	0	255	

a)   What is the pixel value if an un-weighted filter is used?

b)   What is the pixel value with the following weighted filter?

1	2	4
1	2	4
1	2	4