Worksheet 1: Matrices & Transformations

CS770/870

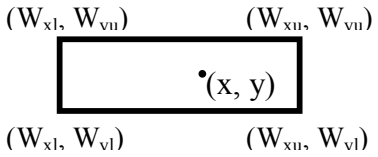
Fall 2008

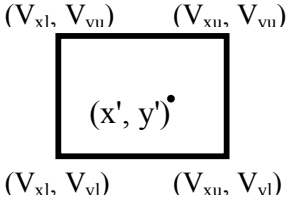
1. Multiply these two matrices together by hand. Please show your work in the space provided below, and show the answer at right.

$$\begin{bmatrix} 5.0 & 0.5 & 0 & 2.0 \\ -0.5 & 5.0 & 0 & -2.0 \\ 0 & 0 & 5.0 & 4.0 \\ 0 & 0 & 0 & 1.0 \end{bmatrix} \begin{bmatrix} 2.0 & 0 & 1.0 & -1.0 \\ 0 & 2.0 & 1.0 & -2.0 \\ 0 & 0 & 2.0 & -3.0 \\ 0 & 0 & 0 & 1.0 \end{bmatrix} = \begin{bmatrix} & & & \\ & & & \\ & & & \\ & & & \end{bmatrix}$$

2. Write the matrix you would use to rotate a 3D object Θ degrees about the Y-axis, followed by a rotation of α degrees about the X-axis. Show your starting matrices, and how you arrived at your final answer.

3. Assume you have a window in world coordinates, defined by (W_{xl}, W_{xu}, W_{yl}, W_{yu}), and a viewport in normalized device coordinates (NDC) defined by (V_{xl}, V_{xu}, V_{yl}, V_{yu}). Write the 3x3 homogeneous matrices you would need to map a point (x, y) in world coordinates to a point (x',y') in NDC. Don't multiply the matrices out, but do show (and label) the matrices you would use and the order you would multiply them in.





4. Given an object in 3D whose local origin is located at (50, -20, 10) and whose local Z-axis is parallel to the world Y-axis, show the minimum number of steps that would be necessary to rotate this object by Θ degrees about its local Z-axis and then scale it uniformly by *s* about its local origin. Write (and label) the matrices necessary to achieve this composite transformation, and show how a coordinate (x, y, z) in the object would be transformed (multiplied) by these matrices to produce a transformed coordinate (show the matrices and vector in the correct order). Do not do the matrix multiplication.