CS371 Spring 2007 Assigned: Wed. 2/28/07
Prof. Morgan McGuire Due: Fri. 3/02/07 10:00am

Homework 3b

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Name

As with all homework in this class, work on this alone. You can use your notes, books, and the internet.

1. Write the following 4x4 transformation matrices, assuming the column vector will be placed on the right during the multiplication that applies the transformation:

a) Scale uniformly by 2 in every dimension

b) Translate points by (2, 1, 4)

c) Scale by 2 and then translate by (2, 1, 4)

d) Transformation that undoes (inverts) the transformation from part (c)

e) If the answer from (c) transforms points on a surface to world space, what is the corresponding matrix for transforming normals of that surface to world space?

f) Rotate by 90 degrees counter-clockwise about the Z-axis.

2. Derive the inverse of the transformation matrix $R_1R_2S_1T_1S_2$ in terms of the inverses of the individual matrices.

3. A rigid-body or "RT" transformation is one that preserves lengths and angles (i.e. only rotation and translation occur). If the first column of the 4x4 matrix representing that transformation is given by column vector A and the third column by column vector B, what is the second column? Why?

3. A *skew symmetric* matrix has $K = -K^T$. Compute the result of multiplying the skew symmetric matrix, K, below with a vector, v.

$$K_{x,y,x} = \begin{bmatrix} 0 & -x & y \\ x & 0 & -z \\ -y & z & 0 \end{bmatrix}, v = \begin{bmatrix} a \\ b \\ c \end{bmatrix}$$

$$Kv = ?$$

What do you notice about the result? Hint: consider the vectors (x, y, z) and (v_x, v_y, v_z).