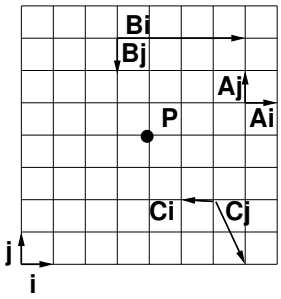
CPSC 314, Written Homework 1: Transformations

Out: Thu 12 May 2005
Due: Wed 18 May 2005 4pm
Value: 5% of final grade
Total Points: 100

1. (18 pts) The point coordinate P can be expressed as P = 4*i + 4*j, where i and j are basis vectors of unit length along the x and y axes, respectively. Describe the point P in terms of the 3 other coordinate systems given below.



2. (6 pts) Write down the 4x4 matrix for translating an object by 1 in X.

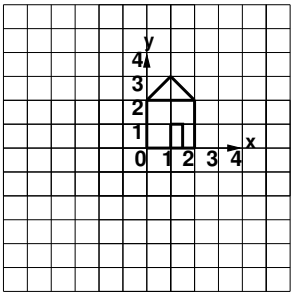
3. (6 pts) Write down the 4x4 matrix for nonuniformly scaling an object by 5 in Z and .2 in Y.

4. (10 pts) Describe in words what this matrix does, interpreting it as an operation in local coordinates that changes the coordinate frame. Be specific about the order of operations.

$$\begin{bmatrix} 0 & -1 & 0 & 0 \\ 1 & 0 & 0 & -2 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

5. (10 pts) Describe in words what the matrix above does, interpreting it as an operation in a fixed global coordinate system coordinates that moves the object. Be specific about the order of operations.

6. (10 pts) Draw a picture of the object transformed by the matrix above.



7. (12 pts) Give the series of matrices needed to rotate a scene by 90° around the y axis with a fixed point of (4,-1,2,1). Use column vectors for points, so that $p' = M_1 M_2 ... M_n p$.

8. (10 pts) Give the sequence of OpenGL commands necessary to implement the above transformation.

9. (4 pts) Homogenize the point (8,10,6,2).

10. (14 pts) Prove or disprove that (in 2-D) the operation of shearing by 2 in x and 3 in y simultaneously is identical to first shearing by 2 in x and then shearing by 3 in y.