CS 334
Fall 2007
Voicu Popescu

Due: Friday September 21, 23:59

Assignment 2—Vectors, matrices, transformations

In a nutshell

Implement a 3D vector class, a 3x3 matrix class, a coordinate system class, and a planar pinhole camera class. Illustrate your classes by rotating a point about an arbitrary axis.

Details

1. 3D vector class
    *   Stores 3 floats.
    *   Constructor from 3 floats.
    *   Read/write access to elements with square brackets operator.
    *   Write to and read from stream using >> and << operators.
    *   Normalization.
    *   Length.
    *   Dot product (choose operator).
    *   Cross product (choose operator).
    *   Multiplication/division with scalar (use operator).
    *   Addition/subtraction with another vector (use operators).
2. 3x3 matrix class
    *   Stores 9 floats
    *   Constructor: rotation about {x|y|z} axis alpha degrees.
    *   Read/write access to rows and columns.
    *   Matrix inversion.
    *   Matrix transposition.
    *   Matrix times column vector.
    *   Matrix multiplication.
    *   Stream I/O using << and >> operators.
3. Coordinate system class
    *   Constructor from 3 3D vectors: an origin, the x direction, and the y direction.
    *   Transform point from/to local to/from global.
    *   Transform direction from/to local to/from global.
4. Planar pinhole camera class
    *   Constructor taking image resolution and horizontal field of view
    *   Point projection (with clipping)
5. Example

- Rotate a point about an arbitrary axis with 1 degree increments. Visualize the rotation using your camera class (and your first assignment) Show the point and the axis. Make sure that you choose the axis and point such that you see the point at all times.

Extra credit

1. Make a robot with many joints that moves, danses, plays soccer, etc (x%)
2. Anything else that produces a compelling visual experience. (x%)

Turn in

Email us (TA and 2 instructors) an URL and the password to a password protected archive with the following files:

- Source code, including project/workspace/makefiles
- Code should compile, use relative paths
- Include all non-standard libraries (archive size should be <50MB)
- A short REPORT.{pdf|doc} file that describes your user interface, the extra credit completed, and that includes the graph.