

Due: Monday September 8 at 6:00am

## Assignment 1—Vectors, matrices, transformations

### *In a nutshell*

Implement a 3D vector class and a 3x3 matrix 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.
  - Stream I/O 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).
  - Rotate point about arbitrary axis. Parameters are 2 points to define axis and a scalar (float) to define the rotation angle in degrees.
  - Rotate vector about arbitrary axis.
2. 3x3 matrix class
  - Stores 3 3D vectors
  - Constructor: identity matrix.
  - 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. Example
  - Rotate a point about an arbitrary axis 360 times with  $10^\circ$  increments. Plot the x, y, and z coordinates of the point as functions of the rotation angle (one graph, 3 curves). Choose your favorite graphing tool (e.g. Matlab, Excel, etc.) You choose the point and the arbitrary axis, but specify the point, the axis

origin, and the axis direction in a text file called README.txt. Save the graph in an image file called GRAPH.<ext>, where the extension depends on the file format chosen. Use a popular file format such as tif, jpeg, bmp, etc.

***Turn in***

- Submit your code, README.txt and GRAPH.<ext> files via Blackboard