Computer Science 591B, Graphics

http://www.cs.umass.edu/~elm/graphics/

Test 1: Review Sheet

You should know the following material:

1. Basic structure of the frame buffer and the representation of a pixel as a concatenation of four bytes, where the last three bytes represent the strength of the red, green, and blue components of the pixel.
2. Basic line-drawing algorithms, as in Assignment 1.
3. Properties of the following transformations: rigid, similarity, linear, affine, and perspective. Know what properties of the image each of these types of transformations preserves, such as angle, straightness, parallelness, etc.
4. Know how to implement linear tranformations in two dimensions with two by two matrices, including shearing, scaling (separate scaling in each direction), rotation, and reflection.
5. Know how to implement translation (shifting) in two dimensions by adding a simple offset vector to the coordinates of a point.
6. Know how to implement affine transformations in two dimensions with three by three homogeneous matrices applied to a "homogenized" vector, i.e. a vector where a "1" has been added to the end of the vector. In addition to the linear transformation, you should be able to implement translation with these matrices.
7. Understand why we use "forward" transformations when transforming geometric objects like squares and triangles, but we use "backward" transformations when transforming bitmaps.
8. Know how to find the inverse of the product of matrices.
9. Know how to find the inverse of each kind of basic transformation matrix, including all of the basic affine transformations: shearing, scaling, rotation, translation, and reflection.
10. Know the strategy of moving a point within an object to the origin (using a translation matrix) before applying another sort of transformation, so that the transformation does not "move" the object.
11. Make sure you have read chapter 21 in the book.
12. In two-dimensions, know how to find the area of a triangle given its three vertices.
13. In three dimensions, know how to compute the cross product between two vectors. This results in a vector perpendicular to the original two whose magnitude is equal to the sine of the angle between the vectors times the product of the magnitude of the two vectors.
14. Know how to find the magnitude of a vector in two or three dimensions.
15. Know how to derive the barycentric coordinates for a point in a triangle.
16. Have a basic idea of what a pinhole camera is and how it works. Know that a pinhole camera obeys the image formation model of "perspective projection".
17. Suppose we have a canonical coordinate system defined by an origin $\mathbf{o}$ and perpendicular, unit vector axes $\mathbf{x}$ and $\mathbf{y}$. Now you are given, in these x-y coordinates, the origin $\mathbf{e}$ and the $\mathbf{u}$ and $\mathbf{v}$ axes of another perpendicular coordinate system. Be able to find the coordinates of a point p in u-v coordinates given its coordinates in x-y. Similarly, be able to find the coordinates of a point p in x-y coordinates given its coordinates in the u-v system.