# CSci 490, Spring 2005, Assignment 3

*This assignment, worth 30 points, is due at* 3pm, Friday, February 11. *Submit it by attaching your modified files to an e-mail to* `cburch@cburch.com`.

From the Web page you can download a set of Java classes that implement wire-frame 3D graphics.[1] Currently, it performs an orthographic projection; but in this assignment, you will modify it to use a perspective projection instead.

The TestCube class contains a `main` method suitable for testing the program's behavior, displaying a stack of successively smaller blocks, along with some smaller blocks beside it. You can navigate around the stack by holding down arrow keys. You will notice that it has a Projection menu for selecting the projection mode. By default, the "Perspective" option will be selected — but currently the program cannot handle it and uses orthographic projection instead.

Implementing perspective projection involves modifying two classes: The TransformUtility class contains the method `perspectiveProjection` used by TestCube to generate the projection matrix, although it actually computes the orthographic projection currently; and the Graphics3D class contains the basic method used for drawing a line segment on the screen — although it omits the division step necessary to perspective projection.

You may notice that the graphics pipeline implemented in the Java program omits the step of clipping. You should not implement this feature for this assignment. Effectively, the program will assume that the entire figure lies within the view volume, so that there is no clipping. And, indeed, that is true with the TestCube figure.

Incidentally, though a wire-frame model is easy to draw, it is equally easy to misinterpret. One can easily see the model inverted from its actual state — thinking we are looking from the bottom up through the stack when in fact we are looking at the stack's top. This is particularly easy with an orthographic projection, where disambiguation is impossible; because disambiguation is impossible, though, neither is it an irritating phenomenon. But the same phenomenon will also occur with perspective projection, in which case cubes will appear to mutate in peculiar ways. When you perceive this mutation, you can try to turn the image inside out in your mind. (Doing this can be difficult!) Or, you can select Reset from the File menu to restore the original image. Pressing the up key from this will move the camera up toward the top of the stack; or, equivalently, it will appear that the stack is being tilted toward the camera.

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[1]As I write this, I have yet to proofread the code and accompanying documentation. It will, however, be available by Friday afternoon, February 4.