

CS 465 Homework 4

out: Friday 30 September 2004
due: **Friday 7 October 2004**

Problem 1: 2D Transformations

Here are four letter shapes that, in this particular font, are simple transformations of one another:



(dimensions are in millimeters).

Each letter is positioned with its baseline at $y = 0$ and its left edge aligned with $x = 0$. Express the transformation required to turn p into each of q , b , and d in the three following ways:

1. as a sequence of affine transformations, using only translation, rotation about the origin, and reflections across coordinate axes. Describe the transformations in words.
2. as a single 3×3 homogeneous transformation matrix.
3. as a single rotation about a point or a single reflection across a line.

(That's 9 answers: three ways of expressing each of three transformations.)

Problem 2: 3D Transformations

Suppose I apply a rotation that maps the x axis to the y axis, the y axis to the z axis, and the z axis to the x axis.

1. What axis and angle can be used to describe this rotation?
2. What is the 3-by-3 matrix of the rotation?