

CS 365 HW 5  
Moving Triangles  
31 March 2004 (rev.)

You will draw a triangle strip and apply matrix transformations to it. You might be able to start this program by hacking up your first one, the one that draws triangles.

The program works as follows:

- You will support a strip of triangles. The first three clicks draw the first triangle, each subsequent click draws a new triangle from the most recent three clicks.
- The individual triangles in the strip are colored as in the first program.
- The entire triangle strip moves and is transformed as a unit.
- Internally, you maintain 1) the original coordinates of the triangles that were clicked in, 2) a  $3 \times 3$  transformation matrix that rotates, moves, stretches, etc. the triangles from their original positions. This matrix starts out as an identity matrix when the program starts.
- Every time you display a triangle, you apply the matrix to the original coordinates.
- The origin,  $(0, 0)$  point for these transformations is where the mouse first clicked. The units are in pixels. Please draw  $x$  and  $y$  axes through the origin.
- There are various keyboard operations to change the transformation matrix. Every time a key is pressed you update the current matrix.

The keyboard-driven transformations are as follows.

- The left, right, up, and down arrows translate the triangle by 2 pixels each press in the  $x$  and  $y$  dimensions.
- The  $r$  key rotates by  $5^\circ$  (that's counterclockwise) with respect to the origin,
- The  $R$  key rotates by  $-5^\circ$  (that's clockwise).
- The  $x$  key shears the triangles along the  $x$  axis by  $5^\circ$ ,  $X$  by  $-5^\circ$ .
- The  $y$  key shears the triangles along the  $y$  axis by  $5^\circ$ ,  $Y$  by  $-5^\circ$ .
- The  $S$  key stretches the triangles by a factor of 1.1. The  $s$  key shrinks them, using a factor of  $1/1.1$ .
- The  $m$  key reflects (mirrors) the triangle strip w.r.t. the  $x$  axis, pressing  $m$  multiple times causes it to flip-flop. The  $M$  key does the same with respect to the  $y$  axis.
- The  $P$  key prints the transformation matrix to standard output. Please print three lines of three numbers, using `%15.5f` formatting.
- The  $Q$  or  $q$  key quits.
- The Home key restores the transformation to its original (identity) state, so the triangle strip returns to its original position.