CPSC 4040/6040
Computer Graphics Images

Assigned: Nov. 3, 2015
Due: Nov. 10, 2015 (start of class)

Quiz 4 *(Grading: 0–10 points)*

1. Assume that you are given an input image A that you want to warp into output image B using the warping functions $x(u, v) = 2v$ and $y(u, v) = 2u$.
   - If the image A is 200 pixels wide and 200 pixels high, what would the dimensions of B need to be to completely contain the output image?
   - If the image A contains a 30×30 orange triangle, what would the triangle's shape be after warped to image B? Be precise, describe its shape, orientation, and the dimensions of the new bounding box of the triangle. Its position in the image is not relevant to answer I am looking for.

2. Using the same warp functions as in Question 1, consider the following questions:
   - Explain what artifacts, if any, could appear in an image warped this way.
   - What would the inverse mapping functions be?

3. Suppose that the matrix

   $$M = \begin{bmatrix} 0 & 2 & -100 \\ 2 & 0 & 0 \\ 0.01 & 0 & 1 \end{bmatrix}$$

   determines a forward warp from the input image (u, v) space to the output image (x, y) space. If the input image is 200 pixels wide × 200 pixels high, what will be the minimum required size for the output pixmap?

   There is no need to show your work for the multiplication, but if you require normalization of the w component, it would be helpful to see the before and after values (for partial credit).

4. Using the same warp matrix from Question 3, explain what artifacts, if any, could appear in an image warped this way.

5. Now, compute the inverse map from Question 3 (again, you do not need to show work, use electronic aids).

   Using this matrix, determine which input pixel the following output image pixels will map to. *Be careful.* If you had to translate the output image to align with the pixmap, you need to include this translation in the computation of the inverse map. Note that when I say "output pixel at (x, y)" this specifically means the pixel stored at array position $[y][x]$, assuming that the first index of the array, y, is which row and the second index of the array, x, is which column.

   output pixel #1: $(60, 100)$ comes from input pixel:

   output pixel #2: $(40, 40)$ comes from input pixel: