INTRODUCTION TO DIGITAL IMAGE PROCESSING

POSSIBLE SOLUTIONS TO PRACTICE PROBLEMS – GEOMETRIC OPERATIONS

Question 1 (a)

Question 1 (b)
Result is same.

The negative sign is needed because MATLAB's `imrotate` command considers positive angles to be counter-clockwise, whereas we considered positive angles to be clockwise. On the other hand, `imtransform` adheres to our conventions.

If the 'crop' option is left out, the output image is larger than the input image and no portions of the input are missing from the output. The 'crop' option ensures that the output and input have same size; however, portions of the input image may rotate outside the matrix.

Question 2
See file `GEO_Q2.m` on OWL site.

Question 3
The transformation parameters are approximately `theta` = -0.5236 radians (i.e., -30 degrees; code returns answer in radians), `s` = 1.33, `di` = 99.2 pixels, and `dj` = -159.3 pixels.

I used the points of the leaves as landmarks since they are easy to identify.

The parameters are expected to be close to what your classmates might estimate but not identical because the process is interactive.

To estimate the geometric operation to register the two images and to apply the operation to the source (`maple2.jpg`), I typed the following at the MATLAB prompt:

```
[theta, s, di, dj] = register('maple2.jpg', 'maple.jpg');
source = imread('maple2.jpg');
target= imread('maple.jpg');
scale = [s, 0, 0; 0, s, 0; 0, 0, 1];
rot = [cos(theta), sin(theta), 0; -sin(theta), cos(theta), 0;
0, 0, 1];
trans = [1 0 0; 0 1 0; dj di 1];
geo_op = scale*rot*trans;
tform = maketform('affine', geo_op);
registered =  imtransform(source, tform, 'xdata', [1
size(target,2)], 'ydata', [1, size(target, 1)]);
subplot(223), imshow(registered)
title('Transformed source image', 'fontsize', 15,
'fontweight', 'bold')
```