Quiz 1 Solution: CS CS4640

1. Given a transform matrix, T, whose form is:

$$T = \begin{bmatrix} cos(\theta) & -sin(\theta) & a \\ sin(\theta) & cos(\theta) & b \\ 0 & 0 & 1 \end{bmatrix}$$

Give the Matlab statements to robustly extract the parameters a, b and θ from T; e.g., $a = \ldots$, etc. Note that an instance of T is a 3x3 matrix with fixed values.

```
a = T(1,3);
b = T(2,3);
theta = atan2(T(2,1),T(1,1));
```

2. Suppose scaling is allowed and the transform matrix, T, has the form:

$$T = \begin{bmatrix} s \times cos(\theta) & -sin(\theta) & a \\ sin(\theta) & s \times cos(\theta) & b \\ 0 & 0 & 1 \end{bmatrix}$$

Give the Matlab statements to robustly extract the parameters a, b, s and θ from T; e.g., $a = \ldots$, etc.

```
a = T(1,3);
b = T(2,3);
theta = asin(T(2,1));
cos_theta = cos(theta);
if abs(cos_theta)>0
    s = T(1,1)/cos_theta;
end
```

3. Suppose an image, im, is to be created from a 2-D function, $f(x, y)$, that has min value -1 and max value 7. For each Q and set of f values below, give the corresponding image values generated by CS4640_create_im. Note that there image values will be in the range [0,1,...,Q-1].

a. $Q = 8$

$f(x, y) = -0.5$	$im(x, y) = 0$
$f(x, y) = 3.2$	$im(x, y) = 4$
$f(x, y) = 5.9$	$im(x, y) = 6$

b. $Q = 3$

$f(x, y) = 0$	$im(x, y) = 0$
$f(x, y) = 2$	$im(x, y) = 1$
$f(x, y) = 4$	$im(x, y) = 1$

4. Suppose we have the following Matlab statement:

```
samps = rand(10000,1);
```

Draw the figure resulting from calling *hist(samps)*.

Flat line above x-axis.

5. Suppose we have the following Matlb statement:

```
samps = randn(10000,1);
```

Draw the figure resulting from calling *hist(samps)*.

Bell curve above x-axis