CS1112 Summer 2010

Quiz 5 (Solutions)

1. (a) Describe in English what the following script displays. Assume that `ClockTower.jpg` represents a color image and is in the current working directory.

```
A = imread('ClockTower.jpg');
B = rgb2gray(A);
[m,n] = size(B);
C = zeros(n,m,'uint8');
for i=1:m
   C(:,i) = B(m+1-i,:);
end
imshow(C)
```

Solution The original color image is displayed in black-and-white (1 point) and is rotated 90 degrees (3points) clockwise (1 point).

"The image is flipped and black and white" = 3 points.

1. (b) What is the output if the following script is run?

```
x = uint8(200);
y = uint8(300);
a = (x+y)/2
b = double((x+y)/2)
```

Solution

The value of `y` is 255 since a uint8 variable houses integers between 0 and 255.
The value of `x+y` is 255
The value of `a` is 128
The value of `a` and `b` is the same.

```
Full credit:
               128 128
            or 127 127

Sample -1 deductions:
Output with fractions
Different a and b:
Think uint8 values between something different than 1-to-255
```

2. Recall that the built in function `strcmp` has the property that `strcmp(s1,s2)` is 1 if `s1` and `s2` are identical strings and 0 otherwise. Assume that `C` is an initialized cell array of strings and that `s` is an initialized string. Complete the `while`-loop condition so that the following fragment is correct:

Solution

```
k = 1;
while k<= length(C) && strcmp(s,C{k})==0          <----------------------
   k = k+1;
end
if k>length(C)
   disp('The string in s does not occur in C')
end
```

3 points: k<= length(C)

2 points: && not ||

4 points: strcmp(s,C{k})==0

1 point for correct order, i.e., k <= length(C) && strcmp(s,C{k})==0
instead of   strcmp(s,C{k})==0 && k<= length(C)

(Otherwise you will get a subscript out of bounds.)

3. Consider the following definitions:

Definition 1. For a given black-and-white image, we say that pixel (i, j) is an *interior pixel* if it is not on the edge of the image.

Definition 2. For a given black-and-white image, we say that pixel (i_1, j_1) is a *neighbor* of pixel (i_2, j_2) if $|i_1 - i_2| + |j_1 - j_2| \leq 1$.

Definition 3. For a given black-and-white image, we say that a pixel is *very bright* if it is an interior pixel and each of its neighbors has a lessor intensity.

Complete the following function so that it performs as specified:

```
    function C = VeryBrightPixels(X)
% X names a black-and-white jpg file in the current directory.
% C is a cell array of length-2 vectors that collectively identify
% all the bright pixels in X. Thus, if the function outputs the cell
% array {[40,300],[200,30],[100,150]}, then pixels (40,300), (200,30),
% and (100,50) are the very bright pixels.

A = rgb2gray(imread('X.jpg'));

[m,n] = size(A);
k=0
for i=2:m-1
   for j = 2:n-1
      if A(i,j)>A(i-1,j) && A(i,j)>A(i+1,j) &&
         A(i,j)>A(i,j-1) && A(i,j)>A(i,j+1)
         k = k+1;
         C{k} = [i j];
      end
   end
end

Note that the loops visit only interior pixels
Note that an interior pixel (i,j) has four neighbors:
      (i-1,j), (i+1,j), (i,j-1), (i,j+1)

Loop ranges            2 points
if condition           4 points
The k counter          2 points
Cell array assignment  2 points
```