CS 5420	**Digital Image Processing**	Test 1
Name:	Fall 2012	Max Pts: 42

Important: This is an open book test. You can use any books, notes, or paper, but not exchange anything with other students. You are not allowed to use any electronic/communication devices, including a calculator and e-books. *Do not log into the computer during the test. Switch off your cell phones. Any device with an* ON-OFF *switch should have its switch in the* OFF *position.* Any calculations and rough work can be done on the back side of the test pages. You will lose five points for not writing your name.

1. [10 pt] A common measure of transmission of digital data is the *baud rate*, defined as the number of bits transmitted per second. Generally, transmission is accomplished in packets consisting of a start bit, a byte (8 bits) of information, and a stop bit. Using these facts, how many minutes would it take to transmit a 1024×1024 image with 256 intensity levels using a 56K baud modem?

2. [10 pt] Consider two 8-bit images I_1 and I_2 whose intensity levels span the full range from 0 to 255. What happens when you execute the following loop:

```
for ( int i = 0; i < n; i++ )
{
    tmp = I1 - I2;
    I1 = tmp;
}
```

   Take any arbitrarily large value for n. Would reversing the order of images in subtraction make any difference where we copy `tmp` back into I_2 instead of I_1? Assume that the subtraction operation above results into an 8-bit image.

3. [6 pt] Generally speaking, correlation and convolution of a kernel applied to an image produce different results. However, there is a certain type of kernel that will produce the same result whether you apply it using correlation or convolution. What is the special property of such a kernel?

4. [6 pt] Give a single intensity transformation function to spread the intensities of an image so the lowest intensity is 0 and the highest is $L - 1$.

5. [10 pt] The probability distribution of pixel intensities in a 3-bit image is given as

   0.21, 0.06, 0.05, 0.21, 0.04, 0.18, 0.13, 0.12

   We have a reference image whose probability distribution is given by

   0.07, 0.04, 0.26, 0.17, 0.15, 0.07, 0.05, 0.19

   Compute the lookup table that will allow me to bring the contrast of first image to the reference image.