CS 6420	**Topics in Image Processing and Multimedia**	**Test 1**
Name:	Spring 2013	Max Pts: 50

Important: This is an open book test. You can use any books, notes, or paper but no electronic device, except a non-programmable calculator. *Do not log into the computer during the test, or use any electronic or communications device. Switch off your cell phones*. 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] Construct a fully populated approximation pyramid and corrsponding prediction residual pyramid for the image

$$f(x,y) = \begin{bmatrix} 15 & 6 & 3 & 6 \\ 13 & 13 & 6 & 12 \\ 10 & 15 & 3 & 13 \\ 1 & 13 & 13 & 15 \end{bmatrix}$$

   Use 2×2 neighborhood averaging for the approximation filter and assume the interpolation filter implements pixel replication.

2. [10+10+10 pt] You are given an image containing eight discrete intensity levels $(a_1, \ldots, a_8)$, with distribution given by

$$0.06, 0.10, 0.05, 0.19, 0.24, 0.12, 0.11, 0.13$$

Compute (a) Huffman code, (b) Golomb code $G_4(n)$, and (c) Arithmetic code for the signal

$$a_6, a_3, a_1, a_6, a_1, a_3, a_3, a_2$$

You will compute the first two codes in binary but express both of them as a hexadecimal number; add any padding to the end of the code to make the number of bits as a multiple of 8. If you need to map the input alphabet $(a_1 \ldots, a_8)$ to integers, you may do so.

3. [10 pt] What is the limiting effect of repeatedly eroding an image? Assume that a trivial (one point) structuring element is not used.