CS 5420	**Digital Image Processing**	Test 2
Name:	Fall 2022	Max Pts: 68

Important: This is an open book test. You can use any books, notes, or paper.

1. [6 pt] What is the maximum number of possible different shades of gray in an RGB image whose three component images are 8-bit images?

2. [10 pt] Show that the saturation component of the complement of a color image cannot be computed from the saturation component of the input image alone.

3. [10 pt] Consider an 8-pixel line of intensity data {108, 139, 135, 244, 172, 173, 56, 99}. If it is uniformly quantized with a 4-bit accuracy, compute the rms error and rms signal-to-noise ratios for the quantized data.

4. [10 pt] Consider the simple 4×8, 8-bit image:

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21 21 21 95 169 243 243 243
21 21 21 95 169 243 243 243
21 21 21 95 169 243 243 243
21 21 21 95 169 243 243 243
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   (a) Compute the entropy of the image.

   (b) Compress the image using Huffman coding.

   (c) Compute the compression achieved and the effectiveness of Huffman coding.

5. [14 pt] Compute Golomb code $G_5(n)$ for $0 \leq n \leq 7$.

6. [8 pt] Given a four-symbol source $[a, b, c, d]$ with source probabilities $[0.1, 0.4, 0.3, 0.2]$, arithmetically encode the sequence $bbadc$.

7. [10 pt] Erosion of a set A by structuring element B is a subset of A, provided that the origin of B lies within B. Give an example in which the erosion $A \ominus B$ lies outside, or partially outside, A.