CS 5420	**Digital Image Processing**	Test 2
Name:	Fall 2020	Max Pts: 60

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

1. [10 pt] Consider an RGB cube whose visible vertices are white, yellow, red, magenta, green, cyan, and blue. This cube is to be displayed on a grayscale monitor. What will be the grayscale value for each of the vertices on a scale of [0,255]?

2. [6 pt] Convert the gamma-corrected color $(R', G', B') = (186, 228, 235)$ to HSI color space.

3. [10 pt] Consider any two valid colors c_1 and c_2 with coordinates (x_1, y_1) and (x_2, y_2) in the chromaticity diagram (Fig. 7.5 in the textbook). Derive the necessary general expression(s) to compute the relative percentage of colors c_1 and c_2 composing any color that is known to lie on the straight line joining these two colors.

4. [10 pt] Suppose we have an image with 256 different gray levels. All the gray values appear an equal number of times. How can you achieve lossless image compression on this image?

5. [15 pt] Consider the following 8×8 3-bit image:

```
0 0 0 0 1 2 4 6
0 0 0 0 1 2 4 6
0 0 0 0 1 2 4 6
0 0 0 0 1 2 4 6
1 1 1 1 1 1 1 1
3 3 3 3 3 3 3 3
5 5 5 5 5 5 5 5
7 7 7 7 7 7 7 7
```

   (a) Compute the normalized intensity histogram for the image.

   (b) Compute the Huffman code for each of the intensities.

   (c) Compute L_{avg} – the average number of bits used to store the intensity values of the image with Huffman code.

   (d) Compute the entropy of the image.

   (e) Compute the compression ratio and relative redundancy.

6. [6 pt] What is the limiting effect of repeatedly eroding an image? Assume that a trivial (one point) structuring element is not used.

7. [14 pt] Compute Golomb code $G_3(n)$ for $0 \leq n \leq 7$.

8. [10 pt] Consider the following image where 0 is background and 1 is foreground.

```
0000000000000000
0000000000000000
0111000000001110
0111111111111110
```

```
0111000000001110
0000000000000000
0000000000000000
```

Obtain the opening of this figure using a 3×3 SE of 1's.