CS 4420/5420	**Digital Image Processing**	Test 1
Name:	Fall 2020	Max Pts: 64

Important: This is an open book test. You can use any books, notes, or paper, but not exchange anything with other students, or any other person via the internet.

1. [6 pt] Define α-value in an image. What is the use of α-value or α-channel?
2. [6 pt] What is brightness adaptation in human visual system? How does it relate to Weber ratio?
3. [6 pt] What is image registration? Give an example of a function that is based on image registration.
4. [10 pt] The normalized histogram is computed from the histogram by dividing each element by the total number of pixels in the image. Thus, the normalized histogram gives you the actual probability distribution of pixel intensities and the sum of all pixels in normalized histogram is 1. Compute the histogram and normalized histogram of the following 4×4 3-bit grayscale image

$$I = \begin{bmatrix} 4 & 3 & 2 & 1 \\ 5 & 5 & 1 & 3 \\ 1 & 0 & 1 & 0 \\ 1 & 0 & 4 & 0 \end{bmatrix}$$

5. [6 pt] I have a grayscale image of size 640×480 pixels. I performed the thresholding operation on this image that converted pixels with intensity more than 128 to white while other pixels were changed to black. What is the *minimum* storage requirement (in bytes) to save this threshold image?
6. [6 pt] Electricity is transmitted by using alternating current. Commercial alternating current in the US has a frequency of 60 Hz. What is the wavelength in kilometers of this component of this spectrum? Consider speed of light as 300,000km/sec.
7. [6 pt] Why does a CFL or LED bulb use less energy while providing the same amount of luminance?
8. [6 pt] A photodiode is not sensitive to a specific color but only to the amount of light energy that is incident on it. Given that fact, how do you explain the acquisition of color images in a digital camera?
9. [6 pt] Show the difference between a linear and nonlinear imaging operator by using an example.
10. [6 pt] What is the advantage of blurring using a Gaussian kernel compared to a uniform [box-filter] kernel?