Homework-3

Question 1

A technique for computing optimal thresholds was developed in class under the assumption that if a single pixel x is changed into q the error is $(x-q)^2$. Derive equations for computing the optimal threshold if the error of moving a pixel of value x to a pixel of value q is $|x-q|$ and not $(x-q)^2$. Follow the same steps as the derivation in class. You may want to use the fact that the derivative of $|x|$ is 1 if $x > 0$ and -1 if $x < 0$.

Question 2

You are given the following image:

6	6	6	10
6	6	6	10
17	17	17	17
17	17	17	88

1.

What is the image histogram?

Answer:

2.

What would be the result of applying the optimal thresholding algorithm that was discussed in class to this image?

Answer:

The threshold value is $t =$
The image after the threshold is applied is:

3.

What image is obtained by linearly scaling the pixel values to the $0-255$ range?

4.

What image is obtained by histogram equalization to the $0 - 255$ range?

Question 3

You are given the following color image, where the pixel values are in sRGB. The value of each pixel is given as the triplet (r, g, b).

(0,0,0)	(0,0,0)	(0, 0, 0)	(0, 0, 0)
(255, 0, 0)	(255, 0, 0)	(255, 0, 0)	(255, 0, 0)
(100, 100, 100)	(100, 100, 100)	(100, 100, 100)	(100, 100, 100)
(0, 100, 100)	(0, 100, 100)	(0, 100, 100)	(0, 100, 100)

A

Convert the color image to nonlinear RGB.

(, ,)	(, ,)	(, ,)	(, ,)
(, ,)	(, ,)	(, ,)	(, ,)
(, ,)	(, ,)	(, ,)	(, ,)
(, ,)	(, ,)	(, ,)	(, ,)

B

Convert the color image to linear RGB.

(, ,)	(, ,)	(, ,)	(, ,)
(, ,)	(, ,)	(, ,)	(, ,)
(, ,)	(, ,)	(, ,)	(, ,)
(, ,)	(, ,)	(, ,)	(, ,)

C

Convert the color image to XYZ.

(, ,)	(, ,)	(, ,)	(, ,)
(, ,)	(, ,)	(, ,)	(, ,)
(, ,)	(, ,)	(, ,)	(, ,)
(, ,)	(, ,)	(, ,)	(, ,)

D

Convert the color image to xyY.

(, ,)	(, ,)	(, ,)	(, ,)
(, ,)	(, ,)	(, ,)	(, ,)
(, ,)	(, ,)	(, ,)	(, ,)
(, ,)	(, ,)	(, ,)	(, ,)

E

Convert the color image to Luv.

(, ,)	(, ,)	(, ,)	(, ,)
(, ,)	(, ,)	(, ,)	(, ,)
(, ,)	(, ,)	(, ,)	(, ,)
(, ,)	(, ,)	(, ,)	(, ,)

F

Compute linear illumination stretching in the Luv domain, and convert the result back to sRGB.

(, ,)	(, ,)	(, ,)	(, ,)
(, ,)	(, ,)	(, ,)	(, ,)
(, ,)	(, ,)	(, ,)	(, ,)
(, ,)	(, ,)	(, ,)	(, ,)