

## Homework-2 Solutions

### Question 1

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:**

Pixel value	0	...	6	...	10	...	17	...	88	...	255
# pixels	0	...	6	...	2	...	7	...	1	...	0

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  $t = 18$ . ( $q_1 = 11.7$ ,  $q_2 = 88$ .) The picture after the threshold is applied is:

0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	255

3.

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

$$x \rightarrow (x - 6) * 255/82$$

0	0	0	12
0	0	0	12
34	34	34	34
34	34	34	255

4.

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

48	48	48	112
48	48	48	112
184	184	184	184
184	184	184	248

## Question 2

	$x = 0$	$x = 1$	$x = 2$	$x = 3$	$x = 4$	$x = 5$	$x = 6$	$x = 7$
$y = 0$	10	20	30	40	50	0	70	80
$y = 1$	40	50	60	30	50	0	60	70
$y = 2$	70	80	90	20	50	0	50	60
$y = 3$	100	110	120	10	50	0	40	50
$y = 4$	130	140	150	0	50	0	30	40
$y = 5$	160	170	180	0	50	0	20	30
$y = 6$	190	200	210	0	50	0	10	20

The above picture is transformed by a geometric transformation. The (forward) description of this transformation is:

The pixel at coordinate  $(x, y)$  in the original picture moves to the location  $(6 - 3y, 6 - 2x)$  in the new picture.

**A.**

Compute the transformed image using Nearest-Neighbor interpolation over the  $2 \times 2$  window specified below:

	$x = 0$	$x = 1$
$y = 0$	20	20
$y = 1$	20	20

This result is obtained with  $\text{round}(2.5) = 3$ .

**B.**

Compute the transformed image using Bilinear interpolation over the  $2 \times 2$  window specified below:

**Answer:**

	$x = 0$	$x = 1$
$y = 0$	20	23
$y = 1$	55	52