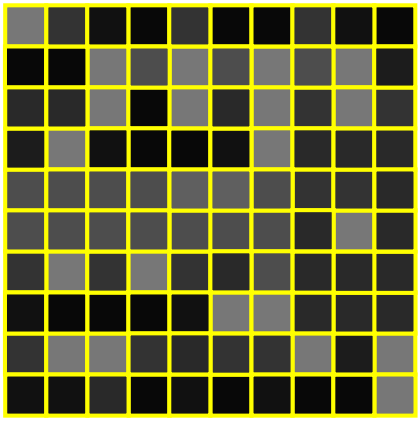
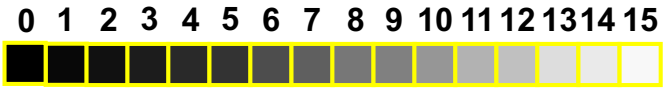
Question:

Show step by step how to construct the histogram-equalized image from the following original image.

A 10 x 10 original image with
16 grey levels (4-bit image)



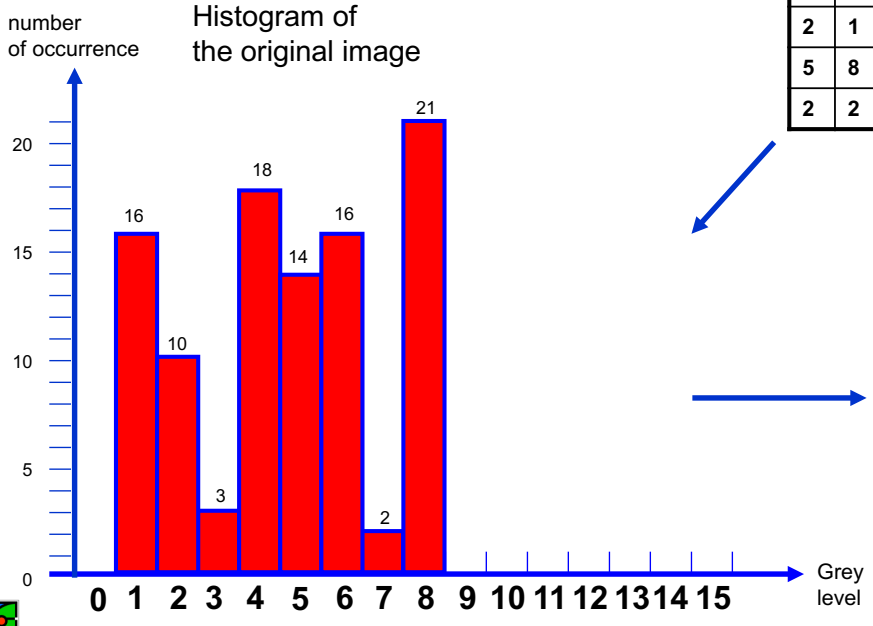
8	5	2	1	5	1	1	5	2	1
1	1	8	6	8	6	8	6	8	3
4	4	8	1	8	4	8	5	8	5
3	8	2	1	1	2	8	4	4	4
6	6	6	6	7	7	6	5	5	4
6	6	6	6	6	6	6	4	8	4
5	8	5	8	5	4	6	4	4	4
2	1	1	1	2	8	8	4	4	4
5	8	8	5	4	5	5	8	3	8
2	2	4	1	2	1	2	1	1	8



A 10 x 10 image with
16 grey levels (4-bit image)

8	5	2	1	5	1	1	5	2	1
1	1	8	6	8	6	8	6	8	3
4	4	8	1	8	4	8	5	8	5
3	8	2	1	1	2	8	4	4	4
6	6	6	6	7	7	6	5	5	4
6	6	6	6	6	6	6	4	8	4
5	8	5	8	5	4	6	4	4	4
2	1	1	1	2	8	8	4	4	4
5	8	8	5	4	5	5	8	3	8
2	2	4	1	2	1	2	1	1	8

Histogram of
the original image



Histogram
Equalization

The new grey levels after Histogram Equalization

r_1	r_2	r_3	r_4	r_5	r_6	r_7	r_8
1	2	3	4	5	6	7	8
n_j/n	0.16	0.1	0.03	0.18	0.14	0.16	0.02	0.21

$$s_k = T(r_k) = \sum_{j=0}^{k} \frac{n_j}{n}$$

s_1	s_2	s_3	s_4	s_5	s_6	s_7	s_8
0.16	0.26	0.29	0.47	0.61	0.77	0.79	1.0

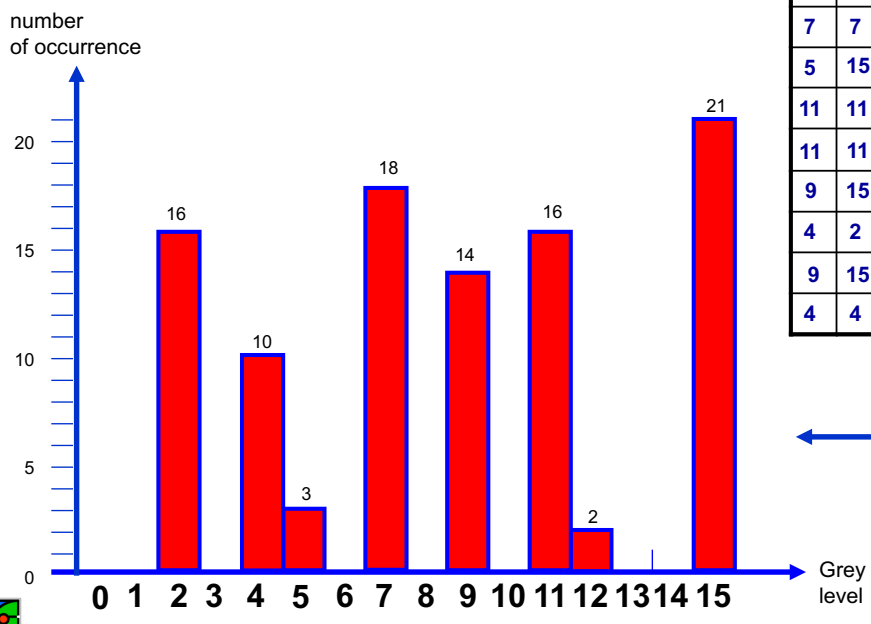
scaling: $ss = s \times 15$

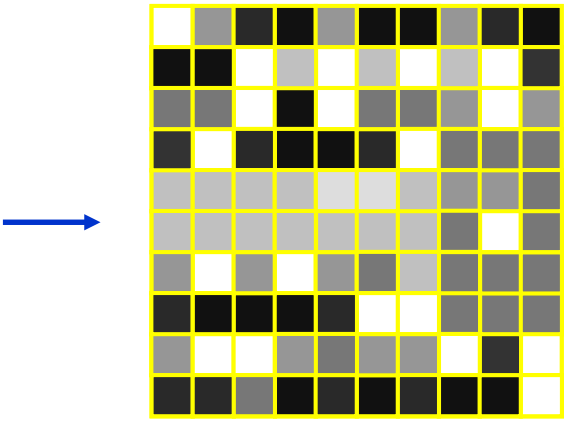
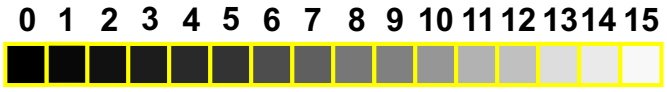
ss_1	ss_2	ss_3	ss_4	ss_5	ss_6	ss_7	ss_8
2.40	3.90	4.35	7.05	9.15	11.55	11.85	15.0
2	4	5	7	9	11	12	15

ss_1	ss_2	ss_3	ss_4	ss_5	ss_6	ss_7	ss_8
2	4	5	7	9	11	12	15

15	9	4	2	9	2	2	9	4	2
2	2	15	11	15	11	15	11	15	5
7	7	15	2	15	7	15	9	15	9
5	15	4	2	2	4	15	7	7	7
11	11	11	11	12	12	11	9	9	7
11	11	11	11	11	11	11	7	15	7
9	15	9	15	9	7	11	7	7	7
4	2	2	2	4	15	15	7	7	7
9	15	15	9	7	9	9	15	5	15
4	4	7	2	4	2	4	2	2	15

The processed image after histogram equalization



The processed image after Histogram Equalization

15	9	4	2	9	2	2	9	4	2
2	2	15	11	15	11	15	11	15	5
7	7	15	2	15	7	15	9	15	9
5	15	4	2	2	4	15	7	7	7
11	11	11	11	12	12	11	9	9	7
11	11	11	11	11	11	11	7	15	7
9	15	9	15	9	7	11	7	7	7
4	2	2	2	4	15	15	7	7	7
9	15	15	9	7	9	9	15	5	15
4	4	7	2	4	2	4	2	2	15