Histogram Specification

Question-01: Given the histogram (a) and (b) modify histogram (a) as given by histogram (b)

a)

Gray levels	0	1	2	3	4	5	6	7
No of pixels	81	96	83	65	32	45	12	23

b)

Gray levels	0	1	2	3	4	5	6	7
No of pixels	0	0	100	61	19	112	81	64

Step-01 : Equalize histogram (a)

Gray Levels	No of pixels	$P(r_k)$ PDF	S_k CDF	$S_k * 7$	Eq Gray levels	New no of pixels
0	81	0.185	0.185	1.295	1	81
1	96	0.216	0.401	2.807	3	96
2	83	0.189	0.59	4.13	4	83
3	65	0.148	0.738	5.166	5	65
4	32	0.073	0.811	5.677	6 ⎤→ 77	
5	45	0.102	0.913	6.391	6 ⎦	
6	12	0.027	0.94	6.58	7 ⎤→ 35	
7	23	0.052	0.992	6.944	7 ⎦	

$n = 437$

Step-02: Equalize histogram (b)

Gray Levels	No of pixels	P(r_k) PDF	Sk CDF	Sk*7	Equalized Gray levels
0	0	0	0	0	0
1	0	0	0	0	0
2	100	0.228	0.228	1.596	2
3	61	0.139	0.367	2.569	3
4	19	0.043	0.41	2.87	3
5	112	0.256	0.666	4.662	5
6	81	0.185	0.851	5.957	6
7	64	0.146	0.997	6.979	7

$$n = 437$$

Step-03: Histogram Mapping.

For mapping of two histograms, we need
a) first and last column of histogram (b)
b) Last two column of histogram (a)

⇒ Make a mapping table as below:

From histogram (b)

Gray Level	Equalized Gray levels
0	0
1	0
2	2
3	3
4	3
5	5
6	6
7	7

From histogram (a)

Equalized Gray levels	New no. of pixels
1	81
3	96
4	83
5	65
6	77
6	
7	35
7	

Note: if there is no mapping gray level on histogram (b) for any gray level of histogram (a); map to nearest histogram equalization level (use floor gray level value)

Now final histogram after matching

Gray levels	0	1	2	3	4	5	6	7
No of pixels	0	0	81	96	96	65	77	35