

INDIAN INSTITUTE OF TECHNOLOGY ROPAR
CSL 461 / CSL 617 Quiz-2 Date: Feb 09, 2018

Name: _____

1. **[5 marks]** Consider a 3 bit digital image A of size 40x40 pixels, having an intensity distribution of $H_r = \{380, 50, 150, 480, 90, 180, 40, 230\}$. We wish to transform image A such that the modified image histogram bin values matches with $H_s = \{50, 280, 100, 200, 280, 140, 250, 300\}$. Find the transformation possible and find the actual histogram bins values for all intensity values in the transformed version of image A. Compute RMSE error between the histogram expected and histogram achieved.

RMSE = 240.15

Or .1501

j	n _j	p _j	Cum p _j	EQ _j	
0	380	0.2375	0.2375	2	
1	50	0.03125	0.26875	2	
2	150	0.09375	0.3625	3	
3	480	0.3	0.6625	5	
4	90	0.05625	0.71875	5	
5	180	0.1125	0.83125	6	
6	40	0.025	0.85625	6	
7	230	0.14375	1	7	
	Desired S_j	Desired P_{Sj}			
	50	0.03125	0.03125	0	
	280	0.175	0.20625	1	
	100	0.0625	0.26875	2	
	200	0.125	0.39375	3	
	280	0.175	0.56875	4	
	140	0.0875	0.65625	5	
	250	0.15625	0.8125	6	
	300	0.1875	1	7	

	(Manually done)			
Expected S _j	Expected P _{Sj}		Square Error	Square Error
0	0		2500	0.00097656
0	0		78400	0.030625
430	0.26875		108900	0.04253906
150	0.09375		2500	0.00097656
0	0		78400	0.030625
570	0.35625		184900	0.07222656
220	0.1375		900	0.00035156
230	0.14375		4900	0.00191406
		MSE	57675	0.0225293
		RMSE	240.1561992	0.15009762

2. **[3 marks]** Consider the 4x4 size image A as shown. An image B is reconstructed using only bit planes 8, 7 and 6 of image A. Specify the 4x4 size **image B values**. Also, report the PSNR between images A and B.

PSNR = 22.601

245	20	150	30
240	10	150	32
128	64	200	128
30	25	10	31

224	0	128	0
224	0	128	32
128	64	192	128
0	0	0	0

441	400	484	900
256	100	484	0
0	0	64	0
900	625	100	961

MSE 357.188
PSNR 22.6018411

3. **[2 marks]** Consider the image with intensities (continuous values) in the range [0,1] having the pdf $p(r)$ as shown here. Find the transformation $T(r)$ required to perform the histogram equalization on given image. Do mention the pdf for the resulting (histogram equalized) image.

$$T(r) = 2r - r^2$$

Pdf of the resulting histogram =
 $1/(L-1) = 1$

