Homework #5

(Digital Image Processing)

Topic: Intensity Processing
Purpose: Understanding on Intensity Processing
Tools: Gamma Correction, Histogram Equalization, RGB Color system, YCrCb Color system.

Project:

1. On two given images attached below, take Gamma Corrections with $\gamma = 0.45$ and 2.2, and print the corrected images.

    - For Gamma Correction, use following function. Notice that it takes same Gamma corrections to R, G, B each and get result color image by combining corrected R, G, B together.

$$I_c' = I_c^{\frac{1}{\gamma}}$$

    where, I_c' is Gamma corrected image, I_c is input image, and c is one of R, G, B.

2. On above two original color images, take Histogram Equalization each, and print the result images. (Here, please get the contrast enhanced images by taking Histogram Equalizations on R, G, B separately and combining together.)

    - Example of Histogram Equalization
      (6x6 sized image with maximum intensity 5)

intensity of input image	No. of pixels	Cumulative No. of pixels	Normalized value $\frac{X}{\text{maximum intensity}}$	Equalized intensity values
0	10	10	(10/36) x 5	1
1	7	17	(17/36) x 5	2
2	7	24	(24/36) x 5	3
3	2	26	(26/36) x 5	4
4	6	32	(32/36) x 5	4
5	4	36	(36/36) x 5	5

3. Transform above two RGB color images to YCrCb color images by using following formula. Then, take Histogram Equalization on only Y (not on Cr, Cb), and take inverse transform to get new RGB, and print the result images. (That is, take Histogram Equalization on only Y)

$$\begin{bmatrix} Y \\ Cb \\ Cr \end{bmatrix} = \begin{bmatrix} 0.299 & 0.587 & 0.114 \\ -0.168736 & -0.331264 & 0.5 \\ 0.5 & -0.418688 & -0.081312 \end{bmatrix} \begin{bmatrix} R \\ G \\ B \end{bmatrix} + \begin{bmatrix} 0 \\ 128 \\ 128 \end{bmatrix}$$

4. Look through the results from above 2, 3 parts. What are the differences? Discuss on those.