Assignment 2

This assignment is due on September 25; marks will be deducted for late homework. Please include all references, and the names of all students in your study group. Remember all programs should be submitted as an IPython (*.ipnb) as well as the pdf file.

1) A) Construct smooth transformation functions using linear combination of exponential of the form $e^{\alpha_1+\alpha_2 r^n}$, where n, α_1 and α_2 are positive constant. Design transformation functions as displayed in **Figure 1**, using the given exponential form. (x-axis is the original intensity going from 0-255. Y-axis is the new map).

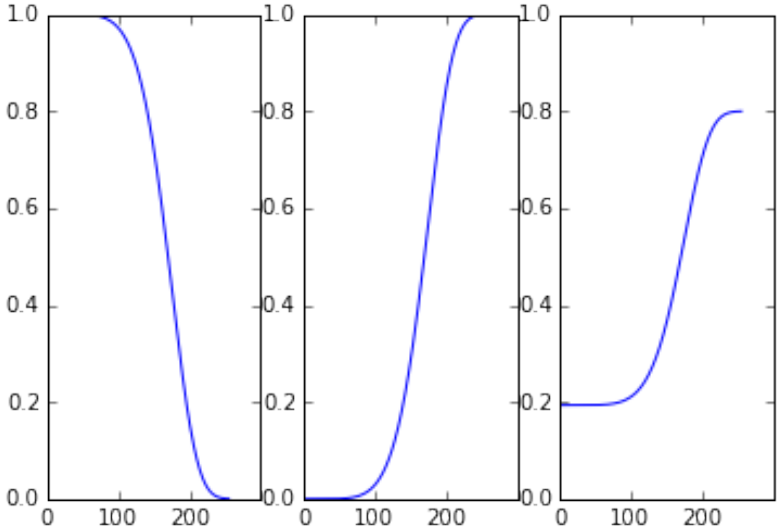

Figure 1: Example of smooth intensity transformation functions

B) Apply these transformations on Image1.jpg and display the results in grayscale.
(20 points)

2) Apply the transformation shown in Figure 2 one Image1.jpg. Here, all intensity values from 0 to 127 are mapped to 0 and intensity values from 128 to 255 are mapped to 1. Such transformations lead to binary images. What is such an operation called? (10 points)

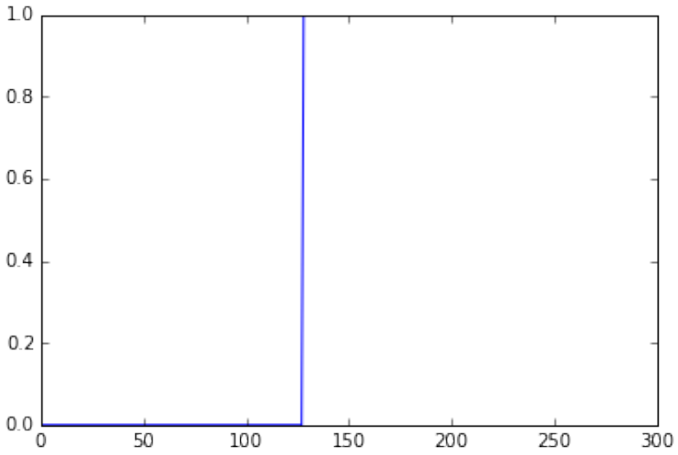

Figure 2

3. a) Write a function to obtain the histogram and the cdf of Image1.jpg.
   b) Obtain the histogram of Image1.jpg using the in-built histogram function in matplotlib.pyplot.
   c) Compare the histogram generated using your function and the in-built function.
   d) Perform histogram equalization using the **`exposure`** module.
   e) Plot the transformation function that is applied on the original image to get the histogram equalized image. (25 points)

4.

a) Construct the checkerboard pattern (200x200) as shown in Figure 3. Each square should be 10x10 pixels. Hence each row and column should have 20 squares (back and white alternating pattern).
b) Sample this image at sampling period 'n'. Determine the highest sampling period, *N*, that can be used to recover this image.
c) Try different sampling periods below *N* and comment on what you observe.
d) Try different sampling periods above *N* and comment on what you observe. What is this effect called? Display results obtained for c) and d) (10 points)

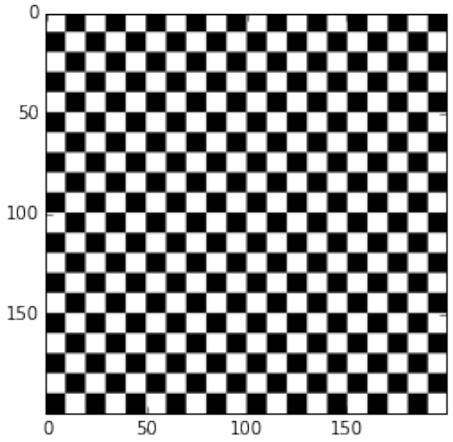

Figure 3