

SD575 – Digital Image Processing
Problem Set 1 - Point Operations for Enhancement

1. Suppose an under-illuminated image has a grey level histogram represented by the probability density function:

$$p_f(r) = 3(1 - r)^2, 0 \leq r \leq 1$$

- (a) What point operation would best enhance this image? Explain. Describe how local contrast is affected in bright and dark regions of the input image.
- (b) Suppose a discrete image has 8 grey levels and 140 pixels with the histogram $H[k] = (7 - k)^2, 0 \leq k \leq 7$. What transformation would you use to enhance this image? Show your resulting histogram.

2. Suppose the grey level probability density function of an image is approximately:

$$p_f(r) = 5 \exp(-5r), 0 \leq r \leq 1$$

- (a) Which of the transformations $s = r^2$ or $s = \sqrt{r}$ would produce a better image? Explain.
- (b) What transformation would equalize the histogram, achieving a uniform grey level distribution?
- (c) Suppose a digitized image has a grey level distribution given by:

$$p_f[k] = 0.5 (0.5)^k; 0 \leq k \leq 7$$

What is the histogram equalization transformation and the resulting histogram over 8 output grey levels from 0 to 7?