Question 1

$$A = \begin{bmatrix} 3 & 2 & 4 & 5 \\ 7 & 7 & 8 & 2 \\ 3 & 1 & 2 & 3 \\ 5 & 4 & 6 & 7 \end{bmatrix}$$

Each element is a pixel of an image and represent the image intensity. As you can see this image is distributed between 1-8, Equalize this matrix between 1-20.

Question 2

Suppose the digital image is subjected to histogram equalization. show that the second pass of the *histogram equalization* will produce the *exactly* the same result

- Let n be the total number of pixels and let n_{rj} be the number of pixels in the input image with intensity value rj. Then, the histogram equalization transformation is

$$s_k = T(r_k) = \sum_{j=0}^{k} \frac{n_{rj}}{n} = \frac{1}{n} \sum_{j=0}^{k} n_{rj}$$

- Since every pixel (and no others) with value r_k is mapped to value s_k , it follows that $n_{sk} = n_{rk}$.
- A second pass of histogram equalization would produce values v_k according to the transformation

$$v_k = T(s_k) = \frac{1}{n}\sum_{j=0}^{k} n_{sj}$$

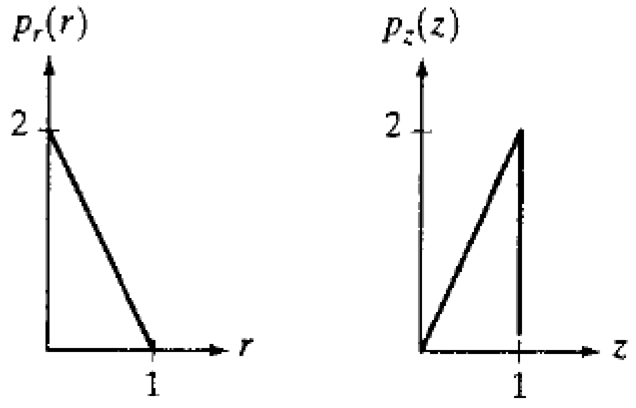
But, $n_{sj} = n_{rj}$, so

$$v_k = T(s_k) = \frac{1}{n}\sum_{j=0}^{k} n_{rj} = s_k$$

which shows that a second pass of histogram equalization would yield the same result as the first pass. We have assumed negligible round-off errors.

Question 3

- An image has the gray level PDF $P_r(r)$ shown in the following diagram. It is desired to transform the gray level of this image so that they will have the specified $P_Z(z)$ shown. Assume continuous quantities and find the transformation (in terms of r and z) that will accomplish this.



Question 4

In some application it is useful to modal the histogram of the input image as Gaussian probability density function of the form

$$P(r)=\frac{1}{\sqrt{2\pi\sigma}}e^{\frac{(r-m)^2}{2\sigma^2}}$$

Where m and σ are the mean and standard deviation of Gaussian PDF. The approach is to let m and σ be measures of average gray level and contrast of a given image. What is the transformation function you use for histogram equalization?