AVD862 Digital Image Processing

Assignment 1

1) Suppose that a 3-bit image (L = 8) of size 64×64 pixels (MN = 4096) has the intensity distribution shown in the following table. Perform histogram equalization in this image.

r_k	n_k
$r_0 = 0$	790
$r_1 = 1$	1023
$r_2 = 2$	850
$r_3 = 3$	656
$r_4 = 4$	329
$r_5 = 5$	245
$r_6 = 6$	122
$r_7 = 7$	81

2) Transform the histogram of the 3-bit 64×64 image given in question 1, so that it will have the values specified in the second column of the following table.

z_k	n_k
$z_0 = 0$	0
$z_1 = 1$	0
$z_2 = 2$	0
$z_3 = 3$	0.15
$z_4 = 4$	0.20
$z_5 = 5$	0.30
$z_6 = 6$	0.20
$z_7 = 7$	0.15

3) What is an ideal low pass filter? Is this filter suitable to use in terms of image processing? If yes, give an example of its application. If not, explain why. Calculate the impulse response of the ideal 1D low-pass filter.

4) Explain the properties of convolution operation. Use the following 3x3 mask to perform the convolution process on the shaded pixels in the 5x5 image below. Write the filtered image.

0	1/6	0
1/6	1/3	1/6
0	1/6	0

3x3 mask

5	15	20	45	50
10	35	45	60	70
20	75	100	85	75
30	40	85	135	80
40	10	45	50	65

5x5 image

5) Consider the following 5x5 image:

5	15	20	45	50
10	35	45	60	70
20	75	100	85	75
30	40	85	135	80
40	10	45	50	65

Apply a 3x3 median filter on the shaded pixels and write the filtered image.

6) Explain Laplacian operator in image filtering, explain its types and give an example for each type.