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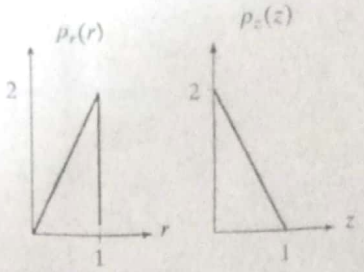
EXAM: FINAL-TERM
SUBJECT: CSE-408 DIGITAL IMAGE PROCESSING TOTAL MARKS:50
SEMESTER: SPRING-2024
TIME: 120 MINS

Question I: An image with intensities in the range [0, 1] has the PDF $p_r(r)$ shown in the following diagram. It is desired to transform the intensity levels 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. **CLO - 2 [10]**



Question II: Perform the histogram matching on the given 8x8 image. **CLO - 2 [10]**

Original Image Gray Levels

0	1	5	1	7	2	0	3
0	0	5	5	5	2	4	5
4	5	1	4	1	5	1	4
5	1	2	4	5	2	6	3
5	2	6	4	0	4	0	5
4	0	2	4	7	4	6	2
5	1	6	1	0	1	1	5
4	5	2	4	2	5	2	5

Target Image Gray Levels

4	6	5	6	6	7	5	5
5	5	4	4	4	7	4	4
5	6	4	5	5	6	6	5
5	4	7	4	5	4	6	7
4	5	5	5	4	4	6	5
6	5	4	5	6	6	7	4
6	4	5	4	7	4	6	5
7	6	6	5	4	5	6	7

Question No: III: Given an input 6x6 image. **CLO - 3 [1+3+3+3]**

7	1	0	6	2	1
5	2	1	5	7	3
4	0	5	0	7	5
0	2	4	7	3	4
2	6	7	5	0	3
5	6	2	1	4	5

Figure 1. Intensity values of the input image

a) What is the bit depth of the input image?

b) Apply the spatial domain Min filter on the image given in Figure 1 and **analyze** the effect of the Min filter on the given image.

c) Apply the spatial domain Max filter on the image given in Figure 1 and **analyze** the effect of the Max filter on the given image.

d) Apply the spatial domain Mid-Point filter on the image given in Figure 1 and **analyze** the effect of the Mid-Point filter on a given image.

Question IV: Use the following kernel shown in (a) to perform the convolution process on the shaded pixels in the 5x5 image patch shown in (b) **CLO - 3** [2+5+3]

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

a) Kernel

30	40	50	70	90
40	50	80	60	100
35	255	70	0	120
30	45	80	100	130
40	50	90	125	140

b. Image patch

a) What type of filter does this kernel represent?
b) What is the primary purpose of this kernel in Image Processing?
c) Write down the filtered output.

Question V A 3-bit 5x6 image is reshaped into a row vector. The intensities and their values are given below. Apply 1st and 2nd order derivatives on it. Fill in the cells given below **CLO - 4** [5+5]