



EXAM: FINAL-TERM

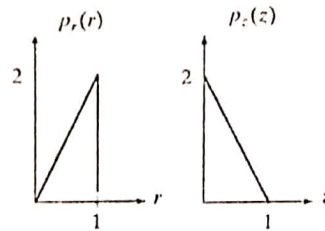
SUBJECT: CSE-408 DIGITAL IMAGE PROCESSING

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]**

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

Figure 1. Intensity values of the input image

- What is the bit depth of the input image?
- 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.
- 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.

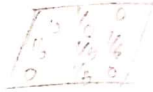
- d) Apply the spatial domain Mid-Point filter on the image given in Figure 1 and analyze the effect of the Mid-Point filter on a given image.

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 | 88 | 120 |
| 30 | 43 | 80 | 100 | 130 |
| 40 | 50 | 90 | 125 | 140 |

b. Image patch

- What type of filter does this kernel represent?
- What is the primary purpose of this kernel in Image Processing?
- 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]

