

# CSE428: Image Processing

Semester: Spring 24

Section: 2

Quiz: 1

Time: 60 mins

Name:	ID:	Section:
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## Question 1

Consider an input image with pixel intensities given in the following table:

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

Image you are given a  $3 \times 3$  kernel with the blurring function defined as follows:

$$\text{Blur}(x, y) = \begin{cases} 2^{-(x+y)} & ; x, y \geq 0 \\ 2^{(x+y)} & ; x, y < 0 \end{cases}$$

- Determine minimum padding width so that after convolution (stride = 1) with the above kernel, the height and width of the output image remains the same as the input image. [2 marks]
- Determine the padded image with padding width two times as the minimum padding width calculated in **a** using
  - Mirror padding [4 marks]
  - Edge padding [4 marks]
- Calculate the coefficients of the  $3 \times 3$  blurring kernel. [6 marks]
- Determine the blurred output image using minimum padding width and zero padding (stride = 1). [10 marks]
- Calculate the unsharp mask using the input image and the blurred image determined in **d**. [4 marks]
- Determine the final output image after performing high boost filtering ( $k = 3$ ). [5 marks]

## Question 2

Consider the following cumulative distribution function values for image A and image B respectively.

Intensity	cdf
0	0.17
1	0.33
2	0.22
3	0.28

image A

Intensity	cdf
0	0.36
1	0.26
2	0.15
3	0.23

image B

- Determine the mapping table for matching the histogram of image A with that of image B. [4 marks]
- Draw the mapping function with the intensities of image B on the y-axis and the intensities of image A on the x-axis. [2 marks]

## Question 3

Consider the following geometric transformation function:

$$x' = 4\left(\frac{1}{\sqrt{2}}x - \frac{1}{\sqrt{2}}y\right)$$

$$y' = 5\left(\frac{1}{\sqrt{2}}x + \frac{1}{\sqrt{2}}y\right)$$

$$z' = z$$

- Determine the matrix representation of the above transformation function. [2 marks]
- The above transformation function is the final product of rotation and scaling. Determine the coefficients of the rotation and scaling transformation matrices. What is the angle of rotation? [5 marks + 2 marks]

**Hint:**

Scaling function

$$\begin{pmatrix} a & 0 & 0 \\ 0 & b & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

Rotation function

$$\begin{pmatrix} \cos\theta & -\sin\theta & 0 \\ \sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{pmatrix}$$