

# ELIC 629: Digital Image Processing

## Lab 8 Assignment / Exam Review

**Due Date: April 25 before the start of the lecture (no late assignments accepted after the last lecture)**

1. Perform a 2D correlation between the pixels at spatial locations (4, 4), (4, 5), (3, 3), (5, 4) and (3,4) of Image A and the **AVERAGING** mask (template, kernel) B as given below. Show all steps for each calculation. Rows and columns begin at index 0. State all (if any) assumptions.

A =

10	10	10	10	10	10	10	10
10	128	128	128	128	128	128	10
10	128	128	128	128	128	128	10
10	128	128	120	120	128	128	10
10	128	120	128	90	90	90	10
10	128	128	128	90	90	90	10
10	120	120	128	90	90	90	10
10	10	10	10	10	10	10	10

B =

0	0	1	0	0
0	1	2	1	0
1	2	16	2	1
0	1	2	1	0
0	0	1	0	0

2. An 8 x 8 image  $f[x, y]$  has gray levels given by the following equation:

**$f[x, y] = |x - y|$ ; where,  $x, y = 0, 1, 2, 3, 4, 5, 6, 7$**

Draw this image (in matrix form, e.g., show each pixel intensity). Find the output image obtained by applying a 3 x 3 median filter on the image  $f[x, y]$ . Note: the border pixels remain unchanged.

3. Consider the 16 x 16 image shown below. The numbers indicate the intensity (gray level) of that “ring” in the image. For example, the outer ring (border), has an intensity level of 0, the next ring, intensity of 1 and so on.

- A 3 x 3 median filter operates on the image. Calculate the values of the central 4 x 4 pixels in the output image.
- Sketch the pixel intensities (in matrix format) and histogram of the image obtained by adding (pixel by pixel) the original image and its **contrast-reversed** image. The contrast reversed image is one which the intensity of each pixel (denoted by  $I$ ) is replaced by  $\max_I - I$  where  $\max_I$  is equal to 7.

[illegible]