ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
Department of Computer Science and Engineering (CSE)

MID SEMESTER EXAMINATION **SUMMER SEMESTER, 2018-2019**

DURATION: 1 Hour 30 Minutes **FULL MARKS: 75**

CSE 6265: Advanced Digital Image Processing

Programmable calculators are not allowed. Do not write anything on the question paper.

There are **3 (three)** questions. Answer **all** of them.

Figures in the right margin indicate marks.

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1. a) What are the illumination and reflectance components of an image formation model? How is the intensity level defined from this model? 7

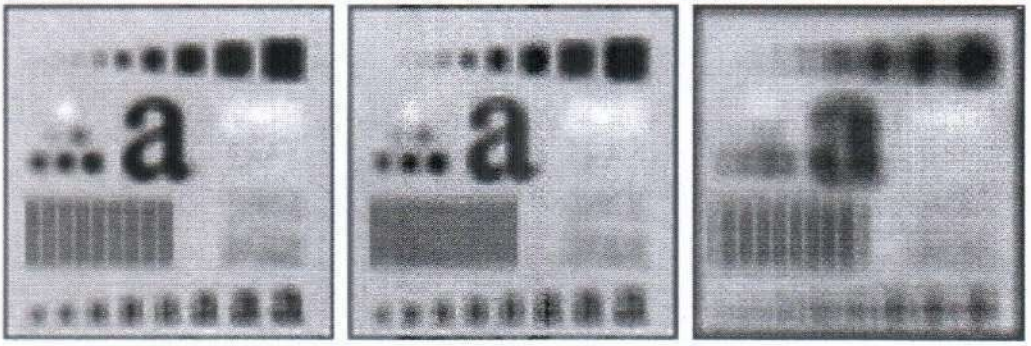
   b) When is an operation H called linear? Show that the absolute operator is not linear. 6

   c) Image subtraction is used often in industrial applications for detecting missing components in product assembly. The approach is to store a "golden" image that corresponds to a correct assembly; this image is then subtracted from incoming images of the same product. Ideally, the differences would be zero if the new products are assembled correctly. Difference images for products with missing components would be nonzero in the area where they differ from the golden image. What conditions do you think have to be met in practice for this method to work? 6

   d) After separately applying channel-wise Histogram Equalization on a RGB color image, what will be average intensity of the equalized output? Justify your answer. 6

2. a) Is Median filter a smoothing or sharpening filter? Explain your choice. 6

   b) The three images shown in Figure 1 were blurred using square averaging masks of sizes n = 23, 25, and 45, respectively. As shown below, the vertical bars on the left lower part of Figure 1.(a) and 1.(c) are blurred, but a clear separation exists between them. However, the bars have merged in Figure 1.(b), in spite of the fact that the mask that produced this image is significantly smaller than the mask that produced Figure 1.(c). Explain the reason for this. 12



(a) **(b)** **(c)**

Figure 1.

   c) Design a single filter which can perform high-boost filtering with a single pass of convolution operation. 7

3. a) How does Homomorphic filter act as both low-pass and high-pass filter? 7

   b) Why does Ringing effects appear when Ideal filters are applied? 5

   c) The two Fourier spectra shown in Figure 2 are of the same image. The spectrum on the left corresponds to the original image, and the spectrum on the right was obtained after the image was padded with zeros. Explain the significant increase or decrease in signal strength along the vertical and horizontal axes of the spectrum shown on the right. Also explain 8

whether there will be increase of decrease of the spectrum value in the DC component for the padded image.

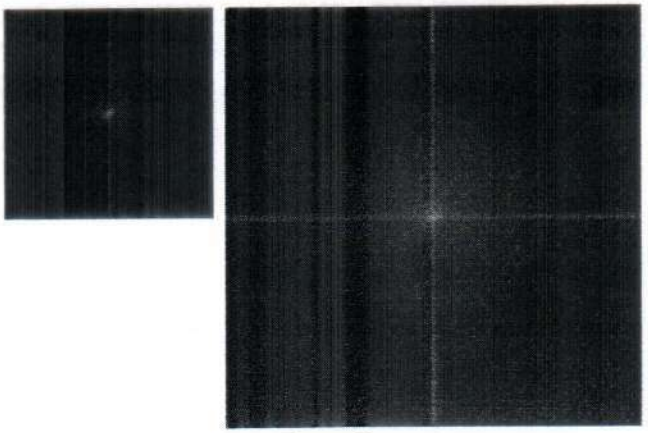


Figure 2.

d) Among the Butterworth and Gaussian filters, which one do you prefer more? Justify your choice. 5