UNIVERSITY OF CALGARY
DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
SCHULICH SCHOOL OF ENGINEERING
ENEL697 DIGITAL IMAGE PROCESSING
TEST NO. 1
WINTER 2008 SESSION
10 March 2008

Instructions:

1. This is a closed-book, closed-notes test.

2. The use of only a nonprogrammable calculator with no text storage facilities is permitted.

3. Answer all five questions.

4. Total marks = 20.

5. Time permitted = 90 minutes.

Question 1: Draw sketches of two images to illustrate the notion of simultaneous contrast in images, including positive and negative contrast.
    Give an equation defining a measure of contrast and explain its significance.

(4 marks)

Question 2: Using the discrete or the continuous Fourier transform, derive the transfer function that characterizes a system whose output $g(x, y)$ is related to the input image $f(x, y)$ as

$$g(x, y) = \alpha \, f(x - x_o, y - y_o).$$

Show and explain all steps.
    Explain the effect of the system in the spatial and frequency domains.

(4 marks)

Question 3: Give the definitions of the ideal lowpass filter and the Butterworth lowpass filter in terms of their transfer functions.
    Explain the significant differences between the two, and indicate their relative advantages and disadvantages.

(4 marks)

Question 4: Explain the method of synchronized or multiframe averaging of images to reduce noise.

State the assumptions, conditions, and requirements for the method to succeed.

(4 marks)

Question 5: Explain the general approach of filtering images based on order statistics.
Give a step-by-step algorithm for the min/max filter.
What type of noise can this filter remove? Explain your answer.

(4 marks)

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