UNIVERSITY OF CALGARY
DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
SCHULICH SCHOOL OF ENGINEERING
ENEL697 DIGITAL IMAGE PROCESSING
TEST NO. 2
WINTER 2007 SESSION
11 April 2007

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: Describe the application of the 3×3 mean and median filters in an algorithmic format.

Explain the characteristics of the two filters and the expected results.

Would you be able to compare the characteristics of the two filters in the frequency (Fourier) domain? Explain.

(4 marks)

Question 2: Explain the general notion of homomorphic filtering of images combined by multiplication. Give the equations and the procedure to convert a multiplicative combination of two images to a linear combination of the related Fourier spectra.

Explain how the method may be used to enhance the contrast in an image with variable intensity or an image with shadows. Describe any assumptions made and their effects.

(4 marks)

Question 3: Explain the formulation of the Hough transform for the detection of circles. Describe the relationships between the image space and the Hough parameter space.

Give a step-by-step algorithm to detect circles in an image, given that the radii of the circles of interest in the image are limited to the range of $5 - 10$ mm. What additional parameters regarding the image are required to address this problem? State any assumptions made.

(6 marks)

Question 4: Give the 3×3 masks for the Prewitt operators for the x and y directions.
Describe the effect of each mask.
Explain how the two masks may be combined to detect edges in all directions.
Explain how the angle (orientation) of an edge may be obtained by using the Prewitt operators.

(3 marks)

Question 5: What is gamma correction? Provide the related formula or transformation and explain its application to an image. State any assumptions made or preprocessing requirements.

(3 marks)

******