UNIVERSITY OF CALGARY
SCHULICH SCHOOL OF ENGINEERING
DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
ENEL 697 DIGITAL IMAGE PROCESSING
FALL 2014 SESSION, TEST NO. 2
2 December 2014

Instructions:

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

2. Calculators and other electronic devices are not permitted.

3. Answer all five questions.

4. Total marks = 20.

5. Time permitted = 75 minutes.

Question 1: Write a mathematical expression to define the histogram equalization procedure for a digital image with discrete gray levels. Explain the how quantization affects the results of the procedure. (4 marks)

Question 2: Write a mathematical expression to define the Butterworth highpass filter. Sketch a one-dimensional section of the filter's transfer function. Explain the nature and effects of the parameters of the filter on its transfer function and on the resulting image.
Explain how the highpass filter may be modified to perform high-frequency emphasis. Explain the differences between the outputs of the two filters. (4 marks)

Question 3: A digital image is processed by applying the 3×3 Laplacian mask and the 3×3 mean filter in series. Derive the impulse response of the combined operation.
Does the sequence of application of the two filters matter? Explain.
Explain the effects of each filter and those of the combined operation. Indicate a potential application of the combined operation. (4 marks)

Question 4: Starting from the basic definition of the first-order derivative or difference operation for a digital image, explain how the 3×3 Prewitt operators are obtained.
Explain the effects and applications of the Prewitt operators. (4 marks)

Question 5: Give a step-by-step algorithm for any one method of region growing.
Explain the effects of the parameters of your method on the results. (4 marks)

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