McMaster University
Department of Electrical and Computer Engineering
Image Processing
Make-up Midterm Exam, March 15, 2006

Exam duration: 60 minutes

Name: Student Number:

Problem 1 (5 points). What happens to histogram if the least significant bit of every pixel is set to 0?

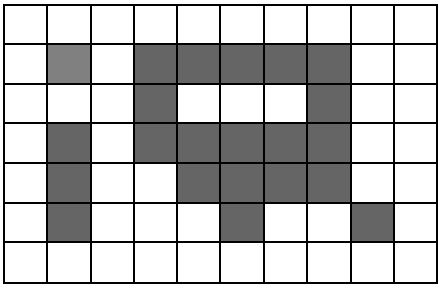
Problem 2 (20 points). What is the best filter for pepper and salt noises in smooth areas of an image? Design a filter for removing pepper and salt noises without blurring the edges.

Problem 3 (20 points). A medical image modality can generate images of 10 bit depth (1024 levels of gray). But a physician has a conventional monitor of only 8 bit depth (256 levels of gray). Can he see all the potential details at one time? If not, design an algorithm to help the physician to see better in a gray scale range $[a,b]$, where $b-a < 256$.

Problem 4 (20 points). What is the Hough transform for detecting circles or circular arcs of a known radius r. What is the number of dimensions of the parametric space?

Problem 5 (15 points). Consider the binary image below. Show the results of 3x3 median filtering if the following masks are used. (a "0" in a mask position means that the corresponding pixel is not used for median calculation).

(a) $\begin{bmatrix} 0 & 1 & 0 \\ 1 & 1 & 1 \\ 0 & 1 & 0 \end{bmatrix}$ (b) $\begin{bmatrix} 0 & 1 & 0 \\ 0 & 1 & 0 \\ 0 & 1 & 0 \end{bmatrix}$ (c) $\begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}$



Problem 6 (20 points). We want to fill all the small cracks and holes in a segment but preserve big holes that can completely contain a circle of radius greater than n. Design an algorithm for the task using mathematical morphological operators, and specify the structure element.