CS 675 – Computer Vision – Fall 2007

Instructor: Marc Pomplun

Practice Midterm Exam

Duration: 75 minutes

Notice that in the actual midterm exam, no calculators, no books, and no notes are allowed.

Question 1: ____ out of ____ points

Question 2: ____ out of ____ points

Question 3: ____ out of ____ points

Question 4: ____ out of ____ points

Question 5: ____ out of ____ points

Question 6: ____ out of ____ points

Total Score:

Grade:

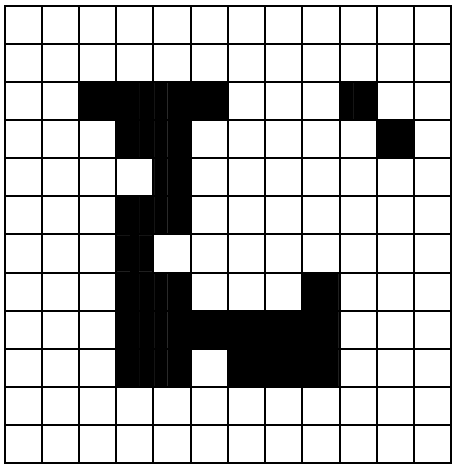
Question 1: True or False?

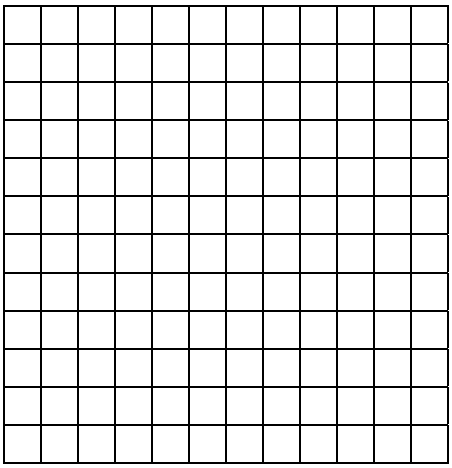
Tell whether each of the following statements is true or false by checking the appropriate box. Do not check any box if you do not know the right answer, because you will lose points for incorrect answers.

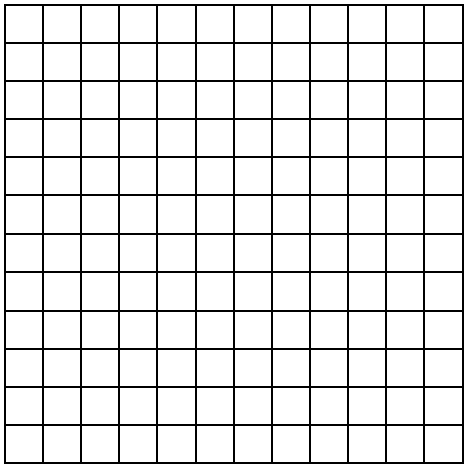
Statement	True	False
a) Convolution is usually a point-level operation.	[ ]	[ ]
b) We can use thresholding to convert grayscale images into binary images.	[ ]	[ ]
c) The horizontal and vertical projections of a binary image always contain the same number of pixels.	[ ]	[ ]
d) In binary images, every 8-path is also a 4-path.	[ ]	[ ]
e) The Sobel convolution filter is actually a pair of 3x3 filters.	[ ]	[ ]
f) Saturation is a measure of the overall amount of light within the visible spectrum.	[ ]	[ ]
g) A CRT monitor using three suitable types of phosphor (e.g., red, green, and blue) can display all visible colors.	[ ]	[ ]
h) Laplacian filters compute the second derivative of the intensity function, which can be used to detect edges.	[ ]	[ ]
i) Edge relaxation is an iterative process used for determining contours in edge images.	[ ]	[ ]
j) High-pass filtering of an image has a similar effect as a Gaussian Smoothing filter.	[ ]	[ ]

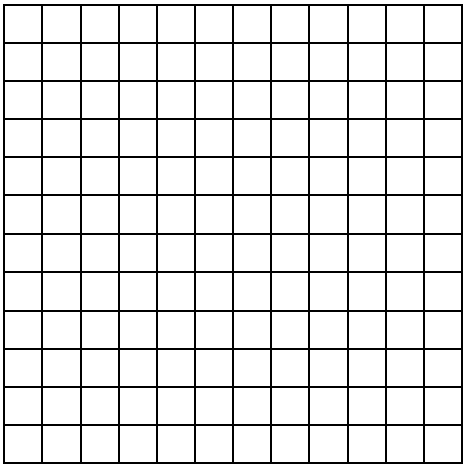
Question 2: Inhale and Exhale

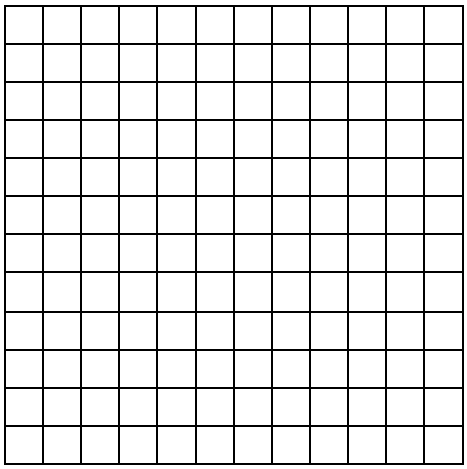
On the following page you see a noisy binary image of the character “L”. Show how to use a sequence of shrink and expand operations in order to remove the noise without too much damage to the character. Use as many of the empty images as you need, mark the order in which they are to be read, and what operations are being performed.

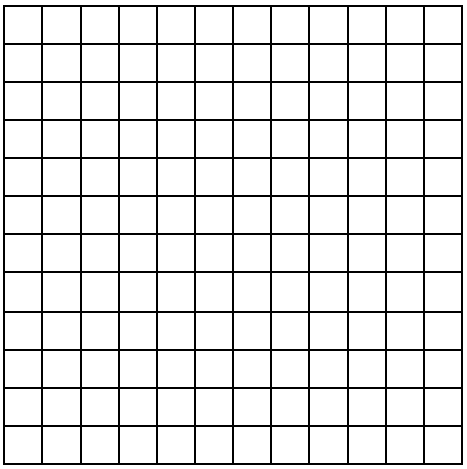






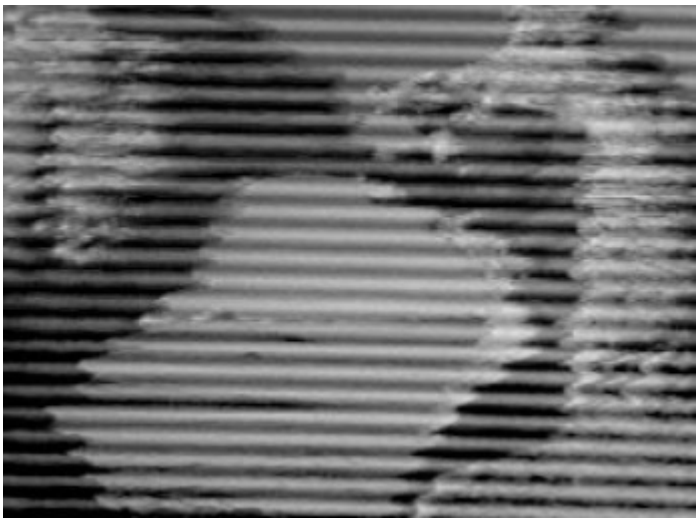






Question 3: Saving Your TV Night

Just imagine that you want to spend a quiet night in front of your TV watching documentaries about rock structures in southern France or similar topics. However, when you turn on the TV, your excitement turns into sadness: There is some interference that adds a lot of periodic noise to your TV signal (see the image below).

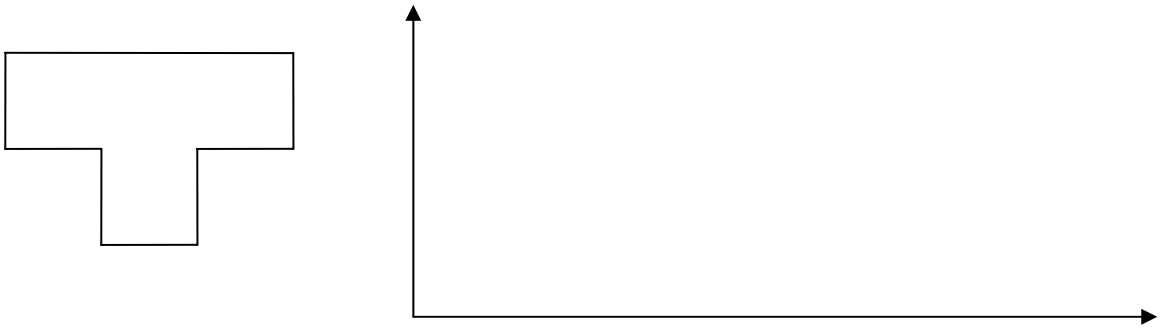


In order to save your long-awaited TV night, you need to come up with a way to filter out this unwanted noise so that you can enjoy clear pictures. Fortunately, your modern TV allows you to perform any kind of computation on the incoming images before displaying them.

Describe in detail the steps that you will take to get rid of the noise. Your description should contain a sketch of a Fourier-transformed image.

Question 4: Signature, Please!

Use the diagram on the right to sketch the signature of the contour on the left. It does not have to be perfectly scaled.



Question 5: The Canny Detector

List the sequence of operations performed for Canny edge detection.

Question 6 (Bonus Question): Characters and Their Recognition

Let us assume that you want to build a system that can identify hand-written characters. Before you build the system, you find out that pages of hand-written text usually consist of about 8 to 10 percent of dark surface (i.e., covered by ink), and the rest is plain white paper. Explain exactly how you can make use of this knowledge to build a better system. Feel free to draw any kinds of diagrams.