Math 155, Spring, Vese

Final exam: Friday, March 16, 1-2pm (during the last lecture).
(There will be no final exam during the week of finals.)
Office hours: Monday and Wednesday at 2pm (after lecture); an additional office hour on Thursday will be determined later.

Sections covered for the final exam (3rd edition):
Chapter 4: Sections 4.2 (except 4.2.2), 4.4, 4.5 (except 4.5.4), 4.6, 4.7, 4.8, 4.9, 4.10, 4.11.
Chapter 5: Sections 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8, 5.9, 5.10, 5.11 (except 5.11.6).
Chapter 10: Sections 10.1, 10.2. (parts that we will cover in class on Monday and Wednesday).

Sample theory questions (but not limited to this list):
• What is the definition of
- the arithmetic mean filter ?
- the geometric mean filter ?
- the harmonic mean filter ?
- the contraharmonic mean filter ?
- the median filter ?
- the max and mean filters ?
- the midpoint filter ?
- the alpha-trimmed mean filter ?

• Give the main steps of an adaptive, local noise reduction filter ? (explain).

• What is the goal of a bandreject filter for periodic noise reduction ? Give an example. What is the goal of a bandpass filter ? Give an example.

• Explain the optimum notch filtering technique.

• Give the definition of a unite impulse, located at coordinates (x, y).

• Show that, if $g(x, y) = H[f(x, y)]$, with H linear, position invariant, and extending the additivity property to integrals, then H is given by a convolution with the function f.

• Show in continuous variables that the Fourier transform of

$$f(x, y)e^{2\pi i(u_0x+v_0y)}$$

is given by $F(u-u_0, v-v_0)$, where $F(u, v)$ is the Fourier transform of $f(x, y)$.

• Consider the motion degradation function

$$g(x, y) = \int_0^T f[x - x_0(t), y - y_0(t)]dt.$$

Find $H(u, v)$ such that $G(u, v) = H(u, v)F(u, v)$, where G and F are the Fourier transforms of g, f, respectively (show the details of the derivation).

• Give an example of restoration filter (in the presence of blur)

• Give an example of mask w that can be used to detect

- a light point on a constant dark background (explain)
- a light vertical line on a constant dark background (explain)

• Give the main steps of the zero-crossings of the Laplacian method for edge detection.

• Recall the definition in continuous variables of the convolution

$$f(x, y) * g(x, y).$$

• Show that $\nabla^2(f * g) = f * (\nabla^2 g)$ at (x, y), where ∇^2 denotes the Laplace operator in (x, y).

See additional problems and exercises from the homework and textbook.