CSE166 – Image Processing – Midterm

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`http://www-cse.ucsd.edu/~sjb/classes/fa02/cse166`

3:00-3:50pm Mon. Nov. 4, 2002.

On this exam you are allowed to use a calculator and one 8.5" by 11" sheet of notes. The total number of points possible is 100. In order to get full credit you must **show all your work**. Good luck!

1. (25 pts) Consider the system $g(x) = f(x-2) - 2f(x-5)$.
   (a) Is this system linear? If it is linear, what is the impulse response?
   (b) Is this system shift invariant?
2. (25 pts) You are given an image `f` of size 256×256 and a kernel `h` of size 15×15.
   (a) What is the size of `g=conv2(f,h)`?
   (b) Explain the steps necessary to compute `g` using frequency domain filtering.
3. (25 pts) Consider the kernel $h(x,y) = \nabla^2 g(x,y)$, where $g(x,y) = e^{-(x^2+y^2)/2\sigma^2}$.
   (a) What is the name of this kernel?
   (b) Which kind of filter is $h(x,y)$: lowpass, bandpass, or highpass?
   (c) What is the average value of any image convolved with $h(x,y)$?
4. (25 pts) Let `W=dftmtx(4)`.
   (a) Explain in words what each row of `W` represents.
   (b) Write down the result of the operation `(1/4)*W*W'`.