

**Homework #2**

Due Date: Jan. 30, 2003

1. [20] Carry out the 2D convolution of  $f(n,m) = \begin{bmatrix} 1 & -2 & 1 \\ -2 & 4 & -2 \\ 1 & -2 & 1 \end{bmatrix}$  with  $h(n,m) = u(n)u(m)$ ,

where  $u(n) = \begin{cases} 1 & n \geq 0 \\ 0 & \text{otherwise} \end{cases}$ , the 1D discrete step function. Perform this convolution five

different ways and compare the results. Create images showing the resultant convolution and differences between part a. and the other parts. Explain any differences.

- a. Manually – derive an expression for the values of the convolution.
  - b. Using Matlab `conv2` using a 64x64 support region.
  - c. Using Matlab `conv` in x and y directions.
  - d. Using Matlab using `fft2` and `ifft2` using a 64x64 support region.
  - e. Using Matlab `fft` and `ifft` in x and y directions.
2. [10] Lim, Problem 1.19
3. [10] Lim, Problem 1.22
4. [40] Lim, Problem 1.23
5. [60] Lim, Problem 1.35