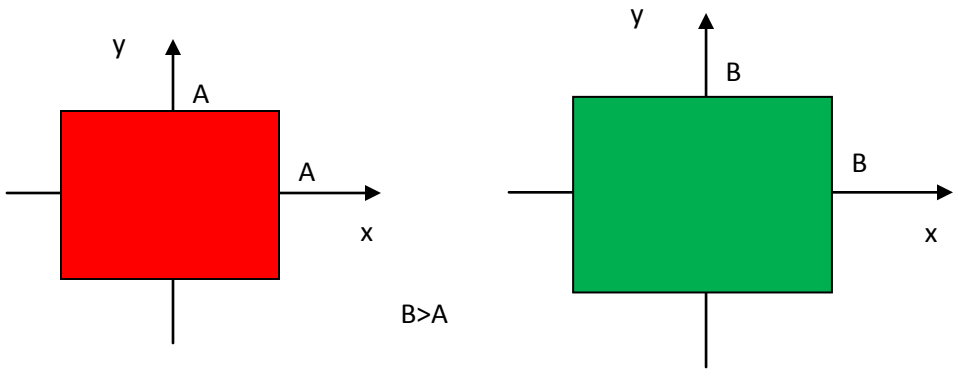
Catholic University of America

ENGR-652: Digital Image Processing- Due OCT 10-2014

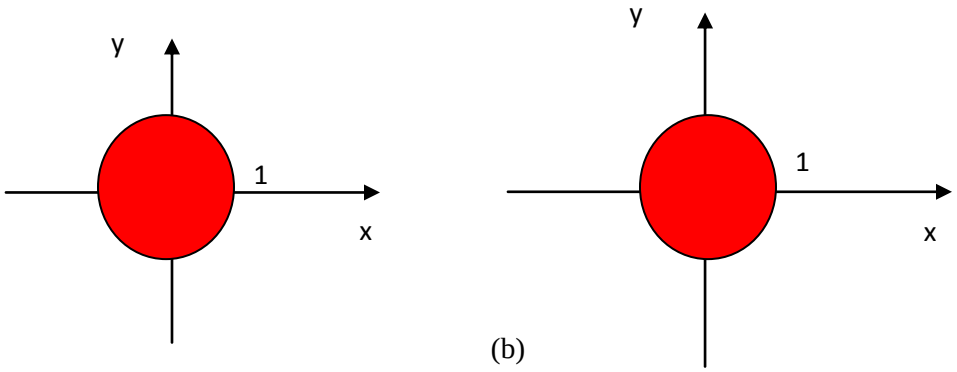
Assignment 3:

1. Use Matlab to plot samples of sinc(x,y) as a mesh plot. Use the image () command to view this function as a gray scale image.

2. Convolve the two pairs of 2D signals shown below. Find an analytic expression for each output and sketch them using MATLAB.
   Hint: You might want to use for the circular case the gencircsym function provided on blackboard.



(a)



(b)

3. For each of the following 2D periodic signals, find by hand and sketch the spatial frequency spectrum F(u,v):
   (a) $f(x,y)=\cos(\pi x)$
   (b) $f(x,y)=4\cos\{2\pi[0.5(x-1)+2(y-1)]\}$
   (c) $f(x,y)=rect(x/2)*comb_4(x)\delta(y)$
   (d) $f(x,y)=rect(x/4-y\sqrt{3}/4)*comb_8(x)\delta(y)$
   (e) $f(x,y)=rect(x,y)*comb_{2,2}(x,y)$

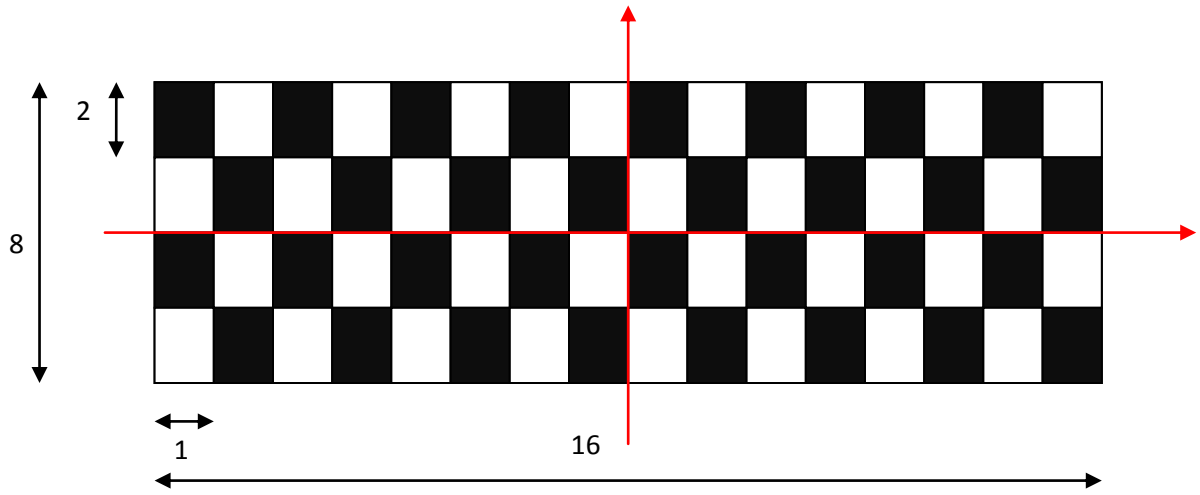
4. Consider a 2D periodic signal such that $g(x,y)=g(x+kX,y+lY)$, where *k, l* are integers and X, Y are the horizontal and vertical periods respectively. Show that this signal can be expressed as a 2D Fourier series as Follows:

$$g(x,y)=\frac{1}{XY}\sum_k\sum_l G_{k,l}e^{j2\pi(kx/X+ly/Y)}$$

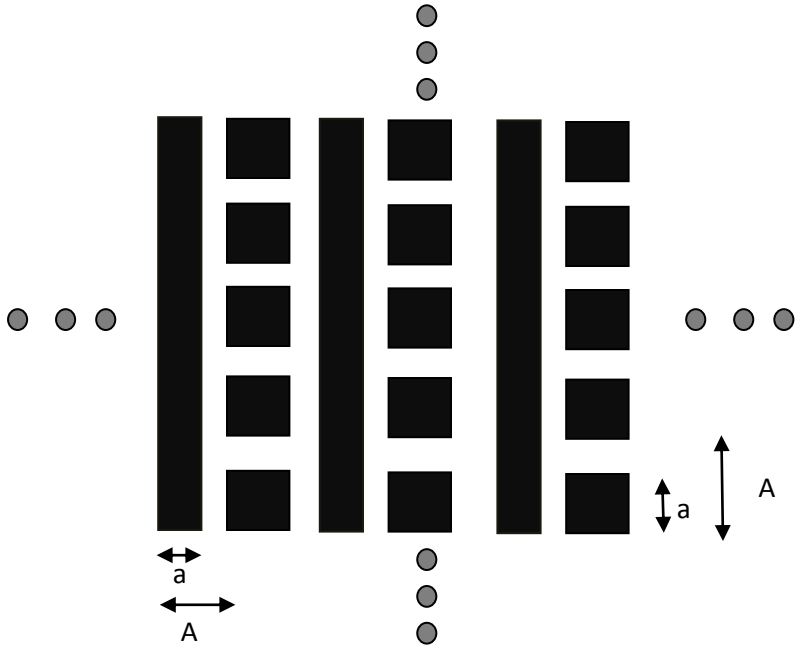
   Find an expression for $G_{k,l}$.

5. For the following periodic signals, find the spatial frequency spectrum by hand or matlab. (The shaded areas are 1 and white are 0).

(a)



(b)



(c)