1) (*Do not use Matlab for this question*.) Consider the 2 dimensional, smoothing/low-pass, convolutive system (filter) discussed in class, $y[m,n] = \dfrac{x[m,n] + x[m,n-1] + x[m-1,n] + x[m-1,n-1]}{4}$.

   a) Sketch this input image: $x[m,n] = \delta[m+1]\delta[n+2] + \delta[m]\delta[n+1] + \delta[m-1]\delta[n] + \delta[m-2]\delta[n-1]$ and explain why this equation gives your sketched image.

   b) Sketch the output image $y[m,n]$ for this input.

   c) Calculate the 2 dimensional impulse response $h[m,n]$. Note that the 2 dimensional impulse is given by $\delta[m,n] = \delta[m]\delta[n]$.

2) After the Batschelet reading of chapter 5, section 5.9 (*Print out the plots described below to turn in*):

   a) Use Matlab to plot the *continuous* function $x_1(t) = \frac{1}{2} + \frac{1}{2}\sin(2\pi t)$ for three periods (what *is* its period?). Because it is continuous, please use the `plot()` function instead of `bar()`or `stem()`, and you should use a lot of points (e.g. hundreds) for the plot. (If you have a lot of trouble plotting three periods, I'll settle for just one period.)

   b) Repeat (a) for $x_2(t) = \frac{1}{2} + \frac{1}{2}\sin(2\pi t) + \frac{1}{2}\frac{1}{3}\sin(2\pi 3t)$

   c) Repeat (a) for $x_3(t) = \frac{1}{2} + \frac{1}{2}\sin(2\pi t) + \frac{1}{2}\frac{1}{3}\sin(2\pi 3t) + \frac{1}{2}\frac{1}{5}\sin(2\pi 5t)$

   d) Infer from this pattern what $x_5(t)$ should be, and then plot it as well.

   e) These plots should increasingly look like a ripply approximation to a repeating "square wave" (a repeating signal equal to one, for the first half of its period, and zero for the second half). In a new figure, redo the previous plot, and overlay a plot of the repeating square wave in a different color. To create the repeating square wave, feel free to use Matlab's `ones()` and `zeros()` functions. To overlay the plot, feel free to use the `hold on` and `hold off` commands.

3) After the Batschelet reading of chapter 6, section 6.6: Two acoustic tones with frequency 1000 Hz are played with loudness L_1 = 30 dB and L_2 = 45 dB respectively. What can you say about the ratio of their physical intensities I_1 and I_2? Explain why.