ASSIGNED: Mar. 26, 2015. **READ:** Sects. 10.1-10.2. Review 7.4.
DUE DATE: Apr. 02, 2015. **TOPICS:** Data windows.

Please box your answers. Show your work. Turn in all Matlab plots and Matlab code.

[40] 1. We observe x[n]=sin(0.3πn)+sin(0.4πn) for $1 \le n \le L$ for some L.
Compute its spectrum: `plot(abs(fft(sin(0.3*pi*[1:L])+sin(0.4*pi*[1:L]),N)))`.
The goal of this problem is to determine how varying L and N affect resolution.

[10] (a) Find the smallest value of L that resolves the two peaks. Use N=256.
"Resolves" means there is a dip (not to zero) between two peaks.
Turn in the plot: Using largest L that doesn't resolve the peaks.
Turn in the plot: Using smallest L that does resolve the peaks.

[05] (b) Use the formula from lecture to estimate L. Compare with (a).
[10] (c) Double N to 512 and repeat (a). Turn in the two plots as in (a).
[10] (d) Use a Hamming window and repeat (a). Turn in the two plots as in (a).
`plot(abs(fft((sin(0.3*pi*[1:L])+sin(0.4*pi*[1:L])).*hamming(L)',N)))`.
[05] (e) Summarize your results: How do varying L,N and a window affect resolution?

Put the six plots for this problem in a (3×2) array using `subplot`.

[30] 2. Download `p8.mat`. In Matlab, type >>`load p8` to get sampled signals `X1 & X2`.

`X1` is the first 75 samples of `X1` from `p7.mat` in problem set #7.
[05] (a) Plot its spectrum using `plot(abs(fft(X1,256)))`. Can you interpret it?
[05] (b) Use a Hamming window: `plot(abs(fft(X1.*hamming(75)',256)))`. Better?
[20] (c) Estimate frequencies of the four sinusoids ([5] each) from peak locations in (b).
Compare to your results from #3 of problem set #7. Turn in the two plots.

[30] 3. Download `p8.mat`. In Matlab, type >>`load p8` to get sampled signals `X1 & X2`.

[05] (a) Listen *carefully* to `X2` using `sound(X2,8192)`. Describe it.
[10] (b) *Segment* (chop up) `X2` into 26 segments of length 3000 each.
Examine spectra of each segment: `imagesc(abs(fft(reshape(X2',3000,26))))`.
[05] (c) Describe `X2` as the sum of two songs. HINT: One rocks, one stinks.
[10] (d) Eliminate the one that stinks by setting some of `fft(X2)` to zero.
This gives `Y`. Prove you did it: `imagesc(abs(fft(reshape(Y',3000,26))))`.
Turn in images from (b) and (d). Put 4 plots from #2 and #3 on one page.

"Diplomacy is the art of saying 'nice doggie' until you can find a stick."