BIOL 708L/NACS 728B Homework #6
Fall 2011

Do not use Matlab for these problems.

1) Consider the convolutive system/filter $y[n] = x[n] + x[n-2]$.
   a) Calculate the system's impulse response $h[n]$, and sketch it (e.g. with a bar plot) on paper.
   b) Calculate the systems transfer function $H(f)$ analytically (i.e. without a computer).
   c) Plot $|H(f)|$ from $f = 0$ to $\frac{1}{2}$ on paper.
   d) Plot $\angle H(f)$ from $f = 0$ to $\frac{1}{2}$ on paper.
   e) Describe in words the behavior of the system at low frequencies ($f \approx 0$), high frequencies ($f \approx \frac{1}{2}$), and middle frequencies.
   f) Is this filter broadly tuned, or narrowly tuned, compared to related filters seen in class?
   g) What is the overall gain of this filter?

2) Consider the convolutive system/filter $y[n] = \frac{1}{8}x[n] + \frac{3}{8}x[n-1] + \frac{3}{8}x[n-2] + \frac{1}{8}x[n-3]$.
   a) Calculate the system's impulse response $h[n]$, and sketch it (e.g. with a bar plot) on paper.
   b) Calculate the systems transfer function $H(f)$ analytically (i.e. without a computer). Hint: combine terms symmetrically around the middle.
   c) Plot $|H(f)|$ from $f = 0$ to $\frac{1}{2}$ on paper.
   d) Plot $\angle H(f)$ from $f = 0$ to $\frac{1}{2}$ on paper.
   e) Describe in words the behavior of the system at low frequencies ($f \approx 0$), high frequencies ($f \approx \frac{1}{2}$), and middle frequencies.
   f) Is this filter broadly tuned, or narrowly tuned, compared to related filters seen in class?
   g) What is the overall gain of this filter?
   h) Which other filters, seen in class, behave qualitatively similar to this one? Can you *quantitatively* express this filter in terms of any of them?