BIOL 708L/NACS 728B Homework #7
Fall 2011

Do not use Matlab for these problems.

1) Consider the filter defined by its transfer function $H(f) = \frac{1}{2} e^{-j2\pi f} \left(1 - \cos(2\pi f)\right)$
   a) Plot $|H(f)|$ from $f = 0$ to $\frac{1}{2}$ on paper.
   b) Plot $\angle H(f)$ from $f = 0$ to $\frac{1}{2}$ on paper.
   c) Describe in words the behavior of the system at low frequencies ($f \approx 0$), high frequencies ($f \approx \frac{1}{2}$), and middle frequencies.
   d) Is this filter broadly tuned, or narrowly tuned, compared to related filters seen in class?
   e) What is the overall gain of this filter?
   f) What is the impulse response $h[n]$?
   g) Is this filter causal? Why or why not?

2) Consider the filter defined by its transfer function $H(f) = \frac{1}{2}\left(1 - \cos(2\pi f)\right)$
   a) Plot $|H(f)|$ from $f = 0$ to $\frac{1}{2}$ on paper.
   b) Plot $\angle H(f)$ from $f = 0$ to $\frac{1}{2}$ on paper.
   c) Describe in words the behavior of the system at low frequencies ($f \approx 0$), high frequencies ($f \approx \frac{1}{2}$), and middle frequencies.
   d) Is this filter broadly tuned, or narrowly tuned, compared to related filters seen in class?
   e) What is the overall gain of this filter?
   f) What is the impulse response $h[n]$?
   g) Is this filter causal? Why or why not?

3) Consider the filter defined by its transfer function $H(f) = j \sin(2\pi f)$
   a) Plot $|H(f)|$ from $f = 0$ to $\frac{1}{2}$ on paper.
   b) Plot $\angle H(f)$ from $f = 0$ to $\frac{1}{2}$ on paper. Don't forget the phase contribution from j.
   c) Describe in words the behavior of the system at low frequencies ($f \approx 0$), high frequencies ($f \approx \frac{1}{2}$), and middle frequencies.
   d) Is this filter broadly tuned, or narrowly tuned, compared to related filters seen in class?
   e) What is the overall gain of this filter?
   f) What is the impulse response $h[n]$?
   g) Is this filter causal? Why or why not?