Homework #13, EECS 206, W03. Due **Never**, by 11:30AM

Notes

- Review the HW policies on HW1!
- This HW will not be graded due to the logistical problems of getting HW scores in time for submitting final grades. However, the final exam will certainly have problems related to this HW.
- The final exam will be cumulative, but will emphasize spectra, sampling, and filtering.
- Reading: Text Ch. 8.
- Relevant practice problems on the DSP CD: 8.1-8.11, 8.15-8.23, 8.57-8.59. This is a partial list; feel free to explore!

Skill Problems

1. [10] Text 8.5. Concept(s): ***($H(z)$, poles, zeros, $h[n]$ from IIR diffeq)***
2. [20] Text 8.6. Concept(s): ***(all pass filter)***
3. [15] Text 8.11. Concept(s): ***(inverse z-transforms)***
4. [20] Text 8.13. Concept(s): ***(pz plots vs other characterizations)***
5. [10] Text 8.16. Concept(s): ***(pz plots to frequency response)***
6. [20] Text 8.20. Concept(s): ***(system function to others characterizations)***

Mastery Problems

7. [10] Repeat problem 7 on the previous HW, except
   - let the input signal be a sinusoid: $x(t) = \cos(2\pi f_0 t)$ with $f_0 = 250$Hz,
   - replace the ideal C-D converter with an A/D converter that quantizes signal values in the range $x_{\min} = -8/7 \leq x \leq x_{\max} = 8/7$ using 3 bits, and
   - change the the impulse response to $h[n] = (1/3)^n u[n]$.
8. [20] Find a causal IIR filter such that the magnitude of the response to a discrete-time sinusoid with frequency $\pi/40$ is at least 30 times larger than the magnitude of the response to any discrete-time sinusoid with frequency in the range 0.7π to π. As your answer give:
   (a) the coefficients of your filter,
   (b) its order,
   (c) a plot of the magnitude frequency response,
   (d) the values of the magnitude frequency response at $\pi/40$ and 0.7π, and
   (e) the ratio of the magnitude frequency response at $\pi/40$ and the maximum magnitude frequency response in the range 0.7π to π.
   This is an open-ended design problem, representative of what an engineer would need to solve. It is not intended to be difficult or tricky in any way. There are many approaches you might take and many possible solutions. For example, some approaches might involve theoretical formulas and some might use Matlab. However, you should solve this problem *on your own* without help or suggestions from the staff or other students. Solving this problem may take some trial and error, where the "trials"might involve experimentation with a method you have chosen, and if this is not successful, with another approach.
   In problems where there are many possible solutions, engineers generally look for the simplest solution.