EECS 206 – Winter 2002

Homework #12 (Last One!) – Assigned Apr. 5 – Due Friday Apr. 12

Relevant Lectures: 4/1, 4/3, 4/5
Relevant Reading: Chapter 8 (8.1 to 8.7)
Relevant Items in the DSP First CD: Homework problems 8.1 to 8.11, 8.15 to 8.23, 8.57 to 8.59. This is a partial list; feel free to explore!
Homework Submission Policies: Same as before (see course Web page).

1. What are the roots of the polynomial $p(z) = z^N + 1$?

2. Textbook, Problem 8.5, p. 311.

3. Textbook, Problem 8.6, p. 312.

4. Textbook, Problem 8.11 (a)(c), p. 313.

5. Textbook, Problem 8.13, pp. 313-4.

6. Textbook, Problem 8.16, p. 316.
   Sketch the Frequency Response Function (E) at the bottom of p. 316 and indicate on the frequency axis those frequencies where the System Function has a pole (by X) or a zero (by O) nearby.

7. Textbook, Problem 8.20, p. 318.

8. (This problem is similar to Problem 8 on Homework Set 10!)
   Find a causal IIR filter such that the magnitude of the response to a discrete-time sinusoid with frequency 0.02π is at least 30 times larger than the magnitude of the response to any discrete-time sinusoid with frequency in the range 0.8π 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 0.02π and 0.8π, and

   (e) the ratio of the magnitude frequency response at 0.02π and the maximum magnitude frequency response in the range 0.8π to π.

   Note: Like Prob. 8 on Homework 10, 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. 10 points extra credit to whoever finds a filter with the smallest order.