**Homework Set 10** **EECS 206** **Due: Friday, March 30, 2002**

Relevant reading materials: Chapter 6, Sections 6.3, 6.6, 6.8. Chapter 7, Sections 7.1, 7.2

Relevant lectures: 3/18, 3/20, 3/22

Relevant items in DSP First CD ROM:

Chapter 6: Demos on Cascading FIR filters, and Homework Problems: 6.2, 6.2, 6.9-6.26, 6.29, 6.30, 6.34.

Chapter 7: Homework Problems: 7.18,7.19,7.22-7.25

Homework submission policies: As usual.

1. 6.12, p. 198. Part (a) should say "Determine the frequency response of the equivalent system that is ..."

2. 6.14, p. 199

3. 6.18, p. 200 (postponed from the previous assignment)

4. 6.19, a,b, p. 200

5. (postponed from the previous assignment) Find the coefficients of two first-order FIR filters such that when cascaded, the overall frequency response is

$$H(\hat{\omega}) = 2 + 3\,e^{-j\hat{\omega}} - 2\,e^{-j2\hat{\omega}}.$$

Hint: Try factoring.

6. 7.3, p. 143

7. (a) 7.8 a,b, p. 244

(b) 7.12 a, p. 246

8. Find a causal FIR filter such that the magnitude of the response to a discrete-time sinusoid with frequency $0.02\pi$ is at least 20 times larger than the magnitude of the response to any discrete-time sinusoid with frequency in the range $0.8\,\pi$ to $\pi$. As your answer give: (a) the coefficients of your filter, (b) its order, (c) a plot of the magnitude frequency response, and (d) the values and ratio of the magnitude frequency response at $0.02\pi$ and $0.8\pi$.

Note: This is an open ended design problem, representative of what an engineer would need to do. 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. The idea is that you need to become skilled at choosing among "tools" to which you have been exposed for items that might be useful for solving a problem that is new to you. 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 if your filter has order 15 or less. An additional 10 points extra credit to whoever finds the filter with the smallest order, or 5 points extra credit if your filter order is within 1 of the smallest anyone finds.