EE112/PPV/Winter'09: Digital Signal Processing

HW SET #1

Due On **Thursday Jan. 15** in class.

The problems here are basic review problems. You should be able to do them based on the prerequisites for this class. Review of Chap. 2 of AVO, especially Sec. 2.7–2.9, helps. The matlab assignment given below serves as a warm-up for future matlabs. We assume you know how to get access to matlab on campus. If not please ask one of the TAs.

1. (180 points) AVO's book Problem 2.44.

2. (150 points) Consider a discrete time signal $h(n)$ of length 11, with $h(0)$ through $h(10)$ given below:

$$-0.0872, 0.0370, 0.0984, 0.1755, 0.2388, 0.2632, 0.2388, 0.1755, 0.0984, 0.0370, -0.0872$$

(a) Using matlab, compute and plot the magnitude of the Fourier transform $H(e^{j\omega})$ in the range $0 \leq \omega \leq \pi$. If you were to regard this as a digital filter, what sort of filter is it? (lowpass, highpass, bandpass, ...)

(b) Also plot the magnitude in dB and the phase (this can be done by using the command *freqz*).

Include printouts of the plots and the matlab code.

3. (150 points) Find an example of a discrete time sequence $x(n)$ of finite duration and at least two nonzero samples, such that the Fourier transform $X(e^{j\omega})$ is real and greater than zero for all ω. Plot the Fourier transform for $-\pi \leq \omega \leq \pi$.

4. (100 points) PPV's book, Problem 2.1.

***5.** (180 points) PPV's book Problem 2.2.

***6.** (10 points) Please send an email to the Head Teaching Assistant Scott Chen saying

"I am taking EE112. My email is ...".

Scott's address is *cyc@caltech.edu*. You will then be included in the class email list.

Reading assignments.

1. Everyone in the class should read Chap. 1 of AVO's book this week. If you have not take a EE111-like course recently, you should review Chap. 2 and 3, and the first three sections of Chap. 4 from AVO's book. This should refresh your minds sufficiently to be able to follow the class.

Reminders:

Late homework policy for EE112. Late homeworks will not be accepted. No exceptions other than institute-established emergency reasons, in which case a signed letter is required from authorized official.

NCT Problems. Remember that problems with an asterik, such as *6 are no-collaboration (NCT) problems.

Books. AVO's book means "Discrete time signal processing" by Oppenheim et al. PPV's book means "Multirate systems and filter banks" by PPV. Most homework problems come from these books.
