Massachusetts Institute of Technology
Department of Electrical Engineering and Computer Science

6.011: Signals, Systems and Inference

Spring 2018

Problem Set 1

Signals & Systems in Time & Frequency

Reading:

Read Sections 1.1–1.3 of *Signals, Systems & Inference* (SSI from now on, if we need to be explicit, otherwise understood). Most of this should be familiar to you from 6.003. You can defer reading Section 1.4 till later in the term. The first problem below relates to the material in Section 1.5, though you can/should try tackling it before reading the section.

In the next two weeks we will be drawing on significant portions of what you learned in 6.003, and adding some more. You should work on re-familiarizing yourself with the material in Chapters 1, 2, 4, 5, 6, 7, 9 and 10 of the Oppenheim and Willsky text (*Signals & Systems*, 2nd Edition), or equivalent material from whatever other text you are more familiar with. (Also take a glance at Chapter 7 of SSI, so you can gauge the level of comfort we'll need with the probability material, when we get to it around spring break.)

Try to get an early start on the homework. Keep in mind that the homework is intended to guide your learning, rather than to be a test or exhaustive checklist of things you have to know. Put in a good, honest effort, but talk to others (students in the class, or staff) if you're stuck, to see if they can help you get unstuck before you put in an inordinate amount of time.

Problem 1.1

Read the posted note[1] on "What you need to know about bandlimited signals for 6.011". Read it partly as a way to review some of your 6.003, because we invoke material from there at every step of the development in the note. Then tackle Problem 1.17, part (a) only (which is Problem 1.21(a) in the softcover edition).

You might find it helpful to read Section 1.5 for background on this problem, or after you've done this problem. However, we're less interested this term in "DT Processing of CT Signals" as a topic in itself than as a vehicle for reviewing 6.003 material.

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[1]Since this note was written today, it may still have a bug or two, so please read attentively and let George know if something doesn't seem quite right!

Problem 1.2

Problem 1.56 (which is 1.49 in the softcover edition of SSI), but instead of the Barker code of length 13 in part (f), use the following sequence of length 14:

-1 1 -1 -1 1 -1 1 1 1 -1 -1 1 1 1

(This was generated as a pseudorandom signed binary sequence using `ltePRBS` in Matlab, but that doesn't matter for this problem.)

Problem 1.3 (Optional)

The following problems from Chapter 1 of SSI should be good practice on the basics of linearity, time invariance, convolution, and Fourier transforms, if you're looking for practice.

Problems 1.2, 1.8, 1.9, 1.10, 1.11, 1.12, 1.27, 1.30, 1.36 in the hardcover version of SSI (which are Problems 1.4, 1.12, 1.10, 1.11, 1.9, 1.8, 1.26, 1.32 in the softcover version).

Problem 1.4 (Optional)

You might find Problem 1.55 (which is Problem 1.48 in the softcover edition) interesting.

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