Homework #2, EECS 206, Fall 2002. Due **Fri. Sep. 20**, by 4:30PM

Notes

- Review the HW policies on HW1!
- Unless instructed otherwise, you may use Matlab to help solve any problem for which it is useful, even if not explicitly instructed to use Matlab by the problem. However, keep in mind that on the exams you will not have Matlab available, so if there is a "non-Matlab" approach then you will need to learn it too. Also, to ensure earning full credit (and to help get partial credit) you should convey to the grader how you solved the problem, (*e.g.*, by including the Matlab code that you used in your solution). Our recommendation would be to use Matlab to check your intuition and/or to get you started, and then try to solve the problems analytically.
- Reading: all of "Part 1" lecture notes, Sections 2.1 to 2.4 of text, and Appendix A of text (complex numbers).

Skills and Concepts

- histograms
- periodicity of sums
- signal operations
- signal similarity measures
- correlation
- sinusoidal signals
- complex arithmetic

Problems

1. [20] Problem 6 in Part 1 lecture notes. (Signal value distributions.)

2. [20] Problem 26 in Part 1 lecture notes. (Periodicity of sums.)

3. [5] Problem 28 in Part 1 lecture notes. (Energy of sum of continuous-time signals.)

4. [15] Consider the following signal: $x[n] = \begin{cases} 3, & |n| \leq 4 \\ -3, & 4 < |n| \leq 8 \\ 0, & \text{otherwise}. \end{cases}$

   As quantified by mean-squared difference, is the signal $x[n]$ more similar to $y[n]$ or to $z[n]$ below. Explain.

   - $y[n] = \begin{cases} 3, & |n| \leq 4 \\ 0, & \text{otherwise} \end{cases}$
   - $z[n] = \begin{cases} 1, & |n| \leq 8 \\ 0, & \text{otherwise} \end{cases}$

   Optional challenge. Consider signals of the form $w[n] = \begin{cases} \alpha, & |n| \leq 8 \\ 0, & \text{otherwise}. \end{cases}$

   What value of α minimizes the MSD between $x[\cdot]$ and $w[\cdot]$?

5. [10] Determine the correlation between the following two signals. Hint: see "useful formulas" (page iv) in lecture notes.

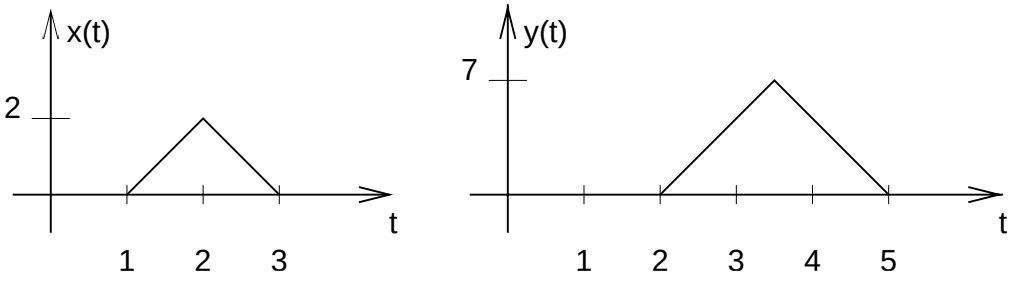
   - $x[n] = \begin{cases} (1/2)^n, & n \geq 0 \\ 0, & \text{otherwise}, \end{cases}$
   - $y[n] = \begin{cases} (-1/3)^n, & n \geq 0 \\ 0, & \text{otherwise}. \end{cases}$

6. [0] Show that the mean value is $M(x) = 1$ for the following discrete-time signal:

$$x[n] = \begin{cases} e^n, & n < 0, \\ 2 + \cos(3\pi n), & n \geq 0. \end{cases}$$

(more on next page)

7. [10] Let $x(t)$ and $y(t)$ be the signals shown below. Find numbers a, b, and c such that $y(t) = ax(bt + c)$.
(No systematic process has been developed to solve this problem. Use your creativity.)



8. [10] Text 2.1. (Plot cosine.) Make your plot by hand, since you need to be able to make such plots without matlab.

9. [10] Text 2.3. (Cosine from plot.)
To facilitate grading, please express your phase as a value between $-\pi$ and π.

10. [10] Text 2.7. (Complex arithmetic.)