

ELEG 305 SIGNALS AND SYSTEMS SPRING 2019

- All Homeworks and Homework Quizzes are worth 25 points.
- Homeworks and Solutions from Spring 2018 have been posted on Canvas.

Math Practice Problems (Extra Credit) due Tuesday February 19 (20 points)

HOMEWORK #1 → *Hand-in on Thursday February 21 (Collected in Lecture)*

Read Chapters 1 and 2 in Oppenheim, Willsky, and Nawab (**O&W**)

Problem #1

Sketch the following signals and compute the total energy, E_∞ , and the average power, P_∞ . State whether the signals are energy signals, power signals, or neither.

a.) The continuous-time signal

$$x(t) = \begin{cases} t, & 0 \leq t \leq 1 \\ 2 - t, & 1 \leq t \leq 2 \\ 0, & \text{otherwise} \end{cases}$$

b.) The discrete-time signal

$$x[n] = (3) \left(\frac{1}{3}\right)^n u[n]$$

NOTE: $u(t)$ and $u[n]$ are *unit step functions* and are shorthand notation for the following:

$$u(t) = \begin{cases} 0, & t < 0 \\ 1, & t \geq 0 \end{cases}$$

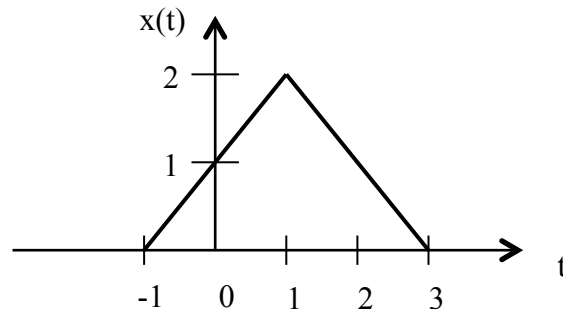
$$u[n] = \begin{cases} 0, & n < 0 \\ 1, & n \geq 0 \end{cases}$$

c.) The continuous-time signal

$$x(t) = je^{j(\pi t + 10)}$$

Problem #2

Consider the following continuous-time signal



Draw the following signals (transformations of $x(t)$):

- $x(t-2)$
- $x(3t)$
- $x(3t+2)$
- $x(-3t-1)$

Problem #3

Consider the following discrete-time signal

$$x[n] = \begin{cases} n, & -2 \leq n \leq 2 \\ 0, & |n| > 2 \end{cases}$$

Draw $x[n]$ and the following signals:

- $x[2-n]$
- $x[n]u[n-3]$
- $\mathcal{E}\{x[n]\}$, where $\mathcal{E}\{x[n]\}$ represents the even part of $x[n]$ (see Eq. 1.18) in the text).

Problem #4

Determine whether or not each of the following is periodic. If a signal is periodic, specify its fundamental period.

- $\cos^2(2\pi t)$
- $e^{-2t}\cos(2\pi t)$
- $(\cos 3t) u(t)$
- $\exp[j(\pi t - 2)]$, where $\exp[a]$ simply means e^a
- $\cos(2\pi n + \pi/8)$
- $\cos(3n)$
- $(-1)^n$
- $\exp[-(1+j\pi)n]$

Problem #5 – More Math Review Problems

- Compute the absolute value of the following complex numbers:

$$\begin{aligned} &1 + 2j \\ &(1 + 2j)^* \\ &2e^{j\pi/4} \end{aligned}$$

- Compute the following sums of complex numbers:

$$\sum_{n=0}^{\infty} \left(\frac{1}{2} e^{j\frac{\pi}{4}} \right)^n$$

$$\sum_{n=0}^{\infty} \left(\frac{1}{2} \right)^{n-1} \cos \frac{\pi}{4} n \quad (\text{Hint: Use Euler's Relation to rewrite cosine.})$$

EXAM # 1 Tuesday March 12

- Closed everything: no calculators, cellphones, laptops, ...
- Chapters 1 and 2
- Review on Monday March 11