EE150 Signal and System
Homework 1

Due on 22 Sep 23:59 UTC+8

Exercies 1.   (10 pts)

Determine the energy E_∞ and power P_∞ of those signals. Which are energy signals? Which are power signals?

(a) $x(t) = e^{j(2t + \frac{\pi}{4})}$

(b) $x[n] = \left(\frac{1}{2}\right)^n u[n]$

Exercies 2.   (15 pts)

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

(a) $x_1(t) = 2e^{j(t + \frac{\pi}{4})} u(t)$

(b) $x_2[n] = e^{j7\pi n}$

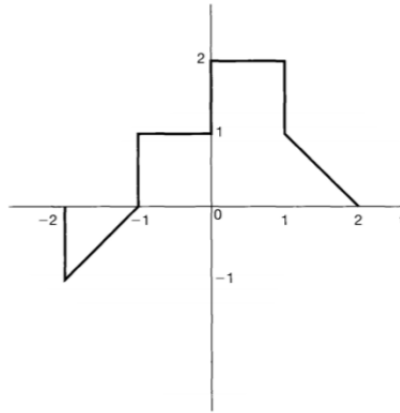(c) $x_3[n] = 3e^{j\frac{3}{5}(n + \frac{1}{2})}$

Exercies 3.   (15 pts)

Question 1.   (7 pts)

A continuous-time signal $x(t)$ is shown in the following. Sketch and label carefully each of the following signals:
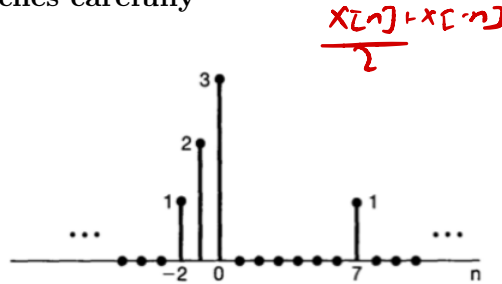
(a) $x(t - 1)$

(b) $x(2t + 1)$

Question 2.   (8 pts)

Determine and sketch the even and odd ~~parts~~ of the signals depicted in the following. Label your sketches carefully

$$\frac{x[n] + x[-n]}{2}$$

Exercise 4.   (20 pts)

In this chapter, we introduced a number of general properties of systems. In particular, a system may or may not be

(1) Memoryless 无记忆的

(2) Time invariant 时不变 ,

(3) Linear

(4) Causal

(5) Stable

Determine which of these properties hold and which do not hold for each of the following ~~continuous-time~~ systems. Justify your anseers. In each example, $y(t)/y[n]$ denotes the system output and $x(t)/x[n]$ is the system input.

(a) $y[n] = nx[n]$

(b) $y(t) = \int_{-\infty}^{2t} x(t)dt$ 2

$$y(t) = \int_{-\infty}^{2t} x(u)du$$

2

Exercise 5.   (40 pts)

(a) Show that the discrete-time system whose input $x[n]$ and output $y[n]$ are related by $y[n] = Re\{x[n]\}$ is additive. Does this system remain additive if its input-output relationship is changed to $y[n] = Re\{e^{j\pi n/4}x[n]\}$? (Do not assume that $x[n]$ is real in this problem)

(b) In the text, we discussed the fact that the property of linearity for a system is equivalent to the system possessing both the additivity property and homogeneity property. Determine whether the systems defined below is additive and/or homogeneous. Justify your answers by providing a proof for each property if it holds or a counter example if it does not.

$$y(t) = \frac{1}{x(t)}[\frac{dx(t)}{dt}]^2$$