EE150 Signal and System
Homework 1

Due on 23: 59, March 17, 2024.

Note:

- Please provide enough calculation process to get full marks.

- Please submit your homework to Blackboard in PDF version.

- It's highly recommended to write every exercise on a single sheet of page.

- Late submissions will have points deducted according to the penalty policy.

- Please use English only to complete the assignment, solutions in Chinese are not allowed.

- Plagiarizer will get zero points.

- The full score of this assignment is 100 points.

Exercise 1. (20pt)

Determine the energy E_∞ and power P_∞ of the following signals. Which are finite-energy signals? Which are finite-power signals?

(a) $x_1(t) = e^{-2t}u(t)$

(b) $x_2(t) = e^{j(2t+\frac{\pi}{4})}$

(c) $x_3(t) = \cos(t)$

(d) $x_1[n] = (\frac{1}{2})^n u[n]$

(e) $x_2[n] = e^{j(\frac{\pi}{2n}+\frac{\pi}{8})}$

(f) $x_3[n] = \cos(\frac{\pi}{4}n)$

Exercise 2. (20pt)

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

(a) $x(t) = 3cos(4t + \frac{\pi}{3})$

(b) $x(t) = e^{j(\pi t - 1)}$

(c) $x(t) = Ev\{sin(4\pi t)u(t)\}$
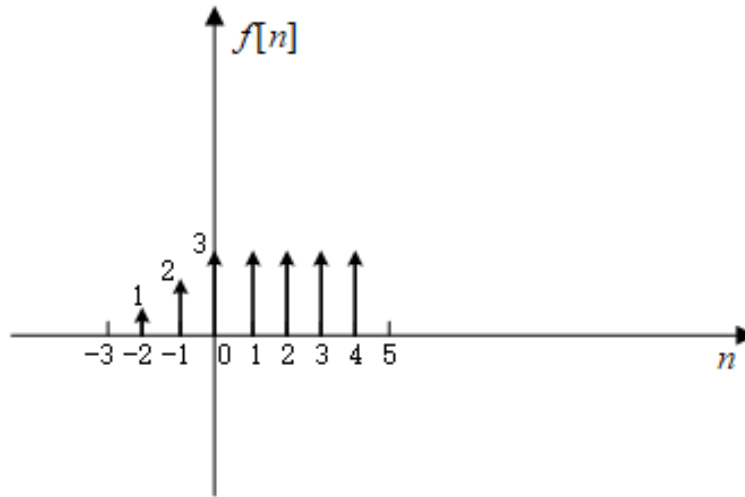
(d) $x[n] = e^{j\frac{2\pi}{3}n} + e^{j\frac{3\pi}{4}n}$

(e) $x[n] = cos(\frac{\pi}{2}n)cos(\frac{\pi}{4}n)$

(f) $x[n] = 2cos(\frac{\pi}{4}n) + sin(\frac{\pi}{8}n) - 2cos(\frac{\pi}{2}n + \frac{\pi}{6})$

Note: Please give your process for each question.

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Exercise 3. (20pt)

Given the discrete signal $f[n]$ shown below
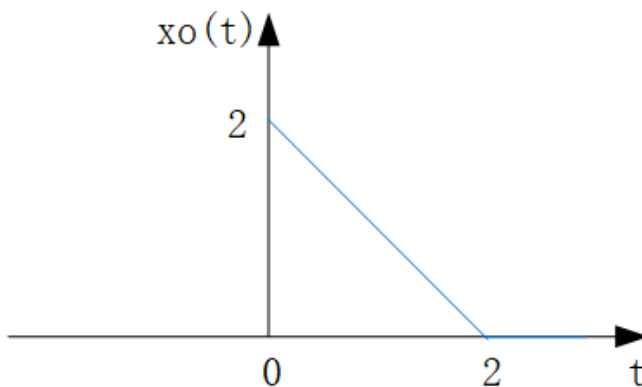

draw the following sequence waveforms:

(a) $f[n-2]u[n]$

(b) $f[n-2]u[n-2]$

(c) $f[n-2][u[n]-u[n-4]]$

(d) $f[-n-2]$

(e) $f[-n+2]u[-n+1]$

Exercise 4. (20pt)

Given in the following figure are the parts of a signal $x(t)$ and its odd part $x_o(t)$ for $t \geq 0$ only; that is, $x(t)$ and $x_o(t)$ for $t < 0$ are not given. Complete the plots of $x(t)$ and $x_o(t)$, and give a plot of the even part, $x_e(t)$ of $x(t)$. Give the equations used for plotting each part of the signals.
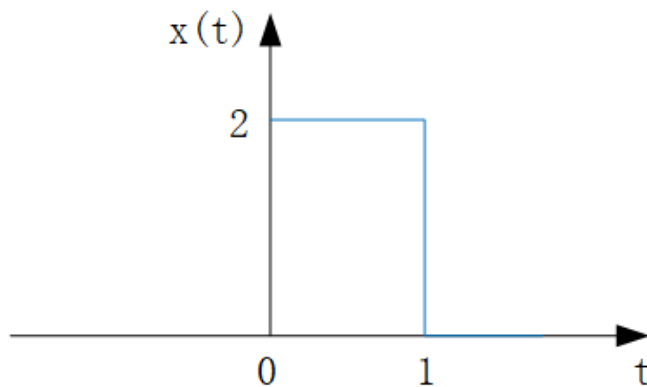
(a) $x(t)$

(b) $x_o(t)$

Exercise 5. (20pt)

For each of the following systems, determine whether the system is (1) stable, (2) causal, (3) linear, (4) time-invariant. Give your reason.

(a) $T(x[n]) = (\cos \pi n)x[n]$

(b) $T(x[n]) = x[n^2]$