دانشگاه صنعتی امیرکبیر
(پلی تکنیک تهران)

Signals and Systems

Assignment 1

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Question 1

For signal x(t) shown in the figure, plot the following (step-by-step):

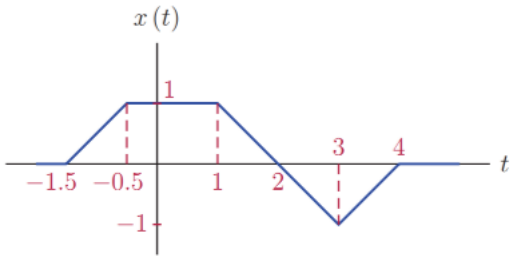
(a) $x_1(t) = x(3t + 1)$

(b) $x_2(t) = 2x(\frac{t}{3})$

(c) $x_3(t) = x(\frac{t+1}{4})$

(d) $x_4(t) = x(-t + 5)$

(e) $x_5(t) = x(-2t - 4)$



Question 2

For each of the signals listed below, find the even and odd components $Ev\{x(t)\}$ and $Od\{x(t)\}$.

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

(b) $x(t) = e^{-|t|}cos(t)$

(c) $x(t) = 2\Pi(t - 2.5)$ (solve by sketching)

note: $\Pi(t) = rect(t) = unitpulse = u(t + 0.5) - u(t - 0.5)$

Question 3

Determine if each signal is periodic. If so, determine the fundamental period and the fundamental frequency.

(a) $x(t) = e^{j\frac{\pi}{3}t}$

(b) $x(t) = e^{j\frac{\pi}{3}t} \times e^{-j\frac{\pi}{3}t}$

(c) $x(t) = e^{jt+\frac{t}{2}}$

(d) $x[n] = e^{j3\pi n}$

(e) $x[n] = e^{j3n}$

(f) $x(t) = e^{2|t|}cos(t)$

(g) $x[n] = 2cos(2\pi n) + cos(\frac{\pi}{3}n)$

(h) $x[n] = \sum_{k=-\infty}^{\infty} \delta[n-6k] + \delta[n-1-6k]$

(i) $x(t) = cos^2(3t + \frac{\pi}{6})$

(j) $x(t) = Od\{cos(\pi t)u(t)\}$

(k) $x[n] = cos(\frac{\pi}{8}n)$

Question 4

Determine whether or not these systems are memoryless, causal, time-invariant, stable and linear:

(a) $y(t) = e^{x(t)}$

(b) $y(t) = sin^2(t)x(t)$

(c) $y(t) = tx^2(t)$

(d) $y[n] = \sum_{k=-\infty}^{n+1} x[k]$

(e) $y[n] = x[2n+1]$

(f) $y[n] = sin(x[n])$

Question 5

Determine if each of the given systems is invertible. If so, find the invert system.

(a) $y[n] = x[n+1]x[n-1]$

(b) $y(t) = x(\frac{t}{2})$

(c) $y(t) = \begin{cases} x(t) & , t \geq 0 \\ x(t-1) & , t < 0 \end{cases}$

(d) $y[n] = \begin{cases} x[n] & , n > 0 \\ 1 & , n = 0 \\ -x[n] & , n < 0 \end{cases}$

(e) $y(t) = \dfrac{dx(t)}{dt}$

Question 6

Determine the values of P_∞ and E_∞ for each of the following signals.

(a) $x[n] = \left(\frac{1}{4}\right)^n u[n]$

(b) $x(t) = jcos(t)$

(c) $x(t) = e^{jt+t}$

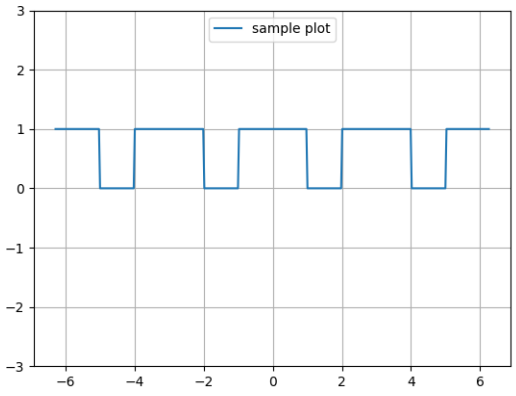
Programming Assignment1

Plot the following continuous signals within interval $-2\pi \leq t \leq 2\pi$.

(a) $x(t) = sin(2t)$

(b) $x(t) = sin(\pi t)$

(c)



Programming Assignment2

Plot the following discrete signals within interval $-4 \leq n \leq 20$.

(a) $x[n] = (0.73)^n u[n] + (0.94)^n u[n-5]$

(b) $x[n] = \sum_{k=-\infty}^{\infty} \delta[n-4k] + \delta[n-1-4k]$ (use loops and conditionals)