Spring 2019 - Problem Set 1
ECE 301: Signals and Systems

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Due Date : February 1, 2019

Instructions

1. Please write clearly and legibly.
2. Your solutions must include detailed steps and/or explanations. Do not simply state the answer.
3. Write your full name (first,last), PUID on your homework submission.
4. All problems carry equal weight.

Problem 1

For $x(t)$ given in figure 1 sketch

a $x(-2t+4)$

b $x(\frac{t}{2}-2)$

c $x(-t)$

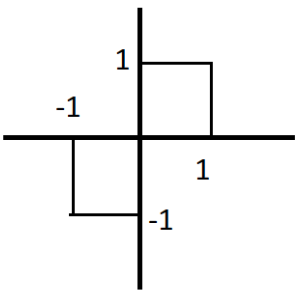

Figure 1: x(t)

Problem 2

a Which of the 2 discrete time frequencies is higher? $\omega_0 = 11\pi$, $\omega_0 = \frac{21}{2}\pi$. Why?

b How many different signals are in the set $\{e^{j\frac{3\pi k}{2}n}$, k is an integer$\}$?Justify your answer.

c Consider the signal $x[n] = e^{j\frac{3\pi}{4}n} + e^{j\frac{5\pi}{2}n}$. Is the signal periodic? If it is periodic, find its fundamental period.

d For $x[n]$ in figure 2 sketch

i $x[\frac{n}{2}]u[n]$

ii $x[-3n+1]$

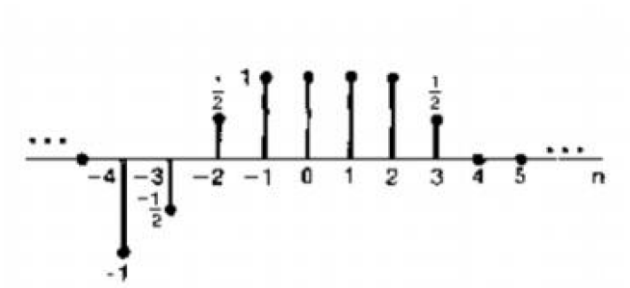

Figure 2: x[n]

Problem 3

a Prove that the even part of any function is even. Also, prove that the odd part of any function is odd.

b Determine if the following functions are odd or even

i $x[n] = n^{101} + \sin(\frac{\pi}{2}n)$

ii $x(t) = \cos(5\pi t) + t^4$

iii For the signals in figure 3, sketch the even and odd parts.

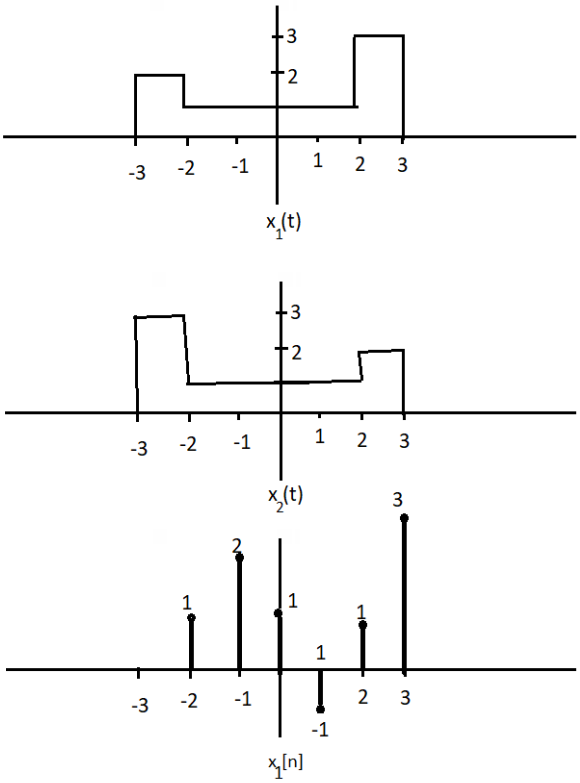

Figure 3: x[n]

Problem 4

For each of the following, state if it is possible to have a signal satisfying the stated conditions. If yes, give an example. If no, justify your answer.

a $E_\infty < \infty$, $P_\infty = 0$

b $E_\infty = \infty$, $P_\infty = 0$

c $E_\infty < \infty$, $P_\infty > 0$

d $E_\infty = \infty$, $P_\infty > 0$

e $E_\infty < \infty$, $P_\infty = \infty$

f $E_\infty = \infty$, $P_\infty = \infty$

Problem 5

Determine if each of the following systems is invertible. It it is, construct the inverse system. If it is not, find two input signals to the system that have same output.

a $y(t) = x(t/7)$

b $y(t) = \cos(\pi x(t))$

c $y[n] = \tan(\frac{\pi}{28}x[n])$

d $y(t) = \frac{d}{dt}x(t)$

e $y[n] = x[n] - x[0]$