

EE 484

Homework 1

Due Monday, January 25, 2016

Work all 6 problems.

Problem 1. Determine for each of the following whether or not the discrete-time system is linear, and/or time-invariant.

a. $y(n) = 2 \sin[x(n)]$.

b. $y(n) = x(n - 2)$.

c. $y(n) = e^{|x(n)|}$.

d. $y(n) = nx(n)$.

Problem 2. Compute the Fourier transform of the following

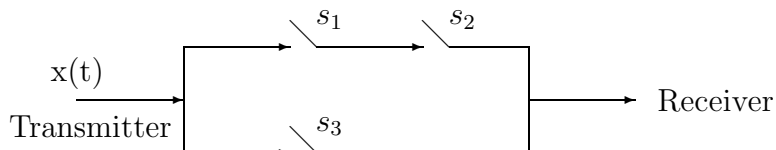
$$x(t) = \begin{cases} t, & 0 \leq t \leq 1, \\ 2 - t, & 1 < t \leq 2, \\ 0, & \textit{elsewhere} \end{cases}$$

and sketch a plot of its magnitude in the frequency domain.

Problem 3. Show that

$$\int_{-\infty}^{\infty} \frac{1}{\sqrt{2\pi}} e^{-x^2/2} dx = 1.$$

Problem 4. Consider the transmission of a signal as shown in the following diagram.



A signal is transmitted along two paths as shown. In the upper path there are two switches to pass through while in the lower path there is one switch to pass through. Each switch s_i operates independently and allows the signal to pass with probability p_i for $i = 1, 2, 3$. The signal transmission is successful if the signal $x(t)$ sent at the transmitter reaches the receiver along either or both paths. Find the probability that the transmission is successful if

a. $p_1 = 9/10$, $p_2 = 1/2$, $p_3 = 3/4$.

b. $p_1 = 9/10$, $p_2 = 1/2$, p_3 is a random variable uniformly distributed in the interval $(0, 1)$.

Problem 5. Suppose the random variable X has mean 1 and variance 4. Let $Y = X^2$. Find the mean of Y .

Problem 6. Suppose the normal random variable X has mean 4 and variance 8. Let $Y = X^2$. Find the variance of Y .