

Problem Set #2

Due: Thursday October 11, 2006

I encourage you to work together on your homework but what you hand in must be written up alone.

1. Consider the system $y[n] = -|-x[n]|/12$. Determine whether this system is

- (a) memoryless?
- (b) invertible?
- (c) causal?
- (d) stable?
- (e) time invariant?
- (f) linear?

2. Repeat Problem 1 for

$$y_1[n] = \begin{cases} x[n]/12 & \text{for } x[n] < 0 \\ 0 & \text{otherwise} \end{cases}$$

and

$$y_2[n] = \begin{cases} -14 & \text{for } x[n] < -1 \\ 4x[n] & \text{for } |x[n]| \leq 1 \\ 10 & \text{for } x[n] > 1 \end{cases}$$

3. Repeat Problem 1 for

$$y_1[n] = \begin{cases} x[n]/12 & \text{for } n < 0 \\ 0 & \text{otherwise} \end{cases}$$

and

$$y_2[n] = \begin{cases} -14 & \text{for } n < -1 \\ 4x[n] & \text{for } |n| \leq 1 \\ 10 & \text{for } n > 1 \end{cases}$$

4. Let $y[n] = x_1[n] * x_2[n]$ and $z[n] = x_1[n + 5] * x_2[n - N]$. Express $z[n]$ in terms of y .

5. consider two signals, $x[n]$ and $y[n]$, and their even and odd components, $x_e[n]$, $x_o[n]$, $y_e[n]$, $y_o[n]$. Determine which one of the following are odd or even:

- (a) $x_e[n] * y_e[n]$
- (a) $x_o[n] * y_e[n]$
- (a) $x_o[n] * y_o[n]$

6. Show that any periodic signal with period N is a power signal. Calculate its power.

Answer to an extra problem (for your own use, not to turn in):

1. The commutative property of the convolution is only valid when the convolution does exist in the first place. Consider the following three signals: $x[n] = 2$, $y[n] = u[n]$, and $z[n] = \delta[n] - \delta[n - 1]$. Show that $z * y * x \neq y * z * x$.