

Signal & Systems

Lecture #7

04th May 18



Revision



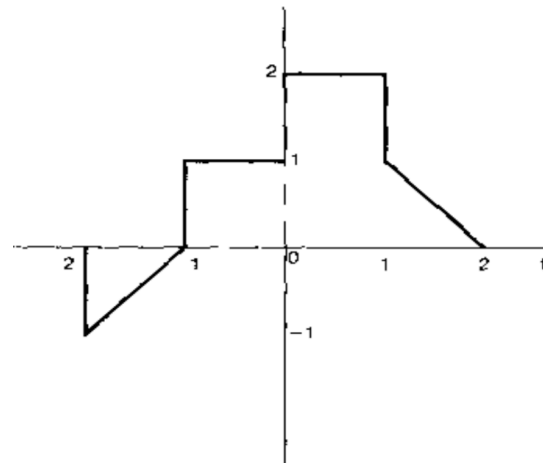
Operation of Signals

Problem #1

- ❖ Let $x[n]$ be a signal with $x[n]=0$ for $n < -2$ and $n > 4$. For each signal given below, determine the values of n for which it is guaranteed to be zero:
 - ❖ (a): $x[-n+2]$
 - ❖ (b): $x[n+4]$

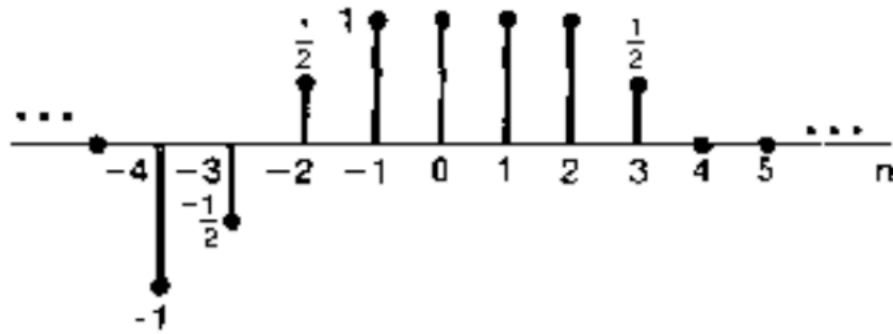
Problem #2

- ❖ A continuous-time signal $x(t)$ is shown in figure below. Sketch and label carefully each of the following signals:
 - ❖ (a): $x(4 - t/2)$
 - ❖ (b): $x(2t + 1)$



Problem #3

- ❖ A discrete-time signal $x[n]$ is shown in figure below. Sketch and label carefully each of the following signals:
 - ❖ (a): $x[3n]$
 - ❖ (b): $x[n] \cup [3-n]$
 - ❖ (c): $x[3n + 1]$

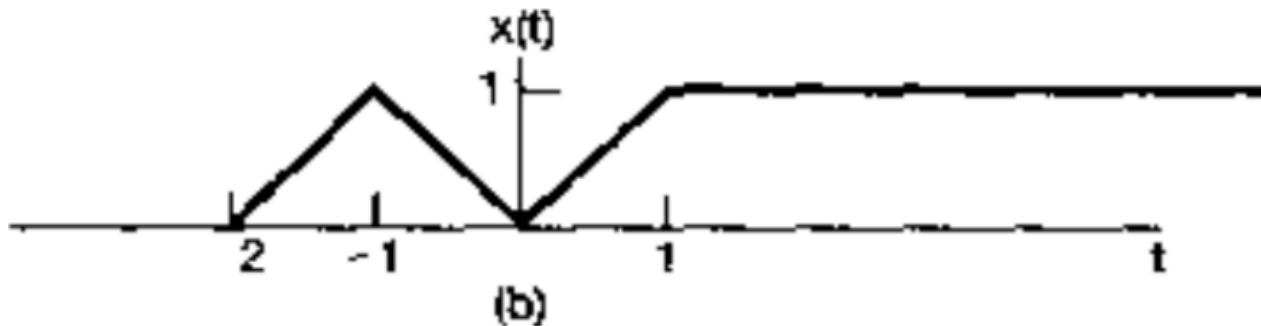
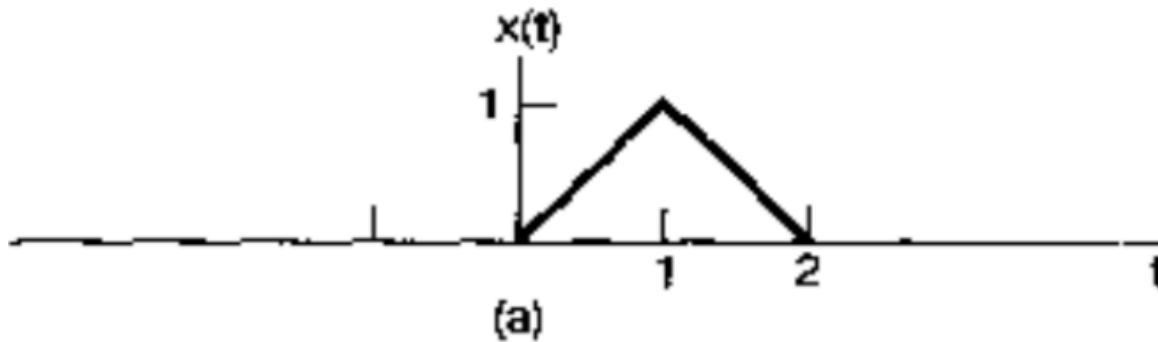




Even & Odd Signals

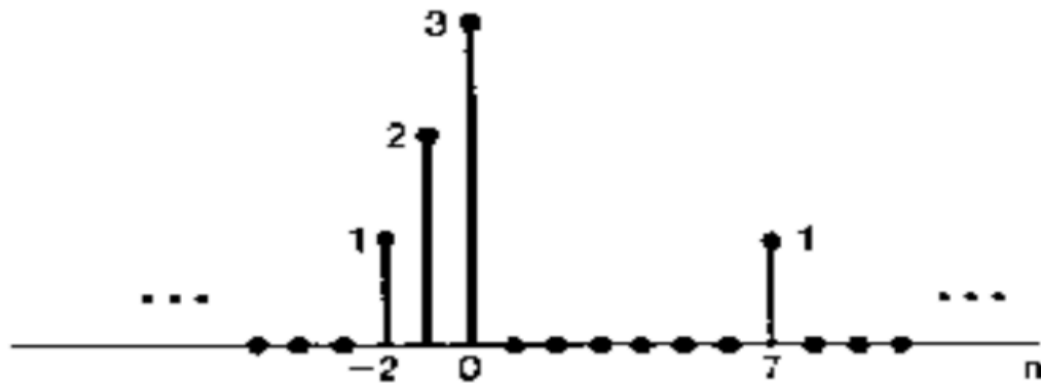
Problem #4

- ❖ Determine and sketch the even and odd parts of the signals shown below:



Problem #5

- ❖ Determine and sketch the even and odd parts of the signal shown below:



Periodic & A-Periodic Signals



Problem #6

- ❖ Determine whether or not each of the following signals is periodic:
 - ❖ (a): $x_1(t) = 2e^{j(t+\pi/4)} u(t)$
 - ❖ (b): $x_2[n] = u[n] + u[-n]$

Problem #7

- ❖ Determine the fundamental period of the signal $x[n] = 1 + e^{j4\pi n/7} - e^{j2\pi n/5}$.

System Properties



Problem #8

- ❖ Consider a system S with input $x[n]$ and output $y[n]$. This system is obtained through a series interconnection of a system S_1 followed by a system S_2 . the input-output relationships for S_1 and S_2 are:

$$S_1: y_1[n] = 2x_1[n] + 4x_1[n-1]$$

$$S_2: y_2[n] = x_2[n-2] + \frac{1}{2}x_2[n-3]$$

- ❖ Where $x_1[n]$ and $x_2[n]$ denote input signals:
 - ❖ (a): Determine the input-output relationship for system S .
 - ❖ (b): Does the input-output relationship of system S change if the order in which S_1 and S_2 are connected in series is reversed (i.e., if S_2 follows S_1)?

Problem #9

- ❖ Consider a continuous-time system with input $x(t)$ and output $y(t)$ related by: $y(t) = x[\sin(t)]$.
- ❖ (a): Is this system causal?
- ❖ (b): Is this system linear?

Problem #10

❖ Determine which of these properties hold and which do not hold for the following system. Justify your answer.

$$\text{❖ } y[n] = x[n-2] - 2x[n-8]$$

❖ (1): Memoryless

❖ (2): Time Invariant

❖ (3): Linear

❖ (4): Causal

❖ (5): Stable



LTI System Properties

Problem #11

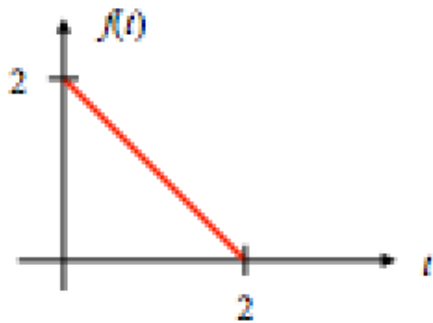
- ❖ The following are the impulse responses of LTI systems. Determine whether each system is causal and/or stable. Justify your answer:
 - ❖ (a): $h[n] = (1/2)^n u[-n]$
 - ❖ (b): $h(t) = e^{-4t} u(t-2)$



Graphical Convolution

Problem #12

❖ Convolve the following two functions:

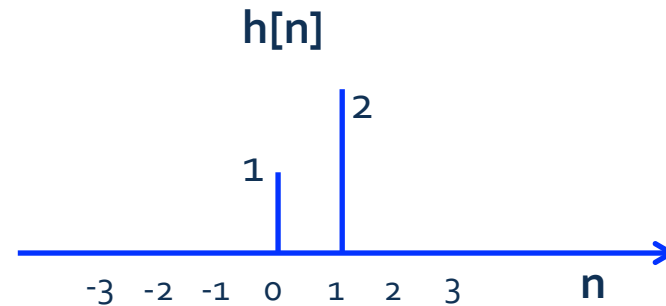
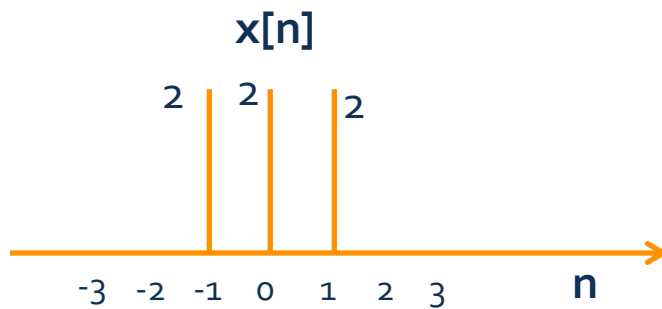


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Problem #13

❖ Convolve the following two functions:





Simple Convolution

Problem #14

- ❖ Compute the convolution of the following pairs of signals:
 - ❖ (a): $x[n] = h[n] = \alpha^n u[n]$
 - ❖ (b): $x(t) = u(t) - 2u(t-2) + u(t-5)$ and $h(t) = e^{2t} u(1-t)$



Thank You!