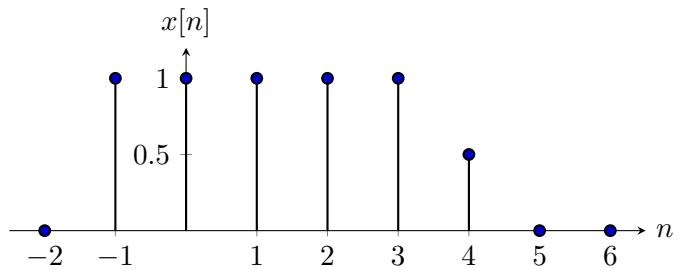


ECE 5210 hw01

1. Discrete-Time Signal Operations

A discrete-time signal $x[n]$ is shown below:



Sketch the following signals $\tilde{x}[n]$:

- a) $\tilde{x}[n] = x[n - 2]$
- b) $\tilde{x}[n] = x[4 - n]$
- c) $\tilde{x}[n] = x[2n]$
- d) $\tilde{x}[n] = x[n]u[2 - n]$

2. Periodic Sinusoids

Determine whether each of the following signals is periodic. If the signal is periodic, state its period.

a) $x[n] = e^{j(\pi n/6)}$

b) $x[n] = e^{j(3\pi n/4)}$

c) $x[n] = \frac{\sin(\pi n/5)}{\pi n}$

d) $x[n] = \cos(\sqrt{3}n)$

e) $x[n] = e^{j\pi n/\sqrt{5}}$

3. Sinusoid Sampling

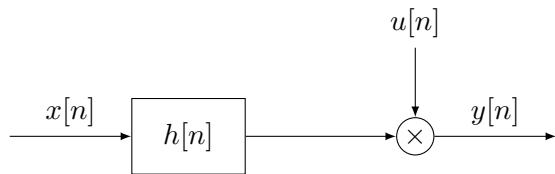
The signal

$$x_c(t) = \cos(2\pi(600)t)$$

was sampled with a sampling period $T = 1/300$ to obtain a discrete-time signal $x[n]$. What is the resulting sequence $x[n]?$

4. System Analysis

Consider the system illustrated below. The output of an LTI system with an impulse response $h[n] = (1/4)^n u[n+10]$ is multiplied by a unit step function $u[n]$ to yield the output of the overall system. Answer each of the following questions.



- a) Is the overall system LTI?
- b) Is the overall system causal?
- c) Is the overall system stable in the BIBO sense?

5. System Characterization

For each of the following systems, determine whether the system is stable, causal, linear, time-invariant, and memoryless.

a) $T\{x[n]\} = g[n]x[n]$ with $g[n]$ given (and is stable)

b) $T\{x[n]\} = \sum_{k=n_0}^n x[k], \quad n \neq 0$

c) $T\{x[n]\} = ax[n] + b$

d) $T\{x[n]\} = x[n] + 3u[n+1]$

e) $T\{x[n]\} = (\cos(\pi n))x[n]$