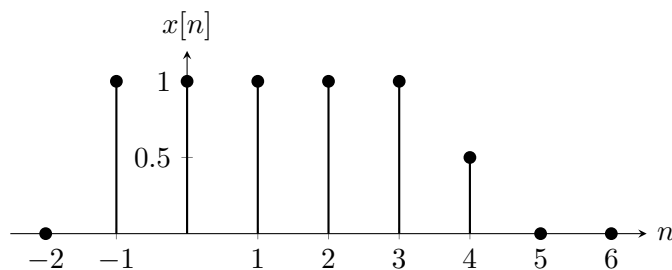# ECE 5210 hw01

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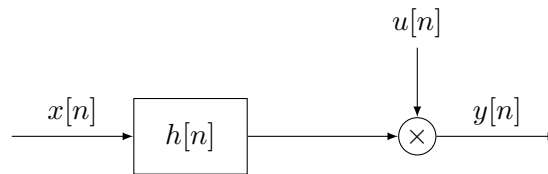
3. Sinusoid Sampling

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.

$$u[n]$$

$$x[n] \rightarrow \boxed{h[n]} \rightarrow \otimes \xrightarrow{y[n]}$$

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

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

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

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