

**PROBLEM:**

Suppose that  $\mathcal{S}$  is a linear, time-invariant system whose exact form is unknown. It needs to be tested by running some inputs into the system, and then observing the output signals. Suppose that the following input/output pairs are the result of the tests:

$$x[n] = \delta[n] - \delta[n - 1] \longrightarrow y[n] = 4\delta[n] - 4\delta[n - 4]$$

$$x[n] = \cos(\pi n/2) \longrightarrow y[n] = 0$$

$$x[n] = \cos(\pi n/3) \longrightarrow y[n] = 6.93 \cos(\pi n/3 - \pi/2)$$

- (a) Make a plot of the signal:  $x[n] = 4\delta[n] - 4\delta[n - 4]$ .
- (b) Use linearity and time-invariance to find the output of the system when the input is

$$x[n] = 3\delta[n] - 3\delta[n - 3]$$

- (c) Determine the output when the input is  $x[n] = 7 \cos(\pi(n - 2)/3)$ .
- (d) Determine the output when the input is  $x[n] = 9 \sin(\pi n/2)$