Assignment - 1

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***Abstract*—This document contains the solution to Exercise 2.36 (a) of Oppenheim.**

Problem 1. The system L in figure P2.36-1 is known to be linear. Shown are three output signals $y_1[n], y_2[n], y_3[n]$ in response to the input signals $x_1[n], x_2[n], x_3[n]$ respectively

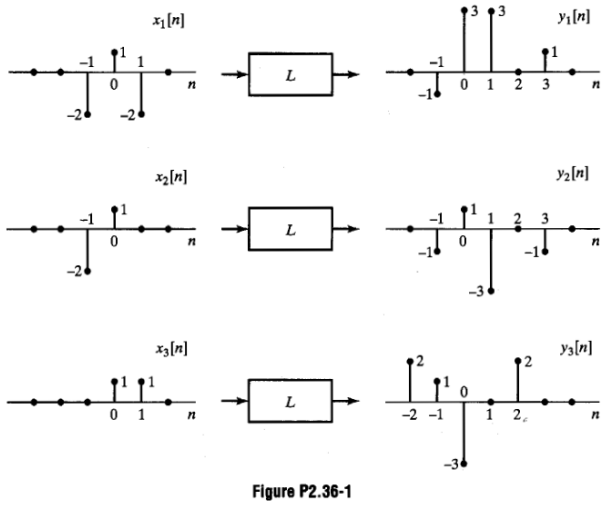

Figure P2.36-1

Fig. 1: $|H\left(e^{j\omega}\right)|$

Solution:
Impulse equation: $\delta[n] = x_3[n] + \frac{1}{2}x_1[n] - \frac{1}{2}x_2[n]$
Shifted Impulse equation: $\delta[n-1] = \frac{1}{2}x_2[n] - \frac{1}{2}x_1[n]$
Given system is linear.

$$\therefore L[\delta[n]] = y_3[n] + \frac{1}{2}y_1[n] - \frac{1}{2}y_2[n] \qquad (1)$$

$$\therefore L[\delta[n-1]] = \frac{1}{2}y_2[n] - \frac{1}{2}y_1[n] \qquad (2)$$

Since (1) $\neq$ (2).
$\therefore$ Given system is not time invariant