

Assignment 2

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Abstract—This document contains the solution for Ex. 2.35(a) of Discrete-Time Signal Processing by Oppenheim and Wilsky.

Problem 1. The system T in Figure P2.35-1 is known to be *time invariant*. When the inputs to the system are $x_1[n]$, $x_2[n]$, and $x_3[n]$, the responses of the system are $y_1[n]$, $y_2[n]$, and $y_3[n]$, as shown.

(a) Determine whether the system T could be linear.

Solution: From the left-hand side of the figure, we can clearly observe that

$$x_1(n) = x_2(n) + x_3(n + 4) \quad (0.1)$$

Therefore, if the system $T\{\cdot\}$ is linear, then,

$$T\{x_1(n)\} = T\{x_2(n)\} + T\{x_3(n + 4)\} \quad (0.2)$$

$$i.e., T\{x_1(n)\} = y_2(n) + y_3(n + 4) \quad (0.3)$$

accordingly, we should get,

$$y_1(n) = y_2(n) + y_3(n + 4) \quad (0.4)$$

But, from the right-hand side of the figure, it can be observed that the equation (0.4) doesn't hold true.

Hence, the system T is **not linear**.

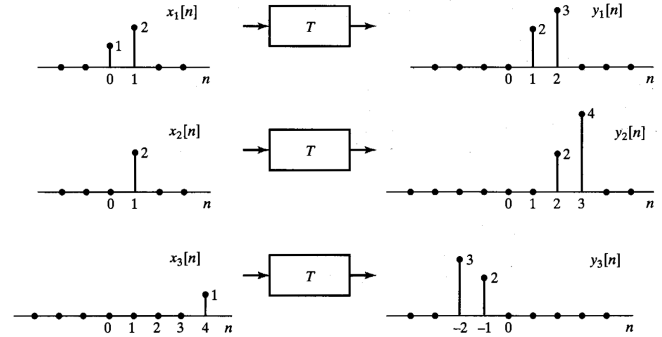


Fig. 0: P2.35-1