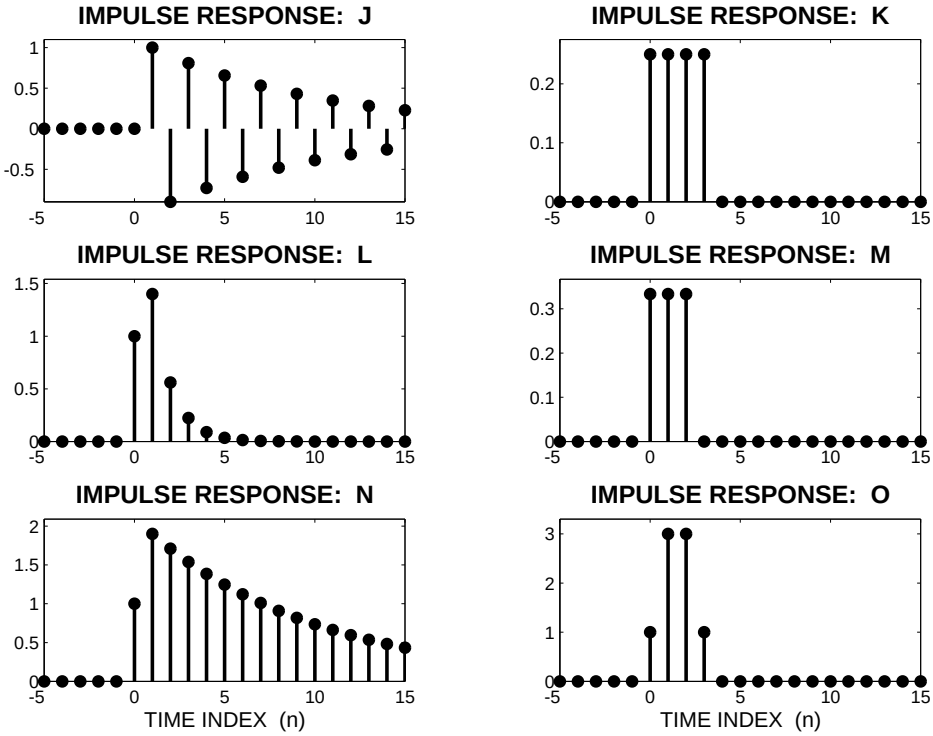
PROBLEM:



For each of the impulse-response plots (J, K, L, M, N, O), determine which one of the following systems (specified by either an $H(z)$ or a difference equation) matches the impulse response.

J:	K:	L:	M:	N:	O:

$$\mathcal{S}_0: \quad y[n] = 0.9y[n-1] + x[n] + x[n-1]$$

$$\mathcal{S}_1: \quad y[n] = 0.4y[n-1] + x[n] + x[n-1]$$

$$\mathcal{S}_2: \quad H(z) = \frac{z^{-1}}{1 + 0.9z^{-1}}$$

$$\mathcal{S}_3: \quad H(z) = \tfrac{1}{3}(1 + z^{-1} + z^{-2})$$

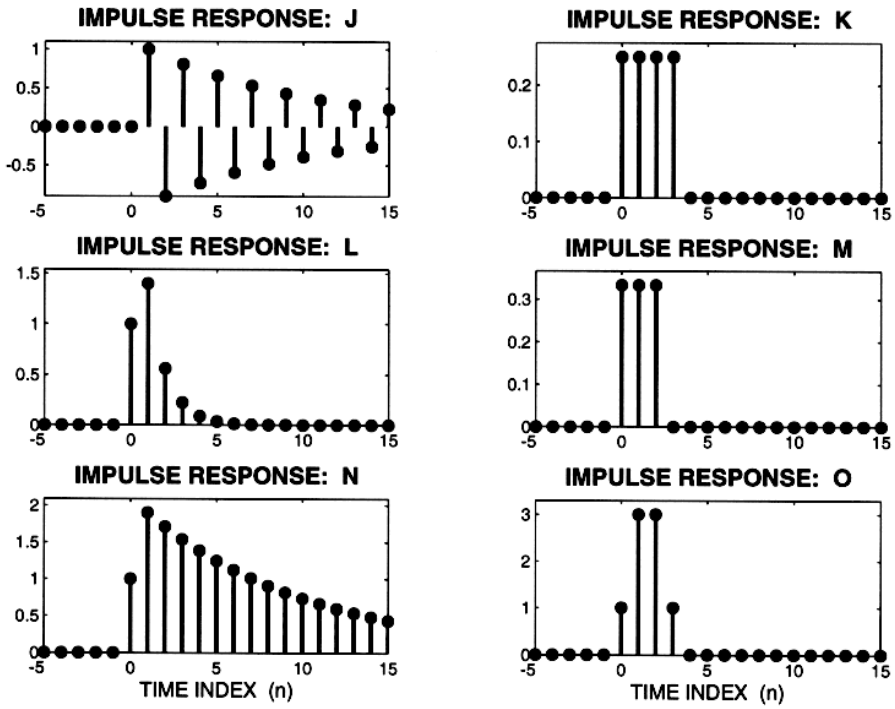
$$\mathcal{S}_4: \quad y[n] = \tfrac{1}{4}x[n] + \tfrac{1}{4}x[n-1] + \tfrac{1}{4}x[n-2] + \tfrac{1}{4}x[n-3]$$

$$\mathcal{S}_5: \quad y[n] = \tfrac{1}{5}\sum_{k=0}^{4} x[n-k]$$

$$\mathcal{S}_6: \quad H(z) = (1 + z^{-1})^3$$

McClellan, Schafer and Yoder, *Signal Processing First*, ISBN 0-13-065562-7.
Prentice Hall, Upper Saddle River, NJ 07458.

SOLUTION



For each of the impulse-response plots (J, K, L, M, N, O), determine which one of the following systems (specified by either an $H(z)$ or a difference equation) matches the impulse response.

J: S_2 | K: S_4 | L: S_1 | M: S_3 | N: S_0 | O: S_6

$\mathcal{S}_0$: $y[n] = 0.9y[n-1] + x[n] + x[n-1]$ $(0.9)^n$

$\mathcal{S}_1$: $y[n] = 0.4y[n-1] + x[n] + x[n-1]$ $(0.4)^n$

$\mathcal{S}_2$: $H(z) = \dfrac{z^{-1}}{1+0.9z^{-1}}$ ← $(-0.9)^n$

$\mathcal{S}_3$: $H(z) = \frac{1}{3}(1 + z^{-1} + z^{-2})$ $L=3$

$\mathcal{S}_4$: $y[n] = \frac{1}{4}x[n] + \frac{1}{4}x[n-1] + \frac{1}{4}x[n-2] + \frac{1}{4}x[n-3]$ $L=4$

$\mathcal{S}_5$: $y[n] = \frac{1}{5}\sum_{k=0}^{4} x[n-k]$ $L=5$

$\mathcal{S}_6$: $H(z) = (1+z^{-1})^3$ $L=4$

$= 1 + 3z^{-1} + 3z^{-2} + z^{-3}$