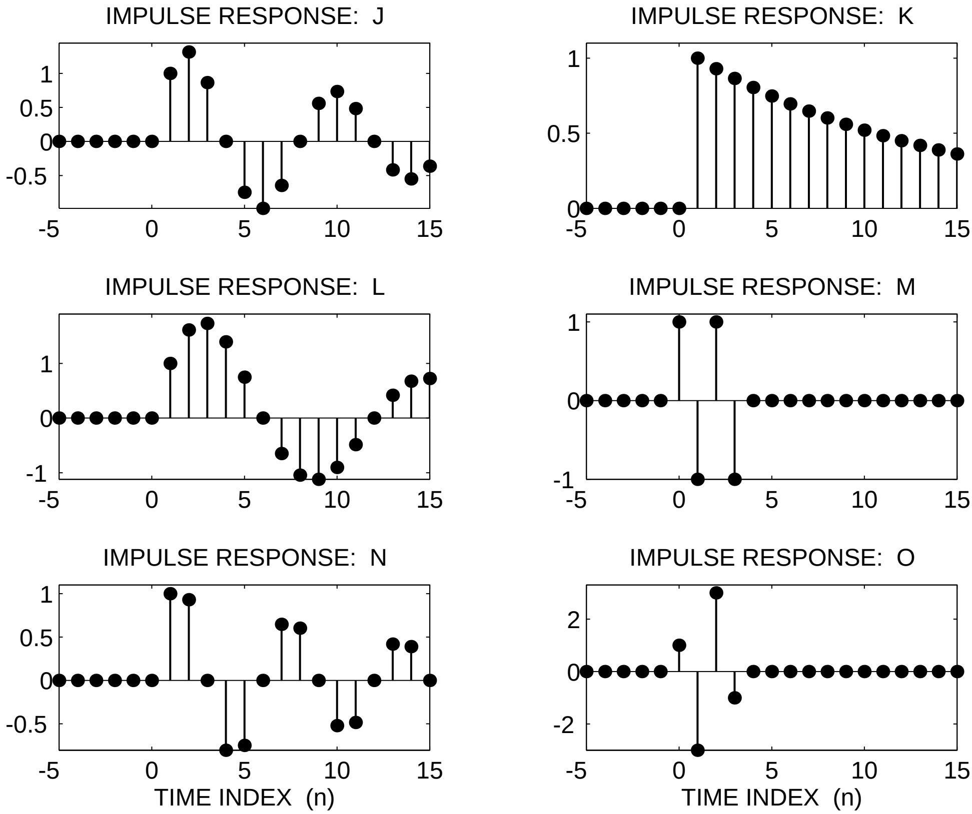
PROBLEM:



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.

$\mathcal{S}_0$: $\quad y[n] = 0.93y[n-1] + x[n-1]$

$\mathcal{S}_1$: $\quad H(z) = \dfrac{z^{-1}}{1 - 1.315z^{-1} + 0.8649z^{-2}}$

$\mathcal{S}_2$: $\quad H(z) = \dfrac{z^{-1}}{1 - 1.61z^{-1} + 0.8649z^{-2}}$

$\mathcal{S}_3$: $\quad H(z) = \dfrac{z^{-1}}{1 - 0.93z^{-1} + 0.8649z^{-2}}$

$\mathcal{S}_4$: $\quad H(z) = (1 - z^{-1})^3$

$\mathcal{S}_5$: $\quad H(z) = 1 - z^{-1} + z^{-2} - z^{-3}$

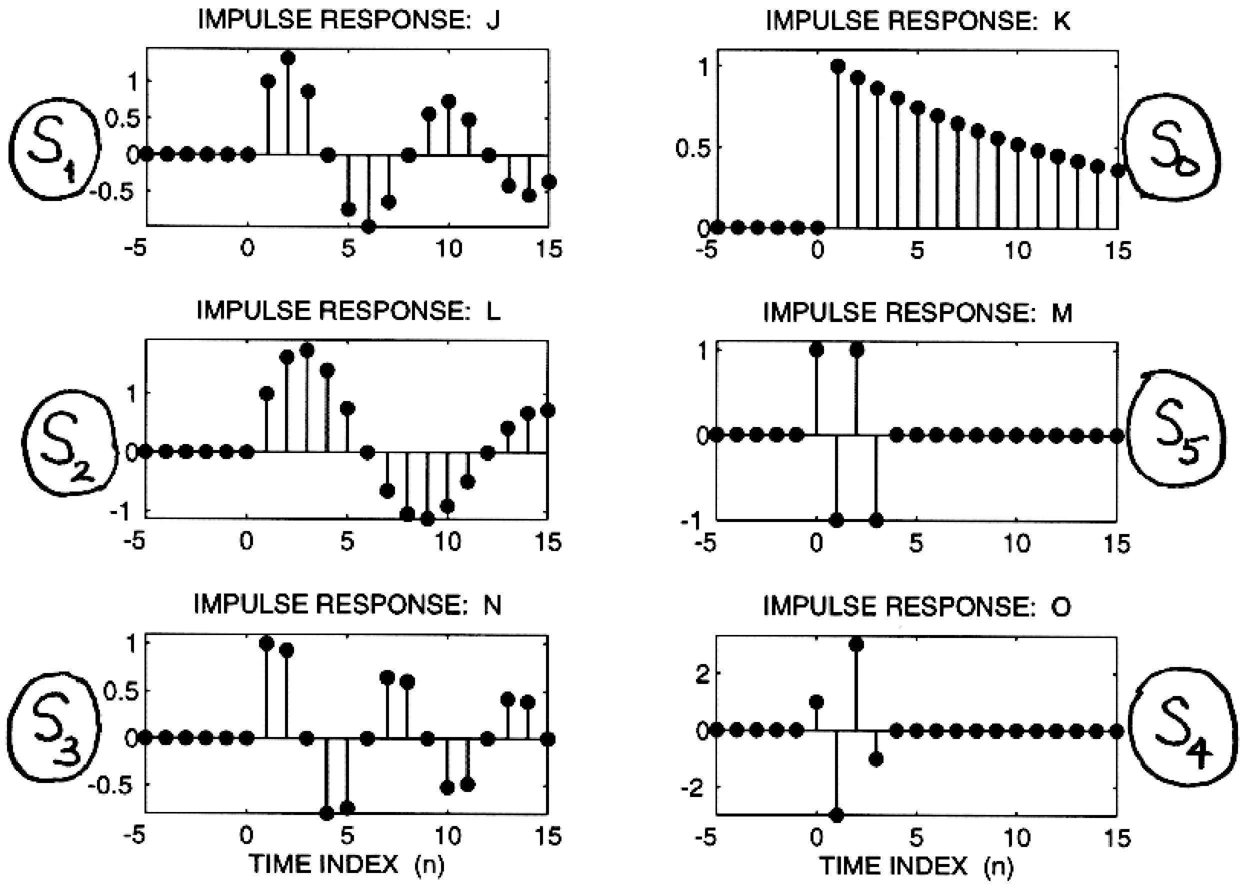
$\mathcal{S}_6$: $\quad y[n] = x[n] - x[n-3]$

$\mathcal{S}_7$: $\quad y[n] = \displaystyle\sum_{k=0}^{3} x[n-k]$

$\mathcal{S}_8$: $\quad y[n] = x[n] + 2x[n-1] + 3x[n-2] + 2x[n-3] + x[n-4]$

McClellan, Schafer and Yoder, *Signal Processing First*, ISBN 0-13-065562-7.

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.

$\mathcal{S}_0$: $y[n] = 0.93y[n-1] + x[n-1]$ $\longrightarrow h[n] = (0.93)^{n-1}$ for $n \geq 1$

$\mathcal{S}_1$: $H(z) = \dfrac{z^{-1}}{1 - 1.315z^{-1} + 0.8649z^{-2}}$ pole angle = 45° $\Rightarrow$ period = 8

$\mathcal{S}_2$: $H(z) = \dfrac{z^{-1}}{1 - 1.61z^{-1} + 0.8649z^{-2}}$ $\rightarrow y[n] = 1.61y[n-1] - 0.865y[n-2] + x[n-1]$
$\Rightarrow y[1] = 1$ & $y[2] = 1.61$

$\mathcal{S}_3$: $H(z) = \dfrac{z^{-1}}{1 - 0.93z^{-1} + 0.8649z^{-2}}$ $\rightarrow$ pole at 60° $\Rightarrow$ period = 6

$\mathcal{S}_4$: $H(z) = (1 - z^{-1})^3 = 1 - 3z^{-1} + 3z^{-2} + z^{-3}$

$\mathcal{S}_5$: $H(z) = 1 - z^{-1} + z^{-2} - z^{-3}$

$\mathcal{S}_6$: $y[n] = x[n] - x[n-3]$ $\rightarrow 1 - z^{-3}$

$\mathcal{S}_7$: $y[n] = \displaystyle\sum_{k=0}^{3} x[n-k]$ $\rightarrow 1 + z^{-1} + z^{-2} + z^{-3}$

$h[n]$ is just the polynomial coeffs.

$\mathcal{S}_8$: $y[n] = x[n] + 2x[n-1] + 3x[n-2] + 2x[n-3] + x[n-4]$

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Prentice Hall, Upper Saddle River, NJ 07458.