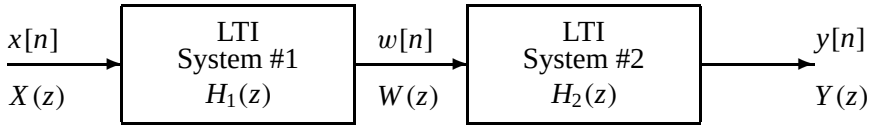
PROBLEM:

Consider the following cascade system:



Suppose that

$$H_1(z) = (1 - jz^{-1})(1 + jz^{-1})(1 + z^{-1}) \quad \text{and} \quad h_2[n] = \delta[n] + \delta[n-4]$$

(a) Determine the system function, $H(z)$, for the overall cascade system (i.e., from input $X(z)$ to output $Y(z)$.)

(b) Determine and plot the impulse response $h[n]$ of the overall cascade system.

(c) Write down the difference equation that relates $y[n]$ to $x[n]$.

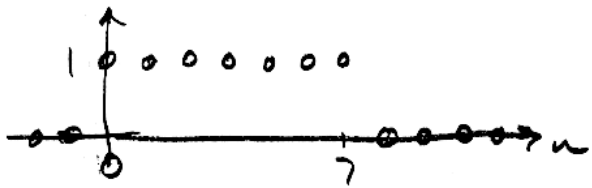
McClellan, Schafer and Yoder, *Signal Processing First*, ISBN 0-13-065562-7.
Prentice Hall, Upper Saddle River, NJ 07458.

SOLUTION

(a) $H(z) = H_1(z)H_2(z) = (1-jz^{-1})(1+jz^{-1})(1+z^{-1})(1+z^{-4})$

$= (1+z^{-1}+z^{-2}+z^{-3})(1+z^{-4}) = \sum_{k=0}^{7} z^{-k}$

(b) $h[n] = \sum_{k=0}^{7} \delta[n-k]$



(c) $y[n] = \sum_{k=0}^{7} x[n-k]$