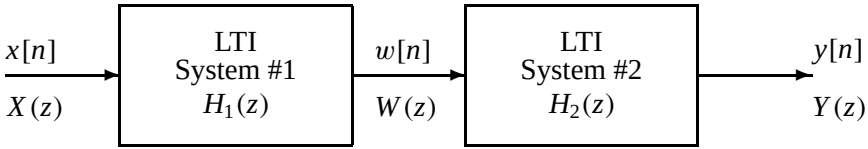
PROBLEM:

Consider the following cascade system:



The system functions for the two systems are

$$H_1(z) = 1 - z^{-1} + z^{-2}$$

and

$$H_2(z) = 1 + 2z^{-1} + 3z^{-2} + 2z^{-3} + z^{-4}$$

(a) Determine the system function $H(z)$ of the overall system from the input $x[n]$ to the output $y[n]$.

(b) Determine the corresponding impulse response of the overall system.

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

SOLUTION

(a) $H(z) = H_1(z)\,H_2(z)$

$$= (1 - z^{-1} + z^{-2})(1 + 2z^{-1} + 3z^{-2} + 2z^{-3} + z^{-4})$$

$$= 1 + z^{-1} + 2z^{-2} + z^{-3} + 2z^{-4} + z^{-5} + z^{-6}$$

(b) Impulse Response is found by taking the coefficients of the polynomial $H(z)$

$$h[n] = \delta[n] + \delta[n-1] + 2\delta[n-2] + \delta[n-3] + 2\delta[n-4] + \delta[n-5] + \delta[n-6]$$