PROBLEM:

A linear time-invariant system has impulse response

$$h[n] = \delta[n] + \delta[n-1] - \delta[n-3].$$

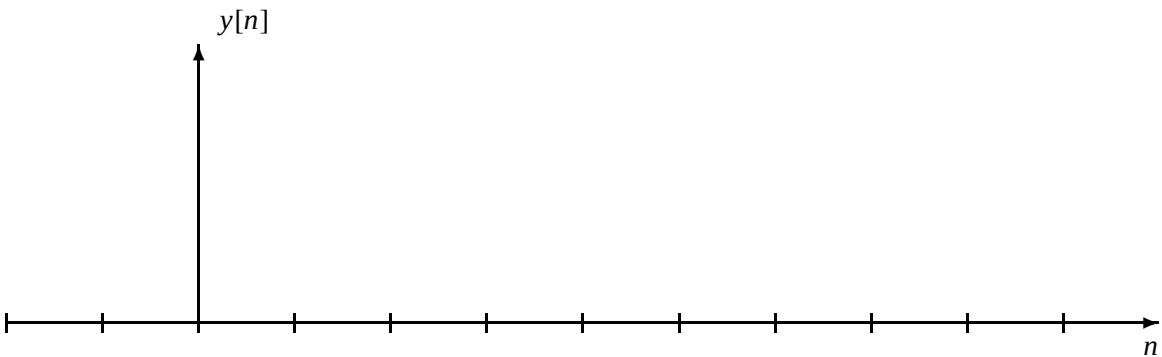
(a) Determinine the difference equation that relates the output $y[n]$ to an input $x[n]$.

(b) Determine the system function $H(z)$ for the system.

(c) Determine the output $y[n]$ of the system when the input is

$$x[n] = \sum_{k=0}^{3} \delta[n-k].$$

Plot the values of $y[n]$ for $-2 \leq n \leq 9$ on the axis below. *Be sure to label your plot carefully.*



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

SOLUTION

A linear time-invariant system has impulse response

$$h[n] = \delta[n] + \delta[n-1] - \delta[n-3].$$

(a) Determinine the difference equation that relates the output $y[n]$ to an input $x[n]$.

$y[n] = x[n] + x[n-1] - x[n-3]$

(b) Determine the system function $H(z)$ for the system.

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

(c) Determine the output $y[n]$ of the system when the input is

$$x[n] = \sum_{k=0}^{3} \delta[n-k].$$

Plot the values of $y[n]$ for $-2 \le n \le 9$ on the axis below. *Be sure to label your plot carefully to receive full credit.*

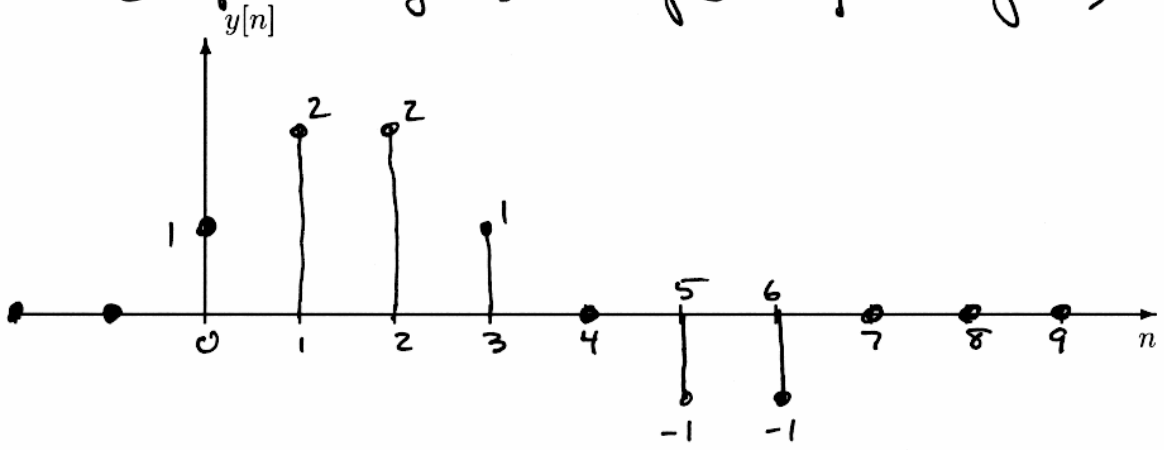
Using z-transforms: $X(z) = 1 + z^{-1} + z^{-2} + z^{-3}$

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

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

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

(you could also use the difference eqn. to compute $y[n]$ sample-by-sample)



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