Name: Solution

EE3221 Digital Signal Processing Homework/Quiz 4 Dr. Prust

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1. (4 pts) Consider a discrete-time LTI system with impulse response

$$h[n] = u[n-1]$$

and input signal

$$x[n] = \{\underline{1}, 1, -2\}$$

The output signal is y[n].

- (a) Find H(z). $u[n] \leftarrow \frac{2}{z-1}$ and delay by 1 introduces a z^{-1} factor $\therefore H(z) = z^{-1} \left(\frac{z}{z-1}\right) = \frac{1}{z-1}$
- (b) Find X(z).

$$X(z) = |+z^{-1} - 2z^{-2} = \frac{z^{2} + z^{-2}}{z^{2}}$$

(c) Using your previous two answers, find an expression for Y(z).

$$y(z) = H(z) X(z)$$

$$= \left(\frac{1}{z-1}\right) \left(\frac{z^2 + z^{-2}}{z^2}\right) = \left(\frac{1}{z-1}\right) \left(\frac{(z+2)(z-1)}{z^2}\right)$$

$$= \frac{z+2}{z^2}$$

(d) Using the inverse Z-transform, find y[n].

$$Y(z) = \frac{z+2}{z^2} = \frac{1}{z} + \frac{z}{z^2}$$

:. $y(n) = S[n-1] + 2 S[n-2]$
= $\{Q, 1, 2\}$