ECE 3510 homework # Z2 Due:

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4/19/22 c

1. Problem 6.3 in the text. Use partial fraction expansions to find the $x(k)$ whose z-transform is

   a) $X(z) = \dfrac{1}{(z-1)\cdot(z-2)}$ b) $X(z) = \dfrac{z}{z^2 - 2\cdot z + 2}$

2. Problem 6.6 in the Bodson text.

3. a) Use partial fraction expansion to find $x(k)$ for the following z-transform: $X(z) = \dfrac{z^2}{(z+1)\cdot\left(z^2 - 1.4\cdot z + 0.98\right)}$

   b) Is the signal bounded? Does it converge? If yes, to what value?

4. Problem 6.8 in the text

homework # Z3 Due:

1. Problem 6.9 in the Bodson text.
2. Problem 6.10 in the text
3. Problem 6.11a) only (NOT b) or c)) in the text.

a) Draw the block diagram of a simple direct implementation of the difference equation.

$$y(k) = 3\cdot x(k) + 2\cdot x(k-1) - x(k-3) - \frac{1}{3}\cdot y(k-1) + \frac{1}{4}\cdot y(k-2)$$

b) Find the $\mathbf{H}(z)$ corresponding to the difference equation above. Show your work.

c) List the poles of $\mathbf{H}(z)$. Indicate multiple poles if there are any.

d) Is this system BIBO stable? Yes No How do you know?

e) Is this an FIR system? Yes No If not, which terms in the difference equation are to blame?

Z2 Answers

1. a) $\left(\frac{1}{2}\cdot\delta(k) - 1 + \frac{1}{2}\cdot 2^k\right)\cdot u(k)$ b) $\left[\left(\sqrt{2}\right)^k\cdot\sin\left(\frac{\pi}{4}\cdot k\right)\right]\cdot u(k)$

2. (6.6) a) $x(k) := -4\cdot\delta(k) + 2 + 2\cdot\sqrt{2}\cdot\cos\left(\frac{\pi}{2}\cdot k + \frac{\pi}{4}\right)$

   $x(0)=0$ $x(1)=0$ $x(2)=0$ $x(3)=4$ $x(4)=4$ $x(5)=0$ $x(6)=0$ $x(7)=4$ $x(8)=4$

3. a) $\left[-0.296\cdot(-1)^k + 0.98^k\cdot\left(0.296\cdot\cos\left(\frac{\pi}{4}\cdot k\right) + 0.71\cdot\sin\left(\frac{\pi}{4}\cdot k\right)\right)\right]\cdot u(k)$

   b) Yes No N/A

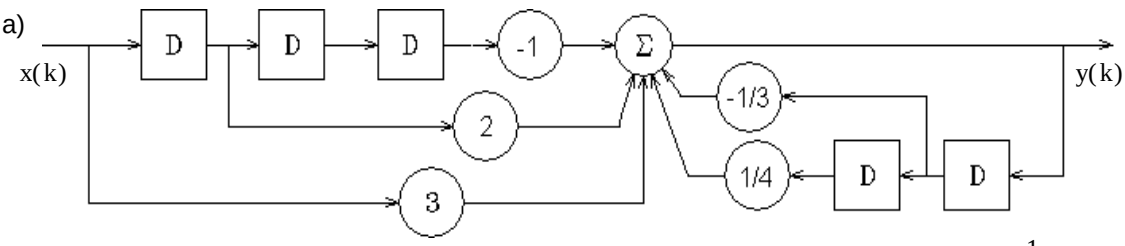
4. (6.8) a) yes b) yes c) no d) yes e) no f) yes

Z3 Answers

1. (6.9) a) $H(z) = \dfrac{z^2}{z^2 - a\cdot z + a^2}$ stable if: $|a| < 1$ b) $H(z) = \dfrac{12\cdot z^2 + 48\cdot z - 3}{z\cdot(2\cdot z - 1)}$ stable

2. (6.10) a) $H(z) = \dfrac{z^2}{z^2 - z - 1}$ unstable b) $\dfrac{1+\sqrt{5}}{2} = 1.618$ 3. (6.11) a) $y_{ss} = -2$

4. a)



b) $\dfrac{3\cdot z^3 + 2\cdot z - 1}{z\cdot\left(z^2 + \frac{1}{3}\cdot z - \frac{1}{4}\right)}$

c) $0.036 \quad -0.694$ d) YES, All poles are inside the unit circle e) NO $-\frac{1}{3}\cdot y(k-1)$ and $\frac{1}{4}\cdot y(k-2)$