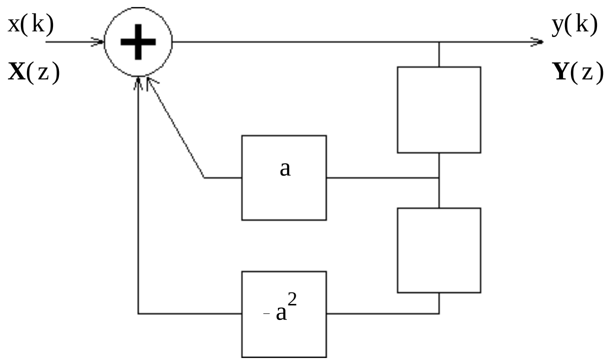
Name______________________ ECE 3510 Homework Z3 d

May be handed in Sat, 4/27

1. Problem 6.9 in the text a) Find the transfer function $\mathbf{H}(z)=\mathbf{Y}(z)/\mathbf{X}(z)$ and a condition on "a" such that the system shown is BIBO stable.

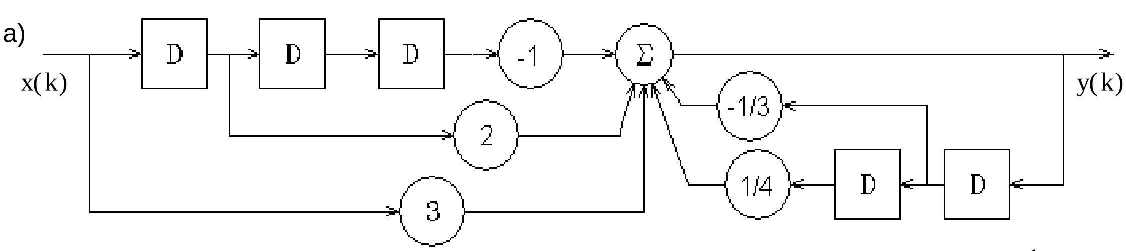


Answers

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

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

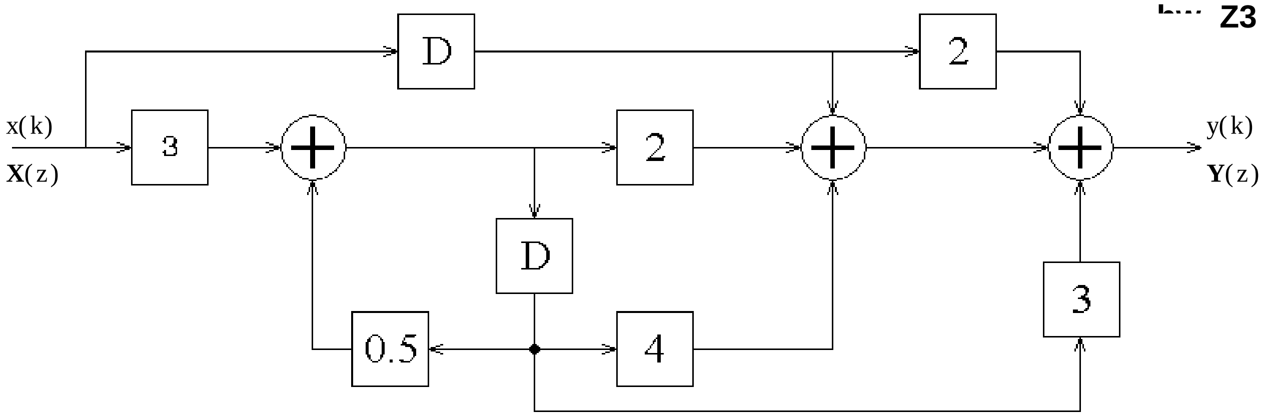
4. a)



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

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

1. b) Find the transfer function $\mathbf{H}(z)=\mathbf{Y}(z)/\mathbf{X}(z)$ and indicate whether the system below is BIBO stable.



2. Problem 6.10 in the text
   a) Find the transfer function $\mathbf{H}(z)=\mathbf{Y}(z)/\mathbf{X}(z)$ corresponding to the difference equation

   $$y(k) = y(k-1) + y(k-2) + x(k)$$

   Is the system stable? Yes No

   b) Let the input be $x(k)=\delta(k)$, the discrete-time impulse. Show that the response of the system of part (a) with zero initial conditions is such that $\lim_{k \to \infty} \frac{y(k)}{y(k-1)}$ exists, and give its value.

3. Problem 6.11 a) in the text. a) Find the steady-state response of $\mathbf{H}(z)$, below, if the input is: $x(k) = 3 \cdot u(k)$

   a) $\mathbf{H}(z) = \dfrac{z-2}{z^4 \cdot (z+0.5)}$

4. 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?