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ASSIGNMENT-1

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Ans 1

(a) $$H(z) = \frac{6z(z^2-4)}{5z^3-4.5z^2+1.4z+0.8}$$

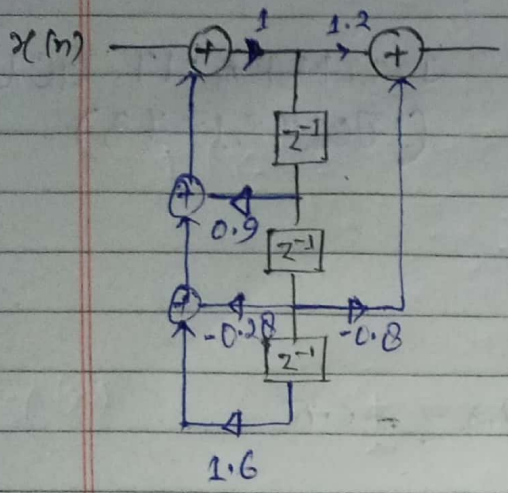
$$= \frac{6z(z^2-4)}{z^3(5-4.5z^{-1}+1.4z^{-2}-0.8z^{-3})}$$

$$= \frac{6(1-4z^{-2})}{(5-4.5z^{-1}+1.4z^{-2}-0.8z^{-3})}$$

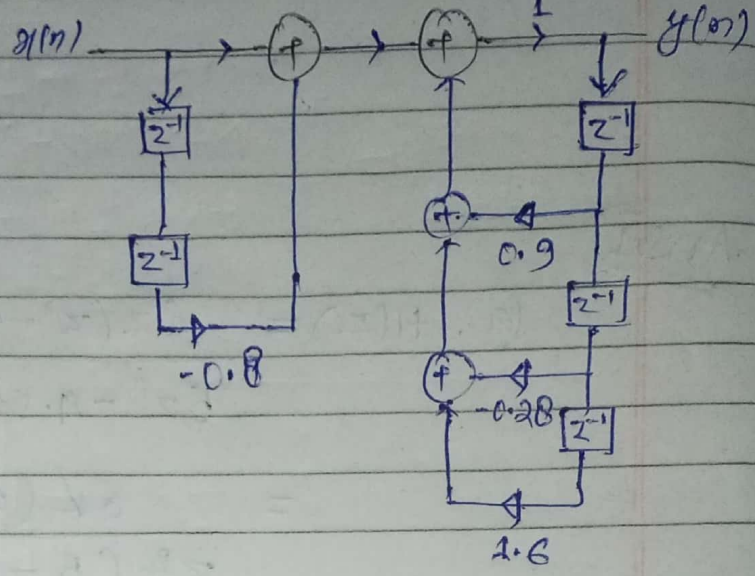
$$= \frac{1.2-0.8z^{-2}}{\left(1-\frac{4.5}{5}z^{-1}+\frac{1.4}{5}z^{-2}-\frac{0.8}{0.5}z^{-3}\right)}$$

$$= \frac{1.2-0.8z^{-2}}{(1-0.9z^{-1}+0.28z^{-2}-1.6z^{-3})}$$

direct form II



direct form I



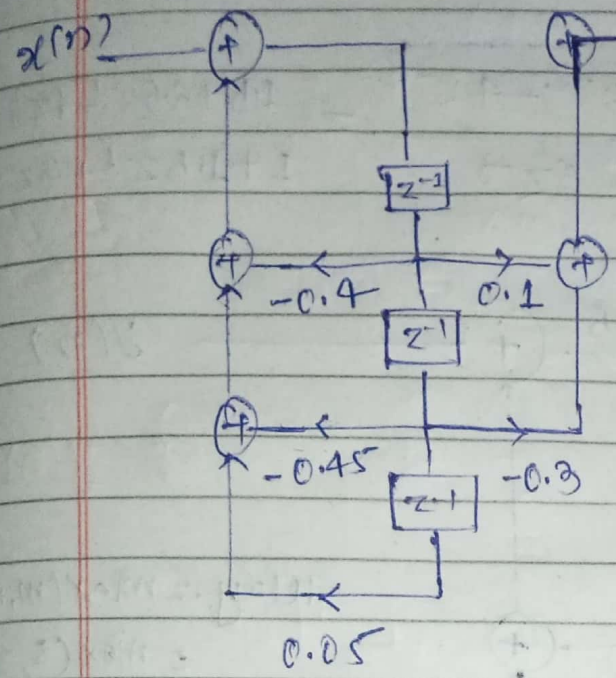
(b) $H(z) = \dfrac{z^{-1} - 3z^{-2}}{(10 - z^{-1})(1 + 0.5z^{-1} + 0.5z^{-2})}$

$= \dfrac{z^{-1} - 3z^{-2}}{10 + 5z^{-1} - z^{-1} + 5z^{-2} - 0.5z^{-2} - 0.5z^{-3}}$

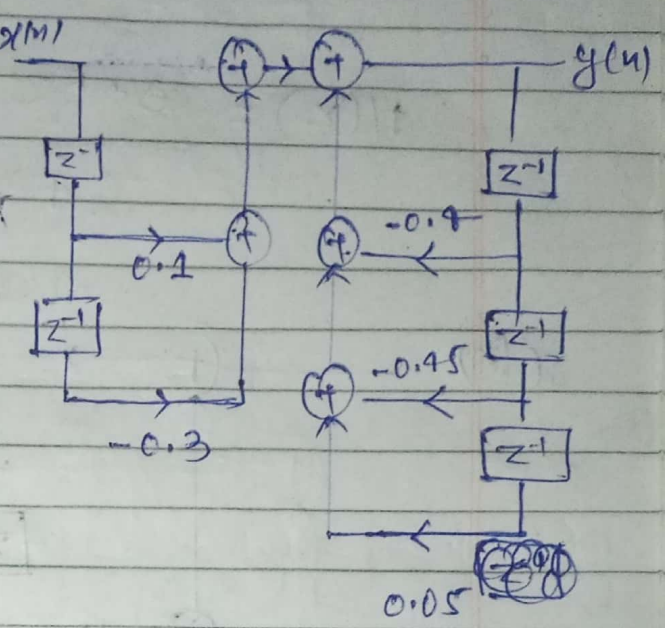
$= \dfrac{z^{-1} - 3z^{-2}}{10 + 4z^{-1} + 4.5z^{-2} - 0.5z^{-3}}$

$= \dfrac{0.1z^{-1} - 0.3z^{-2}}{1 + 0.4z^{-1} + 0.45z^{-2} - 0.05z^{-3}}$

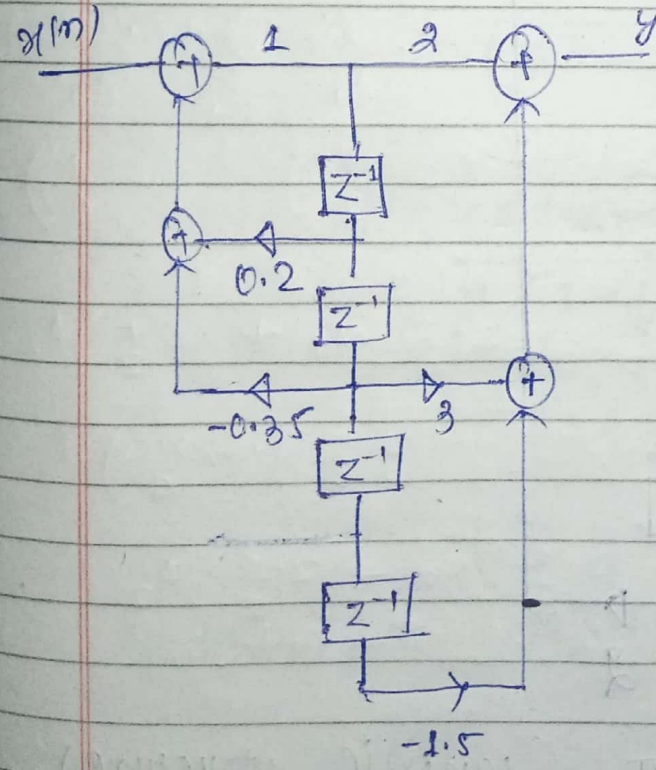
direct form II



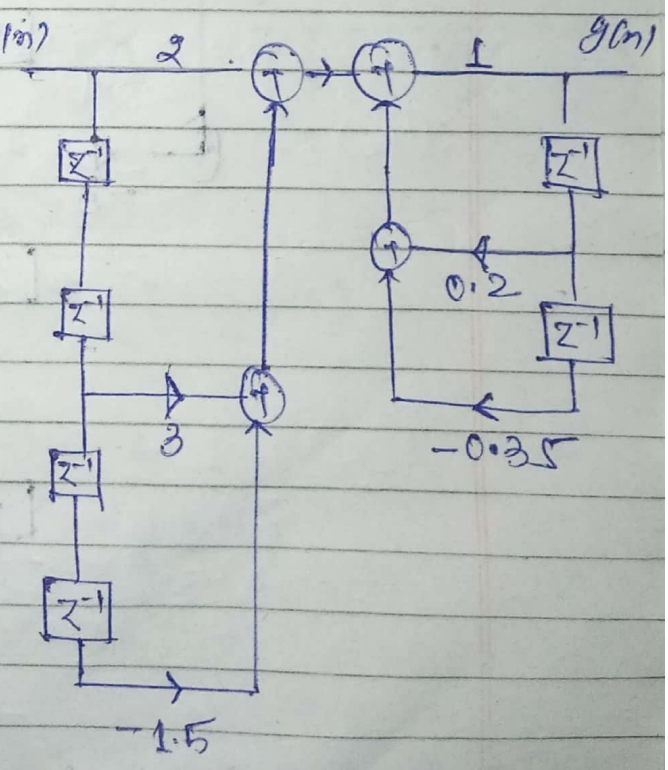
direct form I



(c) $$H(z) = \frac{2 + 3z^{-2} - 1.5z^{-4}}{1 - 0.2z^{-1} + 0.35z^{-2}}$$



direct form II

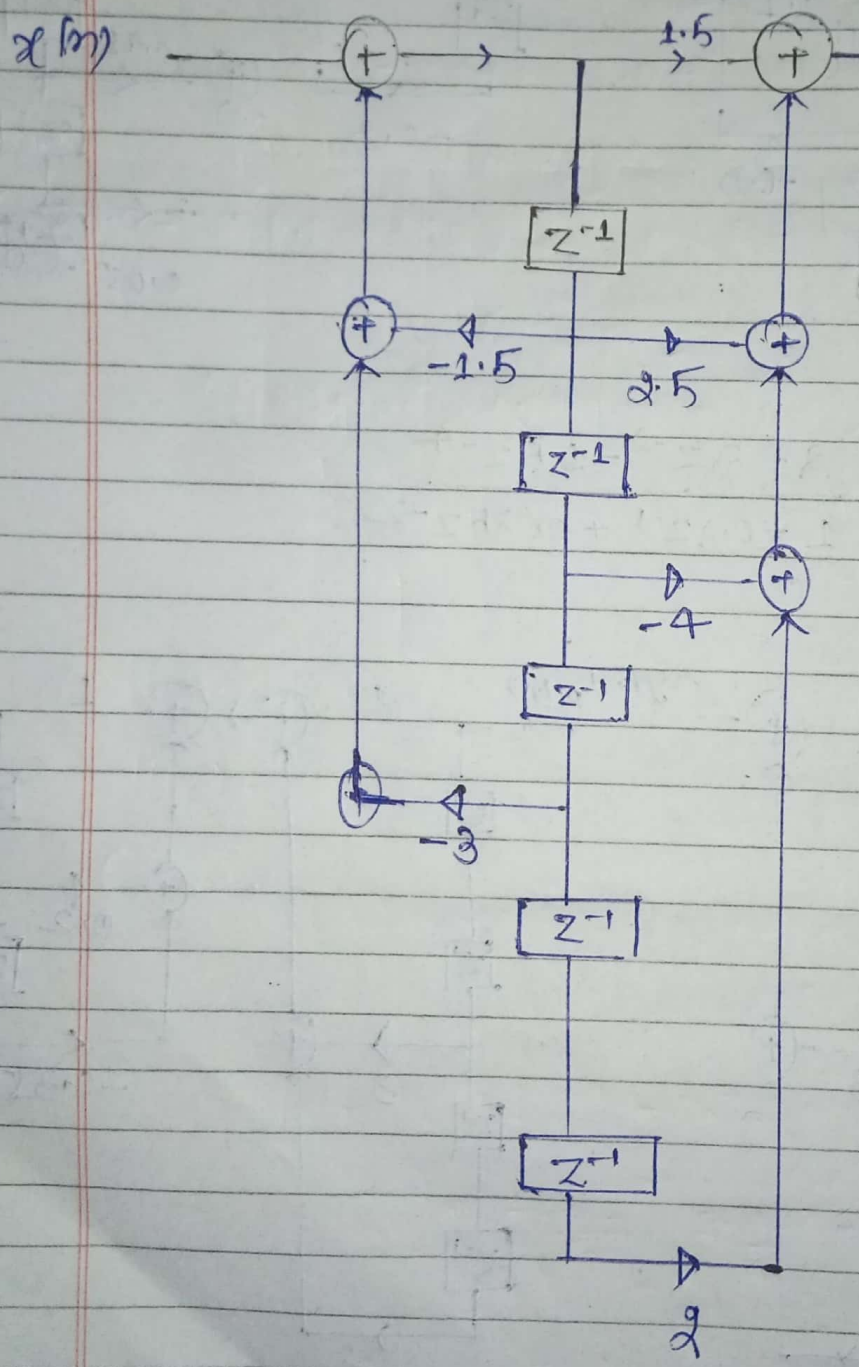


direct form I

canonic - no. of delay element equal to order of difference equation

Ans-2

$$H(z) = \frac{3+5z^{-1}-8z^{-2}+4z^{-5}}{2+3z^{-1}+6z^{-3}} = \frac{1.5+2.5z^{-1}-4z^{-2}+2z^{-5}}{1+1.5z^{-1}+3z^{-3}}$$



delay = max(M, N)
= max (5, 3)
= 5

order = 5

direct form II (canonic structure)

Ans-3

(a) $y(n) = \frac{3}{4} y(n-1) - \frac{1}{8} y(n-2) + x(n) + \frac{1}{3} x(n-1)$

take z transform

$$Y(z) = \frac{3}{4} z^{-1} Y(z) - \frac{1}{8} z^{-2} Y(z) + X(z) + \frac{1}{3} z^{-1} X(z)$$

$$Y(z)\left[1 - \frac{3}{4} z^{-1} + \frac{1}{8} z^{-2}\right] = X(z)\left[1 + \frac{1}{3} z^{-1}\right]$$

$$H(z) = \frac{Y(z)}{X(z)} = \frac{\left(1 + \frac{1}{3} z^{-1}\right)}{\left(1 - \frac{3}{4} z^{-1} + \frac{1}{8} z^{-2}\right)}$$

multiply and divide by z^2

$$= \frac{\left(z^2 + \frac{1}{3} z\right)}{\left(z^2 - \frac{3}{4} z + \frac{1}{8}\right)} = \frac{z\left(z + \frac{1}{3}\right)}{\left(z - \frac{1}{2}\right)\left(z - \frac{1}{4}\right)}$$

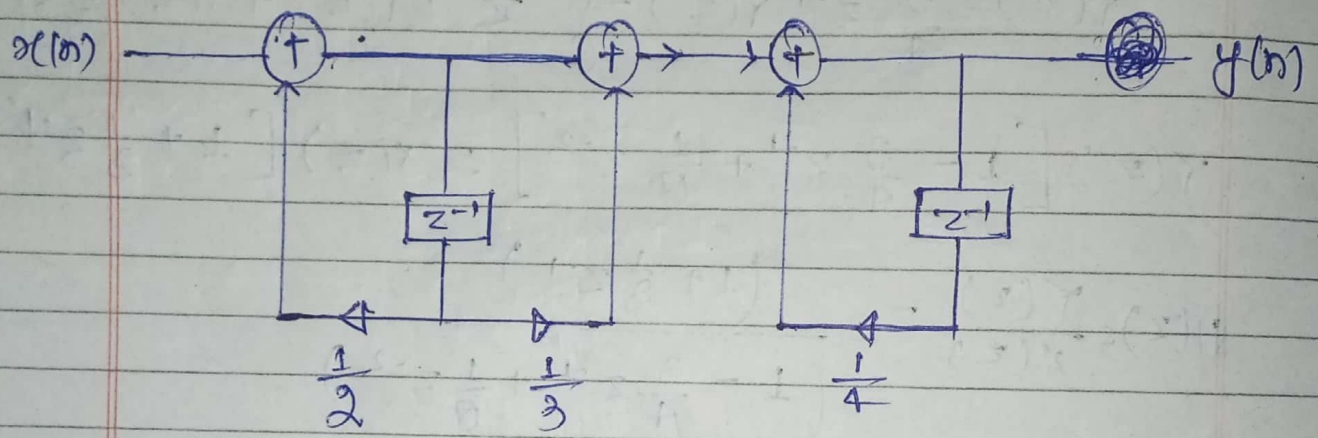
$$= \frac{z \times z\left(1 + \frac{1}{3} z^{-1}\right)}{z\left(1 - \frac{1}{2} z^{-1}\right) \times z\left(1 - \frac{1}{4} z^{-1}\right)}$$

$$= \frac{\left(1 + \frac{1}{3} z^{-1}\right) \times 1}{\underbrace{\left(1 - \frac{1}{2} z^{-1}\right)}_{H_1(z)} \underbrace{\left(1 - \frac{1}{4} z^{-1}\right)}_{H_2(z)}}$$

$$H(z) = H_1(z) \cdot H_2(z)$$

$$H_1(z) = \frac{\left(1 + \frac{1}{8}z^{-1}\right)}{\left(1 + \frac{1}{2}z^{-1}\right)}$$

$$H_2(z) = \frac{1}{\left(1 - \frac{1}{4}z^{-1}\right)}$$



cascade

$$H(z) = \frac{z^2 + \frac{1}{3}z}{\left(z - \frac{1}{2}\right)\left(z - \frac{1}{4}\right)} = \frac{A_1}{\left(z - \frac{1}{2}\right)} + \frac{A_2}{\left(z - \frac{1}{4}\right)}$$

$$= \frac{\left(z - \frac{1}{4}\right)A_1 + \left(z - \frac{1}{2}\right)A_2}{\left(z - \frac{1}{2}\right)\left(z - \frac{1}{4}\right)}$$

$$= z^2 + \frac{1}{3}z = \left(z - \frac{1}{4}\right)A_1 + \left(z - \frac{1}{2}\right)A_2$$

put $z = \frac{1}{4}$

$$\frac{1}{16} + \frac{1}{12} = \left(\frac{1}{4} - \frac{1}{2}\right) A_2$$

$$\frac{7}{48} = \left(\frac{2-4}{8}\right) A_2$$

$$\frac{7}{6} = -2A_2 \qquad \boxed{A_2 = -\frac{7}{12}}$$

put $z = \frac{1}{2}$

$$\frac{1}{4} + \frac{1}{6} = \left(\frac{1}{2} - \frac{1}{4}\right) A_1$$

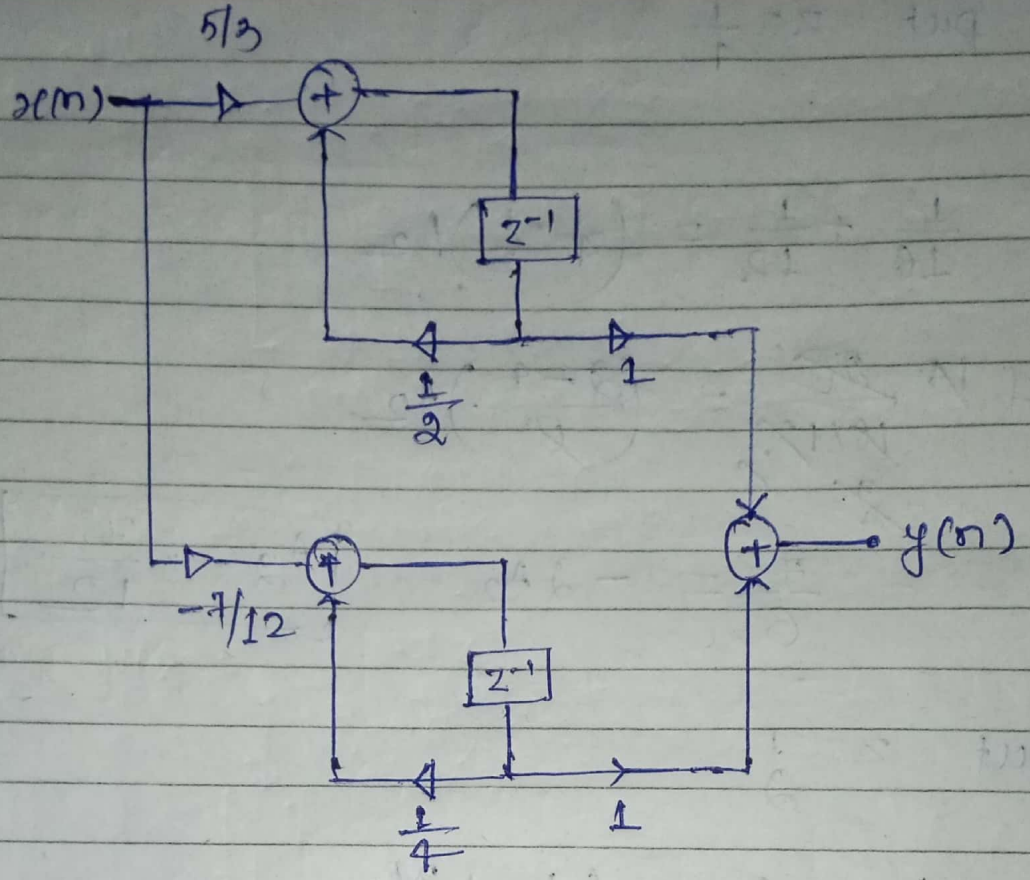
$$\frac{10}{24} = \left(\frac{4-2}{8}\right) A_1$$

$$\frac{10}{3} = 2A_1 \qquad \boxed{A_1 = \frac{5}{3}}$$

$$H(z) = \frac{5}{3} \cdot \frac{1}{\left(z - \frac{1}{2}\right)} - \frac{7}{12} \cdot \frac{1}{\left(z - \frac{1}{4}\right)}$$

$$= \frac{5}{3} \frac{z^{-1}}{\left(1 - \frac{1}{2}z^{-1}\right)} - \frac{7}{12} \frac{z^{-1}}{\left(1 - \frac{1}{4}z^{-1}\right)}$$

NOTE:- It can be solved by assuming $\frac{H(z)}{z}$.



Parallel

(b) $y(n) = -0.1\, y(n-1) + 0.72\, y(n-2) + 0.7x(n)$

take z-transform

$$Y(z) = -0.1\, z^{-1} Y(z) + 0.72\, z^{-2} Y(z) + 0.7\, X(z)$$

$$Y(z)\left[1 + 0.1z^{-1} - 0.72z^{-2}\right] = 0.7\, X(z)$$

$$H(z) = \frac{Y(z)}{X(z)} = \frac{0.7}{1 + 0.1z^{-1} - 0.72z^{-2}}$$

$$= \frac{0.7z^2}{z^2 + 0.1z - 0.72}$$

$$= \frac{0.7z^2}{z^2 + 0.9z - 0.8z - 0.72}$$

$$= \frac{0.7z^2}{z(z+0.9) - 0.8(z+0.9)}$$

$$= \frac{0.7z^2}{(z-0.8)(z+0.9)}$$

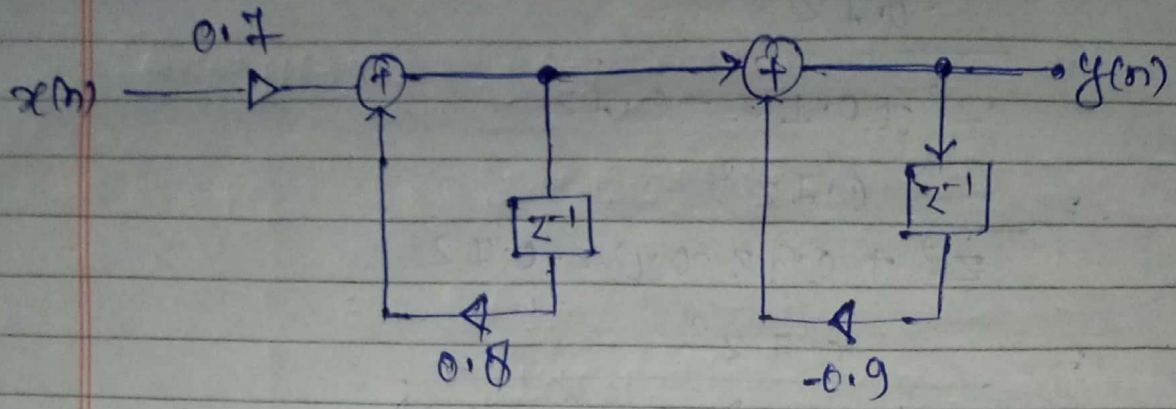
$$= \frac{0.7z^2}{z^2(1-0.8z^{-1})(1+0.9z^{-1})}$$

$$= 0.7 \times \underbrace{\frac{1}{(1-0.8z^{-1})}}_{H_1(z)} \times \underbrace{\frac{1}{(1+0.9z^{-1})}}_{H_2(z)}$$

$$H(z) = H_1(z) \cdot H_2(z)$$

$$H_1(z) = \frac{1}{(1-0.8z^{-1})}$$

$$H_2(z) = \frac{1}{(1+0.9z^{-1})}$$



[cascade]

$$H(z) = \frac{0.7z^2}{(z-0.8)(z+0.9)}$$

$$= \frac{A_1}{(z-0.8)} + \frac{A_2}{(z+0.9)}$$

$$\frac{0.7z^2}{(z-0.8)(z+0.9)} = \frac{(z+0.9)A_1 + (z-0.8)A_2}{(z-0.8)(z+0.9)}$$

$$0.7z^2 = (z+0.9)A_1 + (z-0.8)A_2$$

put $z = -0.9$

$$0.7 \times (-0.9)^2 = (-0.9-0.8)A_2$$

$$0.567 = -1.7A_2$$

$$\boxed{A_2 = -0.33}$$

Parallel II → assuming $\frac{H(z)}{z}$

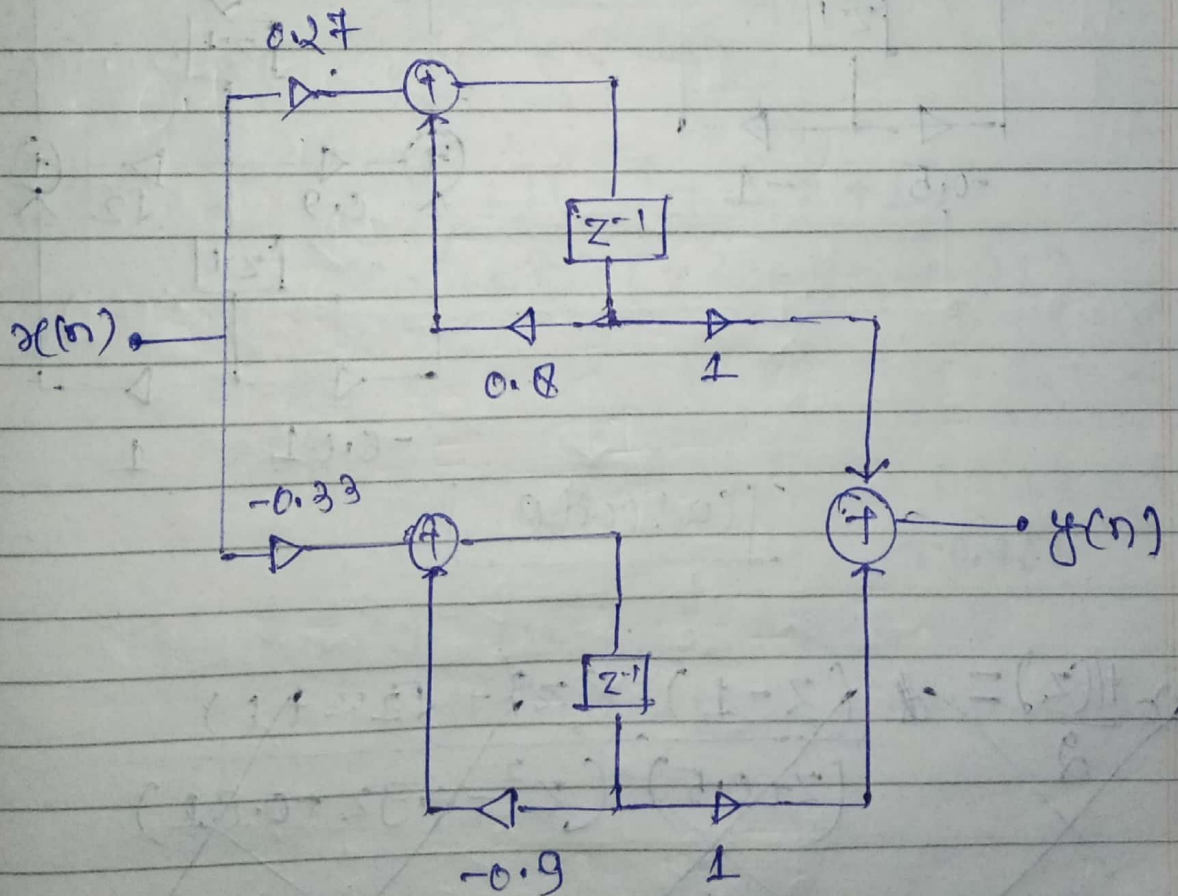
put $z = 0.8$

$$(1.7)A_1 = 0.17(0.8)^2$$

$$\boxed{A_1 = 0.27}$$

$$H(z) = 0.27 \times \frac{1}{(z-0.8)} - 0.33 \times \frac{1}{(z+0.9)}$$

$$= 0.27 \times \frac{z^{-1}}{(1-0.8z^{-1})} - 0.33 \times \frac{1}{(1+0.9z^{-1})}$$

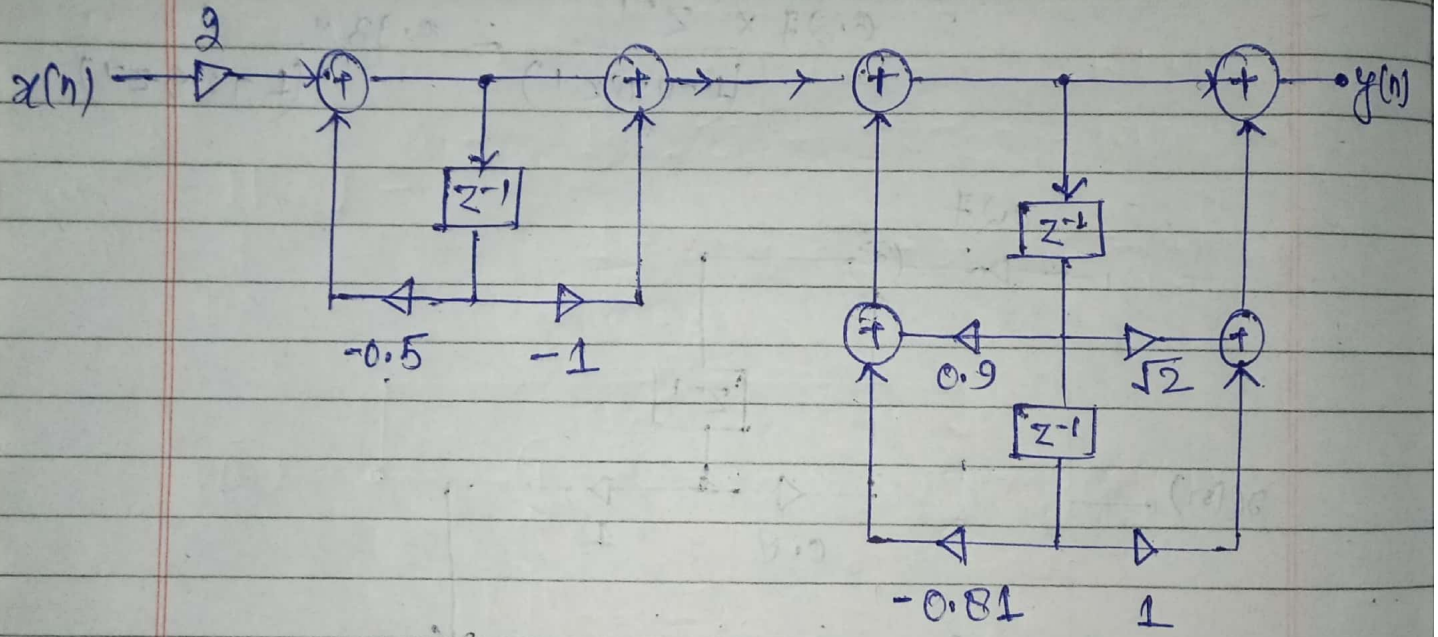


Parallel

(c) $$H(z) = \frac{2(1-z^{-1})(1+\sqrt{2}z^{-1}+z^{-2})}{(1+0.5z^{-1})(1-0.9z^{-1}+0.81z^{-2})}$$

$$= \frac{2(1-z^{-1})(1+\sqrt{2}z^{-1}+z^{-2})}{(1+0.5z^{-1})(1-0.9z^{-1}+0.81z^{-2})}$$

$$= 2 \cdot H_1(z) \cdot H_2(z)$$



Cascade

$$F(z) = \frac{H(z)}{2} = \frac{(z-1)(z^2+\sqrt{2}z+1)}{(z+0.5)(z^2-0.9z+0.81)}$$

$$F(z) = \frac{A_1}{(z+0.5)} + \frac{A_2}{(z^2-0.9z+0.81)}$$

$$= A_1(z^2 - 0.9z + 0.81) + A_2(z + 0.5)$$

$(z+1)(z^2+\sqrt{2}z+1)$

put $z = -0.5$

$(0.5+1)[(-0.5)^2 + \sqrt{2}\times(-0.5) + 1]$

$= A_1[(-0.5)^2 + 0.9\times 0.5 + 0.81]$

$(-0.5)[0.25 - 0.707 + 1] = A_1[0.25 + 0.45 + 0.81]$

$-0.2715 = A_1[1.51]$

$A_1 = -0.18$

$$H(z) = \frac{2(z-1)(z^2+\sqrt{2}z+1)}{(z+0.5)(z^2-0.9z+0.81)}$$

$$= \frac{2[z^3 + \sqrt{2}z^2 - z^2 + z - \sqrt{2}z - 1]}{z^3 - 0.9z^2 + 0.5z^2 + 0.81z - 4.5z + 0.405}$$

$$= \frac{2z^3 + 0.83z^2 - 0.83z - 2}{z^3 - 0.4z^2 + 3.69z + 0.405}$$

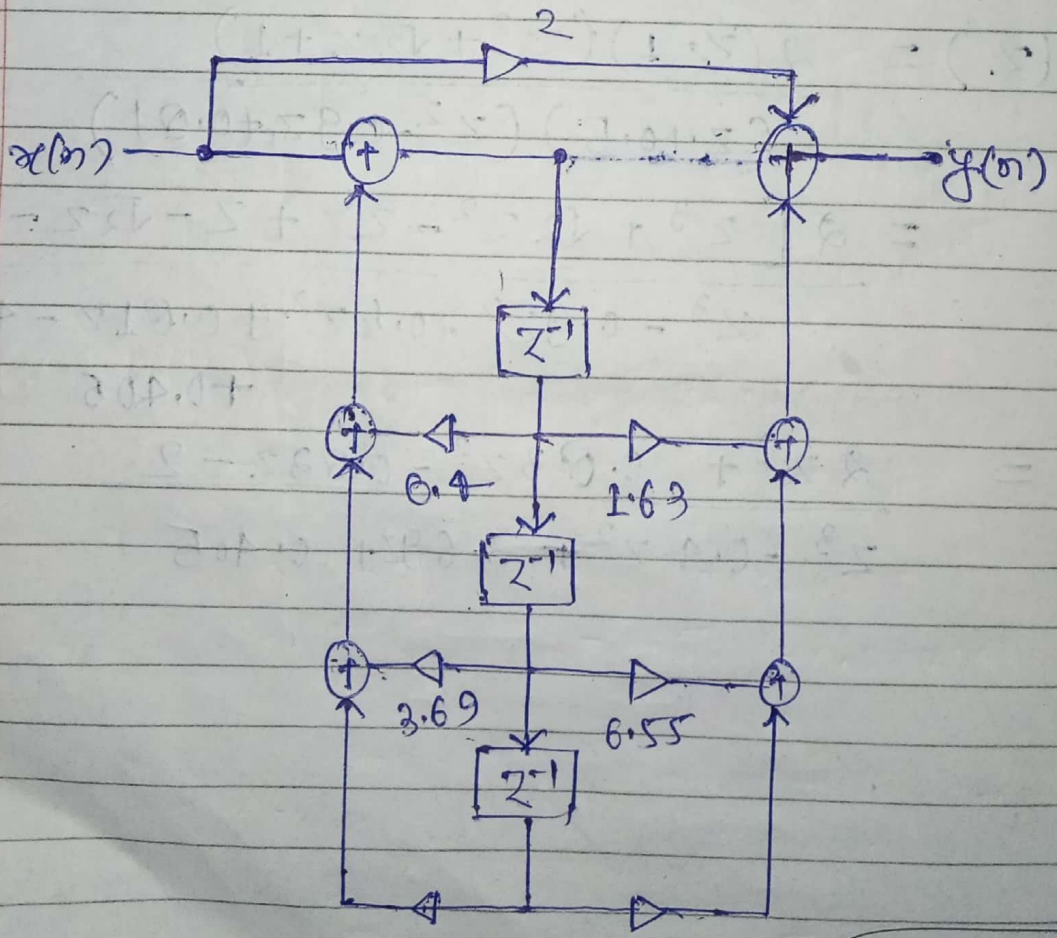
$$z^3 + 0.4z^2 - 3.69z + 0.405 \;\overline{)\; 2z^3 + 0.83z^2 - 0.83z - 2 \;(\; 2}$$

$$\underline{2z^3 - 0.8z^2 - 7.38z - 0.81}$$

$$1.63z^2 + 6.55z - 1.19$$

$$H(z) = 2 + \frac{1.63z^2 + 6.55z - 1.19}{z^3 - 0.4z^2 - 3.69z + 0.405}$$

$$= 2 + \frac{1.63z^{-1} + 6.55z^{-2} - 1.19z^{-3}}{1 - 0.4z^{-1} - 3.69z^{-2} + 0.405z^{-3}}$$



Parallel

(4) $y(n) = \frac{1}{2} y(n-1) + \frac{1}{4} y(n-2) + x(n) + x(n-1)$

Take z-transform

$$Y(z) = \frac{1}{2} z^{-1} Y(z) + \frac{1}{4} z^{-2} Y(z) + X(z) + z^{-1} X(z)$$

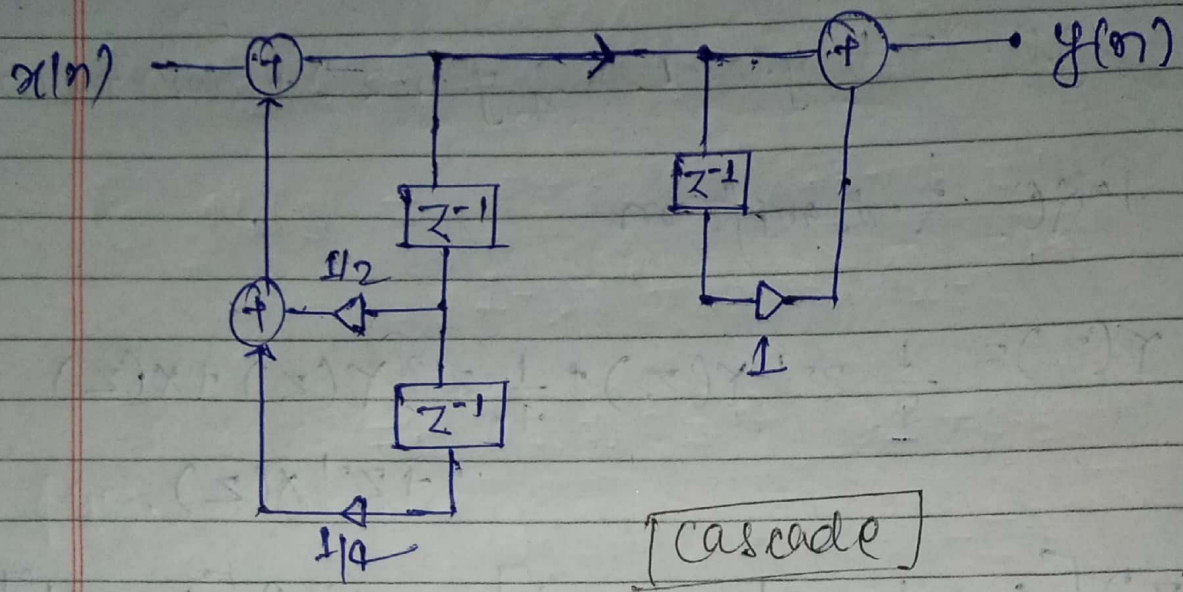
$$Y(z)\left[1 - \frac{1}{2} z^{-1} - \frac{1}{4} z^{-2}\right] = X(z)\left[1 + z^{-1}\right]$$

$$H(z) = \frac{(1 + z^{-1})}{\left(1 - \frac{1}{2} z^{-1} - \frac{1}{4} z^{-2}\right)}$$

$$= \frac{(\quad)}{z^2(\quad)}$$ multiply & divide by z^2

$$H(z) = \frac{z^2 + z}{\left(z^2 - \frac{1}{2} z - \frac{1}{4}\right)} \qquad \frac{z(z+1)}{\left(z^2 - \frac{1}{2} z - \frac{1}{4}\right)}$$

$$= \underbrace{\frac{1}{\left(1 - \frac{1}{2} z^{-1} - \frac{1}{4} z^{-2}\right)}}_{H_1(z)} \times \underbrace{\frac{(1 + z^{-1})}{1}}_{H_2(z)}$$



cascade

Method-I

$$H(z) = \frac{z^2+z}{(z^2-0.5z-0.25)}$$

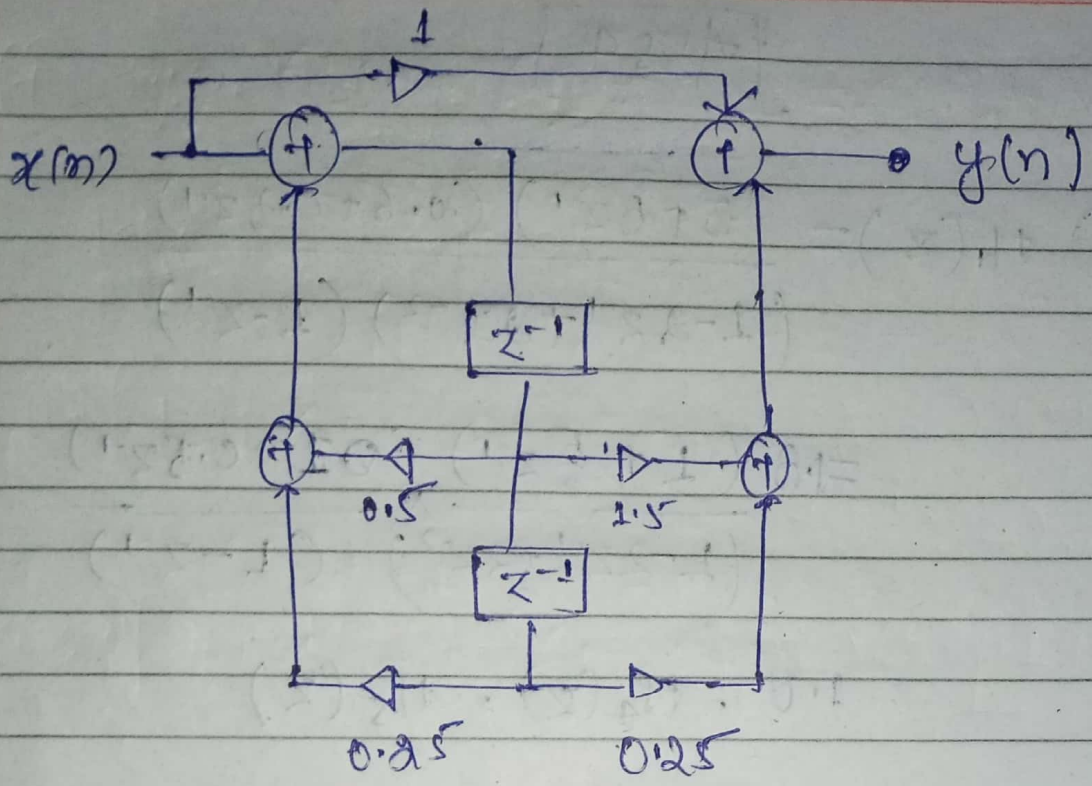
$$z^2-0.5z-0.25 \;\overline{)\; z^2+z \;(\; 1}$$

$$z^2-0.5z-0.25$$

$$1.5z+0.25$$

$$H(z) = 1 + \frac{1.5z+0.25}{z^2-0.5z-0.25}$$

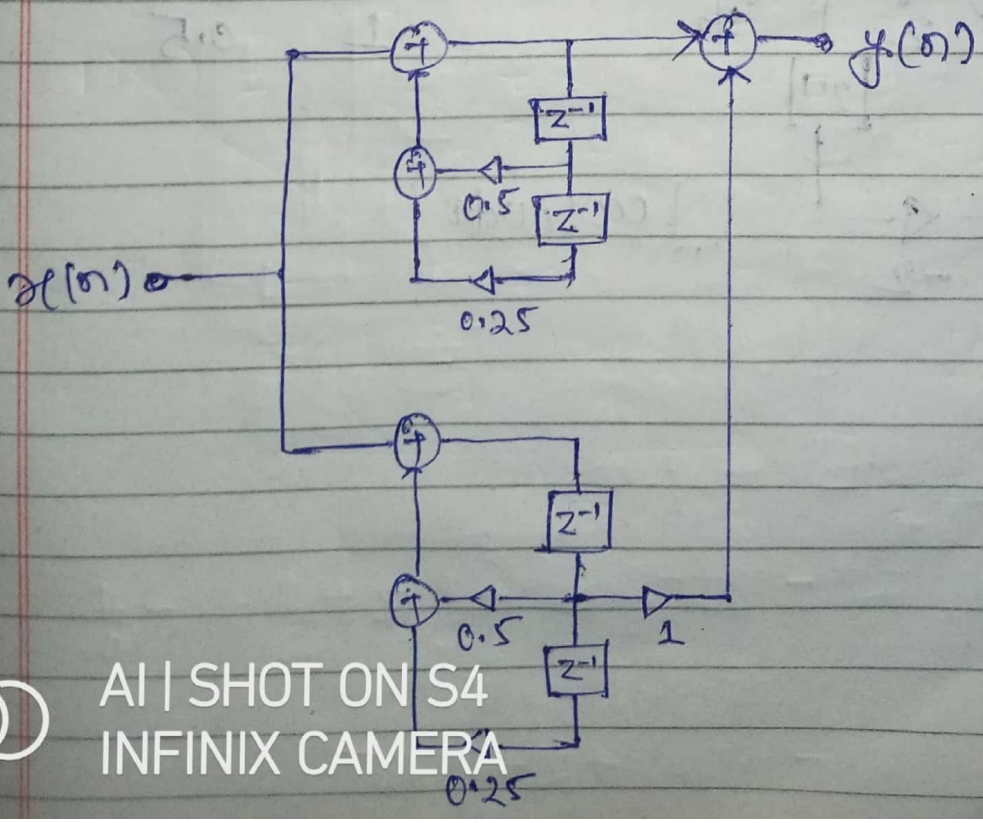
$$= 1 + \frac{(1.5z^{-1}+0.25z^{-2})}{(1-0.5z^{-1}-0.25z^{-2})}$$



Method II

OR

$$H(z) = \frac{1}{\left(1 - \frac{1}{2}z^{-1} - \frac{1}{4}z^{-2}\right)} + \frac{z^{-1}}{\left(1 - \frac{1}{2}z^{-1} - \frac{1}{4}z^{-2}\right)}$$

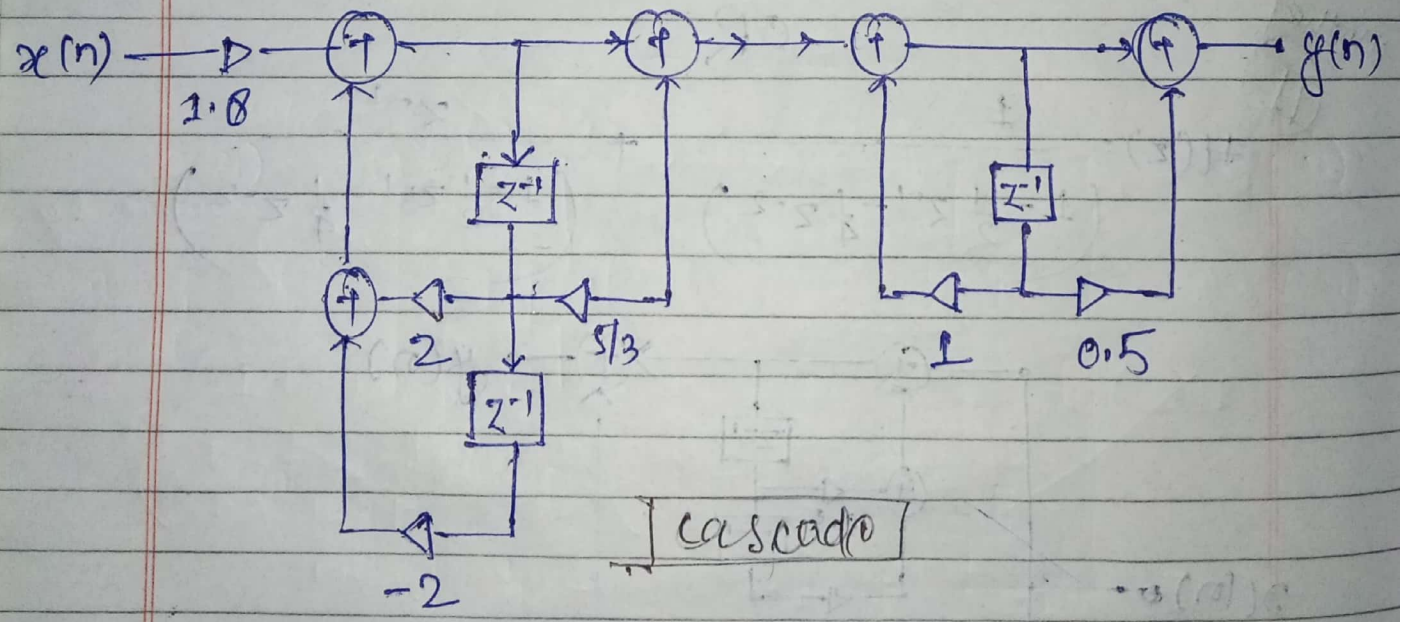


Ans 4

(a) $$H_1(z) = \frac{(3+5z^{-1})(0.6+0.3z^{-1})}{(1-2z^{-1}+2z^{-2})(1-z^{-1})}$$

$$= 1.8 \frac{\left(1+\frac{5}{3}z^{-1}\right)(0.1+0.5z^{-1})}{(1-2z^{-1}+2z^{-2})(1-z^{-1})}$$

$$= 1.8 \cdot H_4(z) \cdot H_5(z)$$



cascade

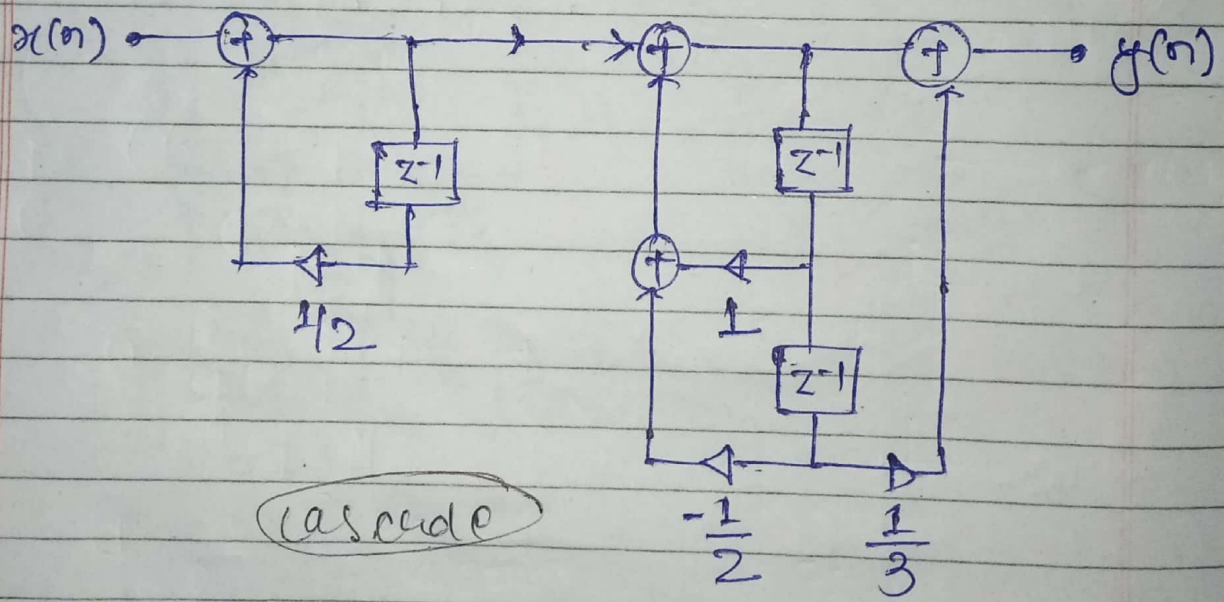
Parallel

(b) $H_2(z) = \dfrac{z\left(z+\frac{1}{2}\right)\left(z^2+\frac{1}{3}\right)}{\left(z-\frac{1}{2}\right)\left(z+\frac{1}{2}\right)\left(z^2-z+\frac{1}{2}\right)}$

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

$H(z) = \dfrac{1}{\left(1-\frac{1}{2}z^{-1}\right)} \times \dfrac{\left(1+\frac{1}{3}z^{-2}\right)}{\left(1-z^{-1}+\frac{1}{2}z^{-2}\right)}$

$H_1(z)$ $\quad$ $H_2(z)$



cascade

$H(z) = \dfrac{z^3+\frac{1}{3}z}{z^3-z^2-\frac{1}{2}z^2+\frac{1}{2}z+\frac{1}{2}z-\frac{1}{4}}$

$= \dfrac{z^3+\frac{1}{3}z}{z^3-1.5z^2+z-0.25}$

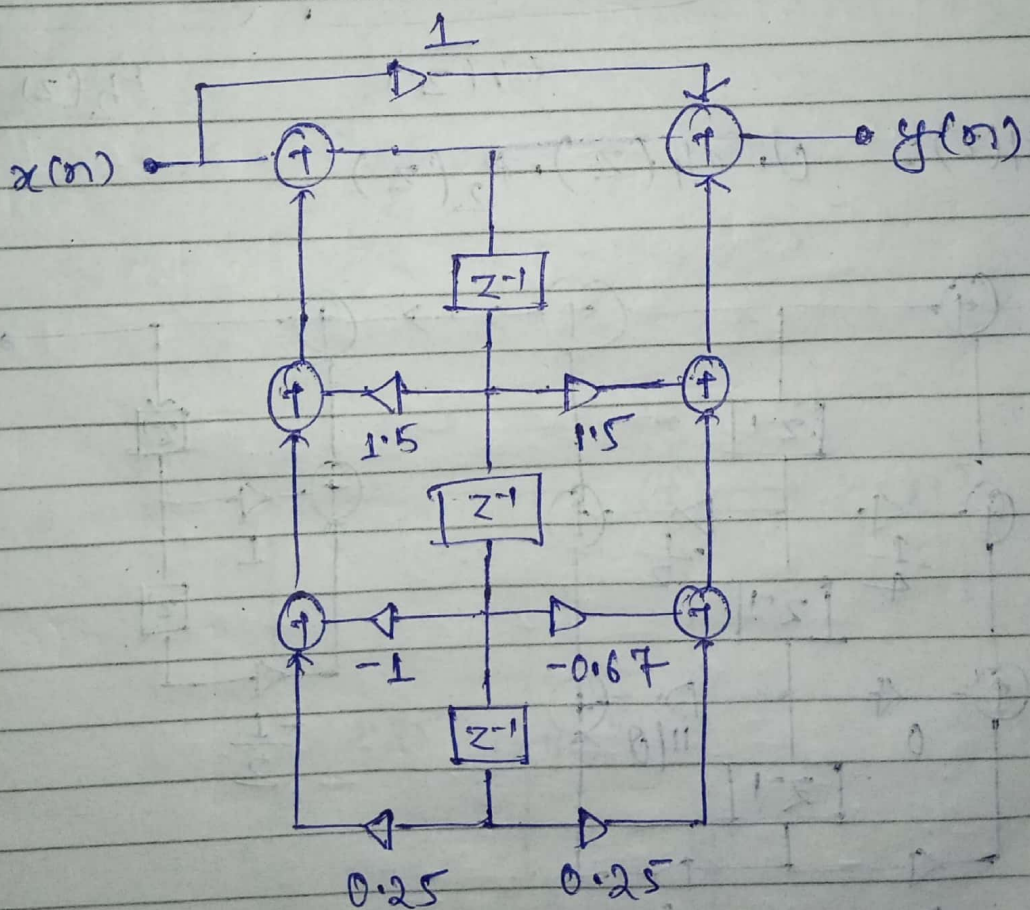
$$z^3 - 1.5z^2 + z - 0.25 \;\big)\; z^3 + \tfrac{1}{3}z \;\big(\; 1$$

$$z^3 - 1.5z^2 + z - 0.25$$

$$1.5z^2 - 0.67z + 0.25$$

$$H(z) = 1 + \frac{1.5z^2 - 0.67z + 0.25}{z^3 - 1.5z^2 + z - 0.25}$$

$$= 1 + \frac{1.5z^{-1} - 0.67z^{-2} + 0.25z^{-3}}{1 - 1.5z^{-1} + z^{-2} - 0.25z^{-3}}$$



Parallel

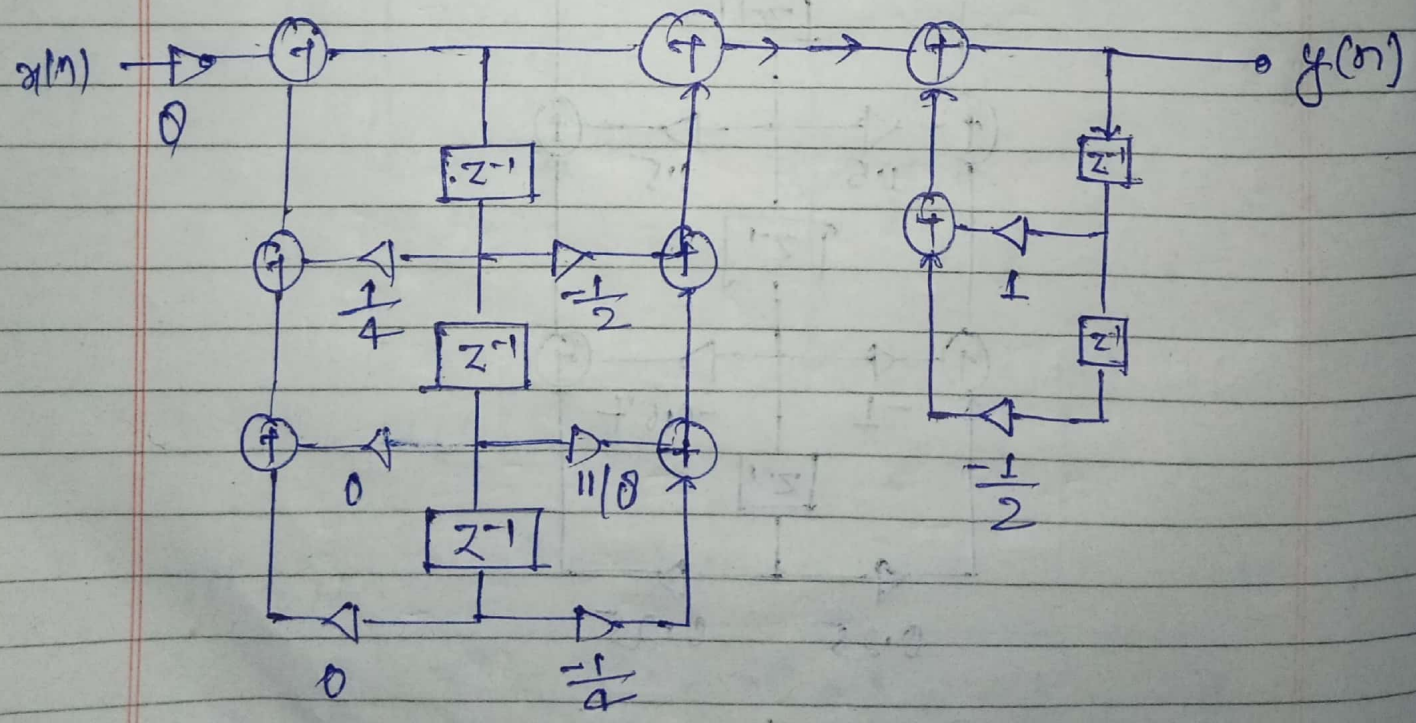
(c) $H(z) = \dfrac{8z^3 - 4z^2 + 11z - 2}{\left(z - \frac{1}{4}\right)\left(z^2 - z + \frac{1}{2}\right)}$

$= \dfrac{8 - 4z^{-1} + 11z^{-2} - 2z^{-3}}{\left(1 - \frac{1}{4}z^{-1}\right)\left(1 - z^{-1} + \frac{1}{2}z^{-2}\right)}$

$= 8 \cdot \left(1 - \frac{1}{2}z^{-1} + \frac{11}{8}z^{-2} - \frac{1}{4}z^{-3}\right) \times \dfrac{1}{\left(1 - \frac{1}{4}z^{-1}\right)\left(1 - z^{-1} + \frac{1}{2}z^{-2}\right)}$

$H_1(z)$ $H_2(z)$

$H(z) = 8 \cdot H_1(z) \cdot H_2(z)$



cascade

$$H(z) = \frac{8z^3 - 4z^2 + 11z - 2}{z^3 - z^2 - \frac{1}{4}z^2 + \frac{1}{2}z + \frac{1}{4}z - \frac{1}{8}}$$

$$= \frac{8z^3 - 4z^2 + 11z - 2}{z^3 - 1.25z^2 + \frac{3}{4}z - \frac{1}{8}}$$

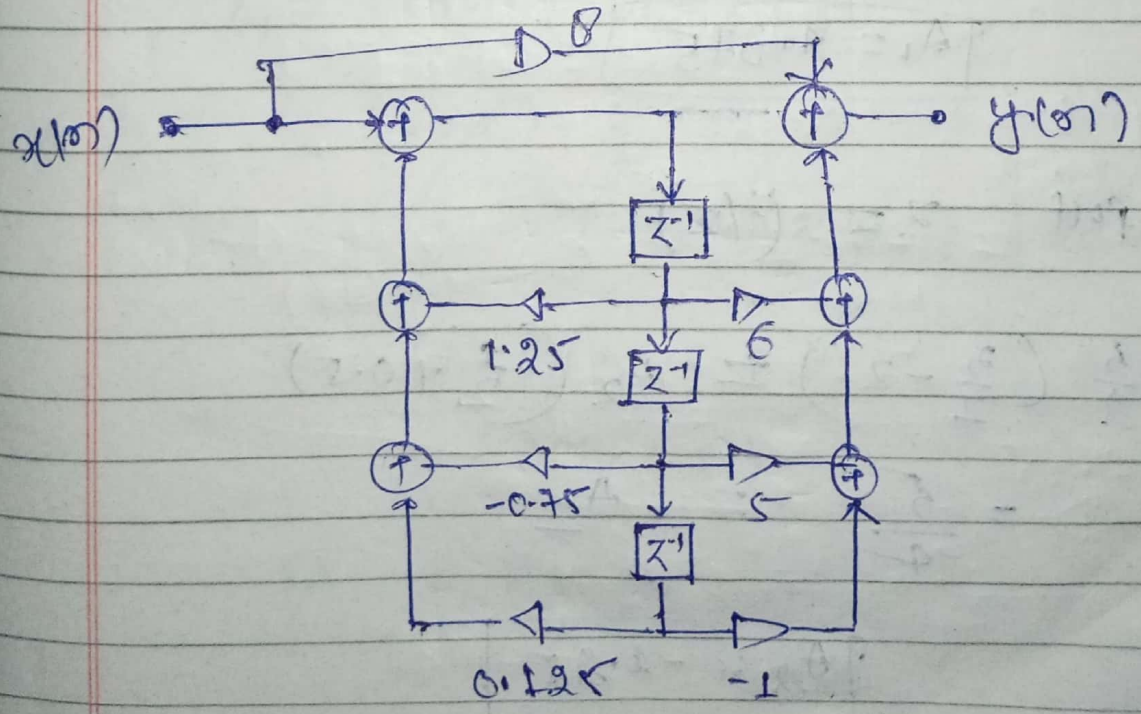
$$z^3 - 1.25z^2 + 0.75z - 0.125 \;\overline{)}\; 8z^3 - 4z^2 + 11z - 2 \;(\; 8$$

$$8z^3 - 10z^2 + 6z - 1$$

$$6z^2 + 5z - 1$$

$$H(z) = 8 + \frac{6z^2 + 5z - 1}{z^3 - 1.25z^2 + 0.75z - 0.125}$$

$$= 8 + \frac{6z^{-1} + 5z^{-2} - z^{-3}}{1 - 1.25z^{-1} + 0.75z^{-2} - 0.125z^{-3}}$$



Parallel

Ans-5

$$H(z) = \frac{5z(3z-2)}{(z+0.5)(2z-1)}$$

Partial decomposition

$$= \frac{A_1}{(z+0.5)} + \frac{A_2}{(2z-1)}$$

$$5z(3z-2) = A_1(2z-1) + A_2(z+0.5)$$

put $z = -0.5$

$$5 \times (-0.5)(-1.5-2) = A_1(-2\times 0.5 - 1)$$

$$-\frac{8.75}{2} = A_1$$

$$\boxed{A_1 = 4.375}$$

put $z = (1/2)$

$$\frac{5}{2}\left(\frac{3}{2}-2\right) = A_2\left(\frac{1}{2}+0.5\right)$$

$$-\frac{5}{4} = A_2$$

$$\boxed{A_2 = -1.25}$$

$$= -1.25 \times \frac{1}{(z+0.5)} + 4.375 \times \frac{1}{(2z-1)}$$

$$= -1.25 \times \frac{z^{-1}}{(1+0.5z^{-1})} + \frac{4.375}{2} \times \frac{z^{-1}}{(1-0.5z^{-1})}$$

$$= -1.25 \times \frac{z^{-1}}{(1+0.5z^{-1})} + 2.1875 \frac{z^{-1}}{(1-0.5z^{-1})}$$

OR

$$G(z) = \frac{H(z)}{z} = \frac{5(3z-2)}{2(z+0.5)(z-0.5)}$$

$$= \frac{A_1}{(z+0.5)} + \frac{A_2}{(z-0.5)}$$

$$A_1 = (z+0.5)\, G(z) \Big|_{z=-0.5}$$

$$= \frac{(z+0.5)}{} \frac{\frac{5}{2}(3z-2)}{(z+0.5)(z-0.5)} \Bigg|_{z=-0.5}$$

$$= \frac{(2.5)(-1.5-2)}{(-0.5-0.5)} = \frac{(2.5)(3.5)}{1}$$

$$\boxed{A_1 = 8.75}$$

$$A_2 = (z-0.5)\, G(z)\Big|_{z=0.5}$$

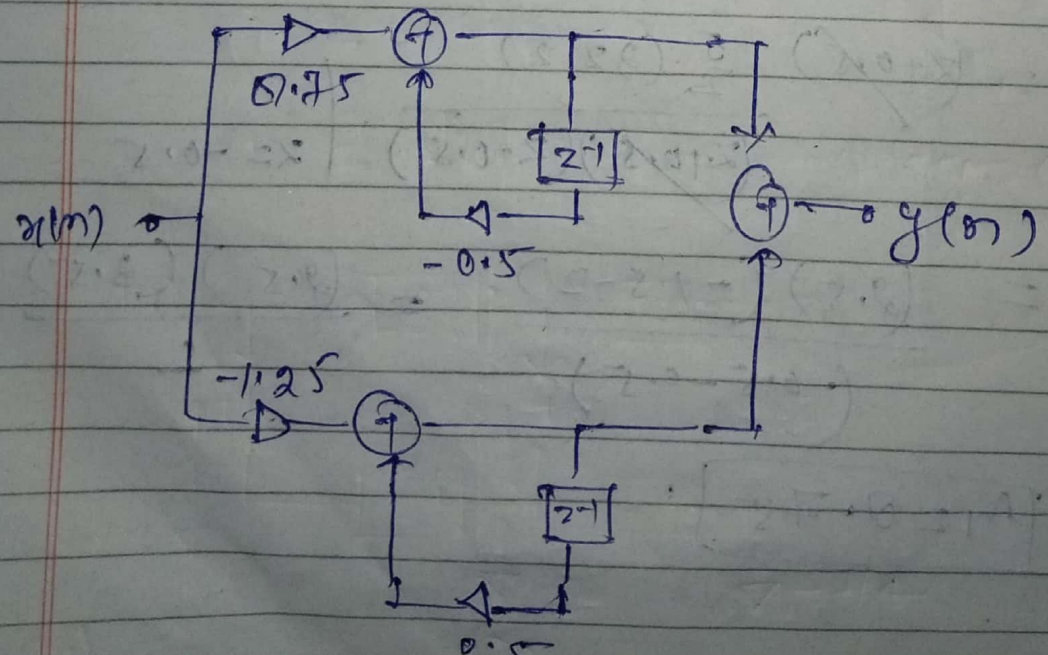
$$= \frac{\left(\frac{5}{2}\right)(3z+2)}{(z+0.5)}\Bigg|_{z=0.5}$$

$$= \frac{(2.5)(1.5+2)}{1}$$

$$= -1.25$$

$$G(z) = \frac{H(z)}{z} = 0.75 \times \frac{1}{(z+0.5)} - 1.25 \times \frac{1}{(z-0.5)}$$

$$H(z) = 0.75 \times \frac{1}{(1+0.5z^{-1})} - 1.25 \frac{1}{(1-0.5z^{-1})}$$



$a = 0.75$

$b = -0.5$

$c = -1.25$

$d = 0.5$

Ans 6

(a) $H(z) = 8. \dfrac{\left(1 + \frac{1}{2}z^{-1}\right)}{\left(1 - \frac{2}{3}z^{-1}\right)} \cdot \dfrac{\left(1 + \frac{1}{2}z^{-1} + \frac{7}{8}z^{-2}\right)}{\left(1 - 0.03z^{-1} - 0.76z^{-2}\right)}$

(b) $H(z) = 10. z^{-2}. \dfrac{(1 + 5z^{-1})}{(1 + 0.2z^{-1})} \cdot \dfrac{1}{(1 + 1.5z^{-1})} \cdot \dfrac{1}{(1 + 0.8z^{-1})}$

(c) $H(z) = 3\dfrac{1}{1} - 4z^{-1} + \dfrac{2}{3}\dfrac{1}{(1 - 2z^{-1})}$

(d) $Y(z) = \frac{1}{4}(1 + z^{-3}) + \frac{1}{2}(z^{-2} + z^{-1})$

$= \frac{1}{4} + \frac{1}{4}z^{-3} + \frac{1}{2}z^{-2} + \frac{1}{2}z^{-1}$

$= \frac{1}{4} + \frac{1}{2}z^{-1} + \frac{1}{2}z^{-2} + \frac{1}{4}z^{-3}$

Ans-8

$$h(n) = \delta(n) + \frac{1}{2}\delta(n-1) - \frac{1}{4}\delta(n-2) + \frac{1}{2}\delta(n-3) + \delta(n-4)$$

impulse response :

output when input is impulse.

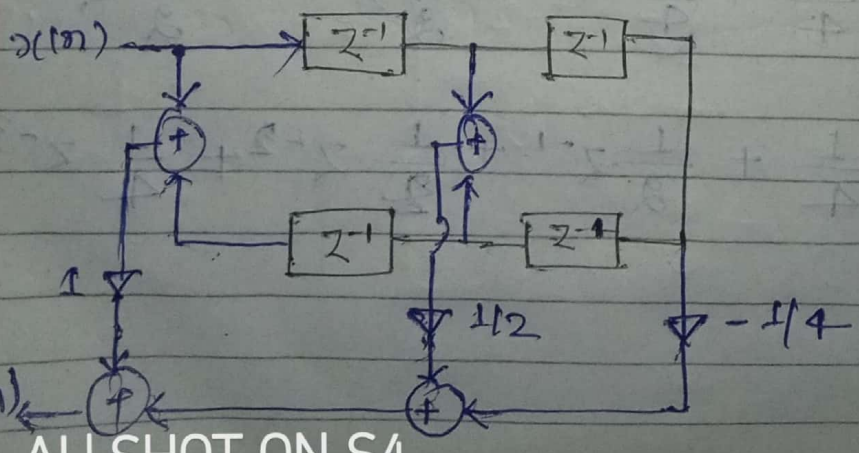
$x(n) = \delta(n)$ $\quad$ $y(n) = h(n)$

Take z transform

$X(z) = 1$ $\quad$ $Y(z) = H(z)$

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

order = 5 $\quad$ delay = 4



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Ans-7

$$h(n) = \left(\frac{1}{2}\right)^n [u(n) - u(n-5)]$$

$$h(n) = \left(\frac{1}{2}\right)^n u(n) - \left(\frac{1}{2}\right)^n u(n-5)$$

$H_1(n)$

Z-transform

$$H(z) = \frac{z}{z-(0.5)}$$

$$H_1(n) = \left(\frac{1}{2}\right)^n u(n-5)$$

$$H_1(z) = \sum_{n=-\infty}^{\infty} \left(\frac{1}{2}\right)^n u(n-5)\, z^{-n}$$

$$= \sum_{n=1}^{\infty} \left(\frac{1}{2}\right)^n z^{-n}$$

$$= \left(\frac{1}{2}\right)^5 z^{-5} + \left(\frac{1}{2}\right)^6 z^{-6} - - \infty$$

$$= \frac{\left(\frac{1}{2}\right)^5 z^{-5}}{1 - \left(\frac{1}{2}\right) z^{-1}}$$

$$H(z) = \frac{1}{1 - 0.5 z^{-1}} - \frac{(0.5)^5 z^{-5}}{1 - (0.5) z^{-1}}$$

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Ans-9

$$H(z) = \frac{1 - 0.6z^{-1} + 1.2z^{-2}}{1 + 0.15z^{-1} - 0.64z^{-2}}$$

First obtain route array

z^{-2}	1.2	-0.6	1
z^{-2}	-0.64	0.15	1
z^{-1}	-0.32	2.875	
z^{-1}	-5.6	-1	
1	2.9		
1	1		

$$\alpha_0 = \frac{1.2}{-0.64} = -1.875$$

$$\beta_1 = 2$$

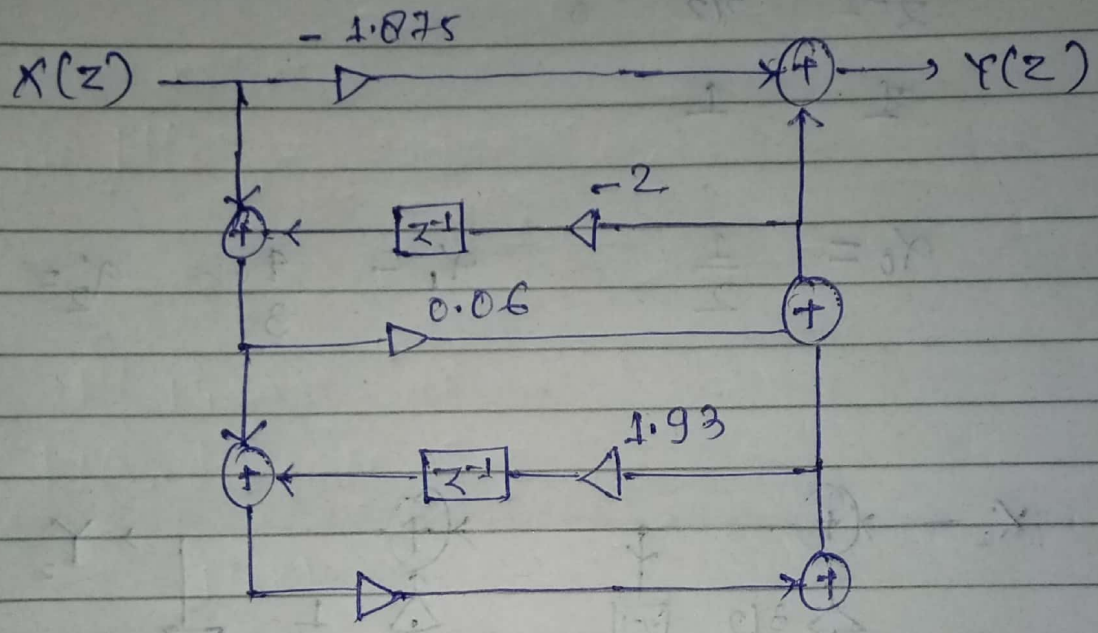
$$\alpha_1 = 0.06$$

$$\beta_2 = -1.93$$

$$\alpha_2 = 2.9$$

$$H(z) = \alpha_0 + \cfrac{1}{\beta_1 z^{-1} + \cfrac{1}{\alpha_1 + \cfrac{1}{\beta_2 z^{-2} + \cfrac{1}{\alpha_2}}}}$$

$$H(z) = -1.875 + \cfrac{1}{2z^{-1} + \cfrac{1}{0.06 + \cfrac{1}{-1.93z^{-1} + \cfrac{1}{2.9}}}}$$



Ans-10

$$H(z) = \frac{1}{z^{-3} + 2z^{-2} + 2z^{-1} + 1}$$

For this f^{n} we have

$$t_{22} = \frac{Q(z)}{P(z)} = \frac{a_3 z^{-3} + a_1 z^{-1}}{a_2 z^{-2} + a_0}$$

$$= \frac{z^{-3} + 2z^{-1}}{2z^{-2} + 1}$$

$$t_{22} = r_0 + \frac{1}{-r_1 + \frac{1}{r_2}} \quad \text{with } x=0$$

$$t_{22} = \alpha_0 z^{-1} + \frac{1}{\alpha_1 z^{-1} + \frac{1}{\alpha_2 z^{-1}}}$$

z^{-3}	1	2
z^{-2}	2	1
z^{-1}	3/2	0
1	1	

$\alpha_0 = \frac{1}{2}$ $\quad \alpha_1 = \frac{4}{3}$ $\quad \alpha_2 = \frac{3}{2}$