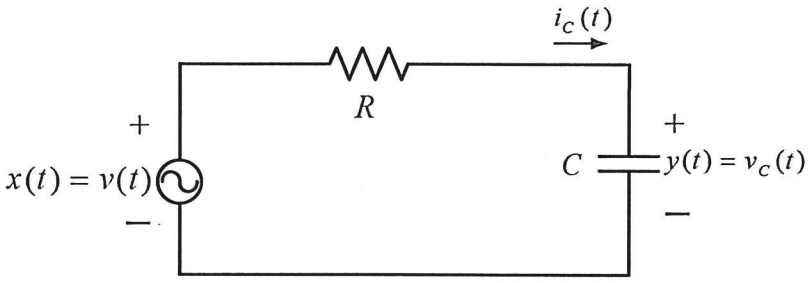
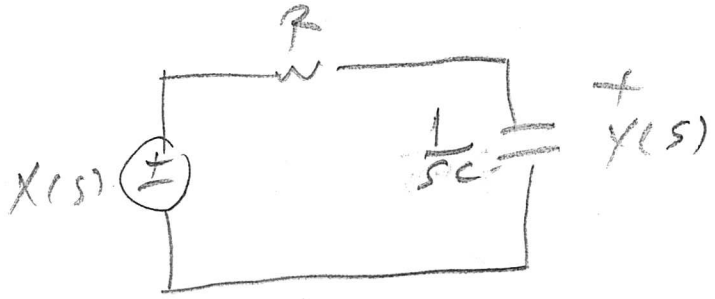
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Class Activity 19: You may discuss it in groups of 2 to 3 but report your own response

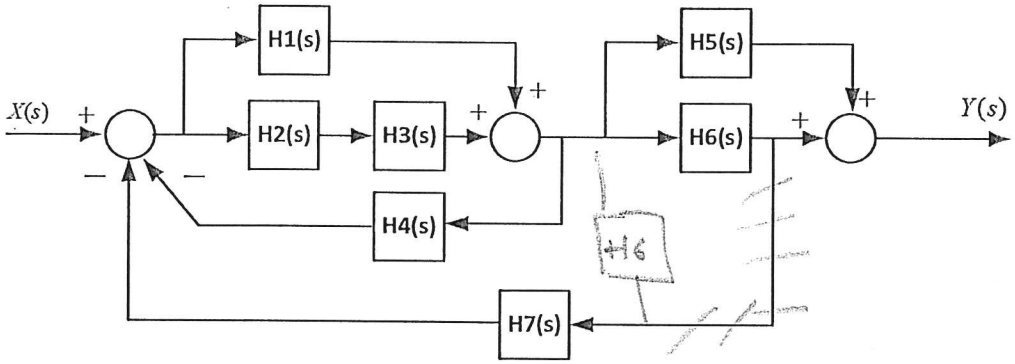
Find the transfer function of the following circuit

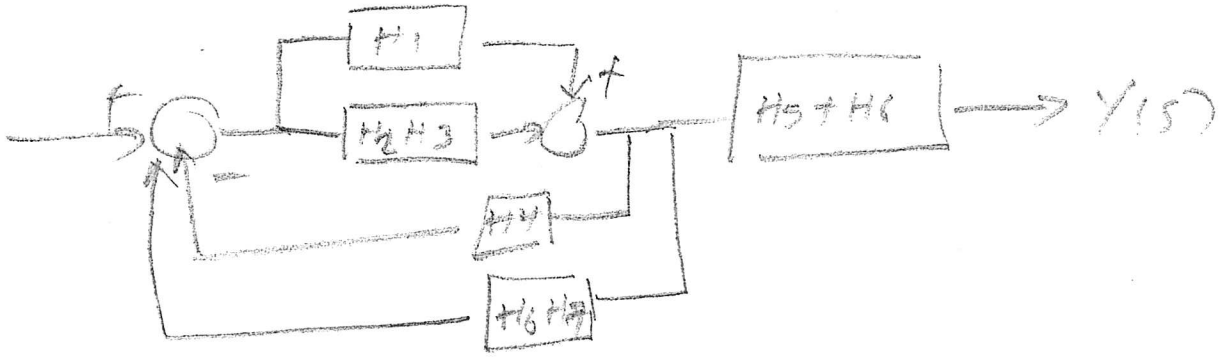


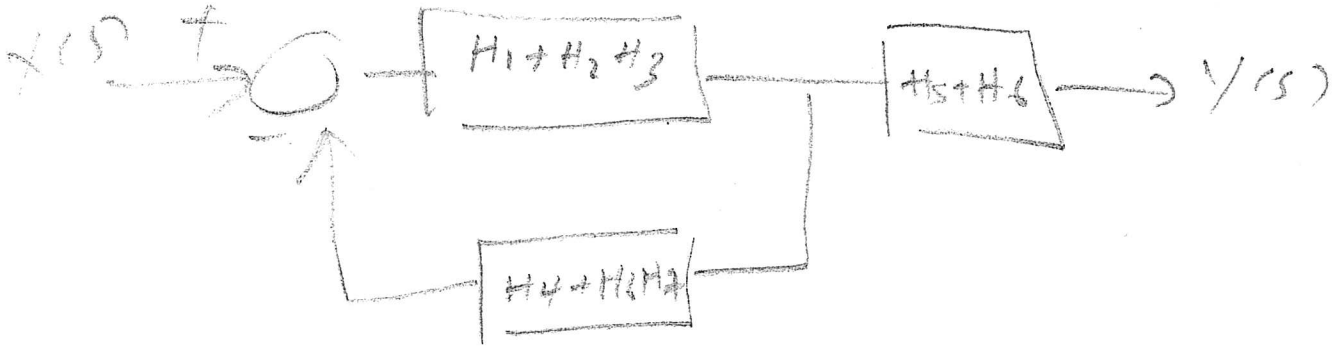


$$H(s) = \frac{\frac{1}{sC}}{R + \frac{1}{sC}} = \frac{1}{1 + RsC} = \frac{\gamma_{RC}}{\gamma_{RC} + s}$$

Find the transfer function of the following system







$$H(s) = \frac{(H_1 + H_2H_3)(H_5 + H_6)}{1 + (H_1 + H_2H_3)(H_4 + H_6H_7)}$$

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Class Activity 20: You may discuss it in groups of 2 to 3 but report your own response

Compute the z-transform of the following discrete-time signal:

$$x[n] = \delta[n] + 2\delta[n-1] + u[n]$$

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

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

If the z-transform of $na^n u[n]$ is $\frac{az}{(z-a)^2}$, compute the z-transform of the following discrete-time signal:

$$x[n] = n^2 a^n u[n]$$

$$x[n] = n\left(n a^n u[n]\right)$$

$$\therefore X(z) = -z \frac{d}{dz}\left(\frac{az}{(z-a)^2}\right)$$

$$= -z\left(\frac{(z-a)^2(a) - (az)(2(z-a))}{(z-a)^4}\right)$$

$$= \frac{az(z+a)(z-a)}{(z-a)^4}$$

$$= \frac{az(z+a)}{(z-a)^3}$$

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Class Activity 21: You may discuss it in groups of 2 to 3 but report your own response

Find the inverse z-transform of $X(z)$ using the (1) long division and (2) partial fraction method

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

(1)

$$\begin{array}{r|l} & 1 + 2z^{-2} + 2z^{-4} \\ \hline z^2-1 & z^2+1 \\ & z^2-1 \\ \hline & 2 \\ & 2-2z^{-2} \\ \hline & 2z^{-2} \\ & 2z^{-2}-2z^{-4} \\ \hline & 2z^{-4} \end{array}$$

$x[0] = 1,\ x[1] = 0,\ x[2] = 2,\ x[3] = 0$

$x[4] = 2, \ldots$

(2)

$$\frac{X(z)}{z} = \frac{z^2+1}{z(z+1)(z-1)} = \frac{A}{z} + \frac{B}{z+1} + \frac{C}{z-1}$$

$$A = z\left(\frac{X(z)}{z}\right)\Big|_{z=0} = \frac{1}{-1} = -1$$

$$B = (z+1)\left(\frac{X(z)}{z}\right)\Big|_{z=-1} = \frac{1+1}{(-1)(-1-1)} = \frac{2}{2} = 1$$

$$C = (z-1)\left(\frac{X(z)}{z}\right)\Big|_{z=1} = \frac{1+1}{(1)(1+1)} = \frac{2}{2} = 1$$

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

$$x[n] = \delta[n] + (-1)^n u[n] + u[n]$$

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Class Activity 22: You may discuss it in groups of 2 to 3 but report your own response

Find the transfer function of the following system and formulate its step response

$$y[n] + 5y[n-1] + 6y[n-2] = x[n] + 4x[n-1]$$

(1) The transfer function:

$$Y(z) + 5z^{-1}Y(z) + 6z^{-2}Y(z) = X(z) + 4z^{-1}X(z)$$

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

(2) The step response

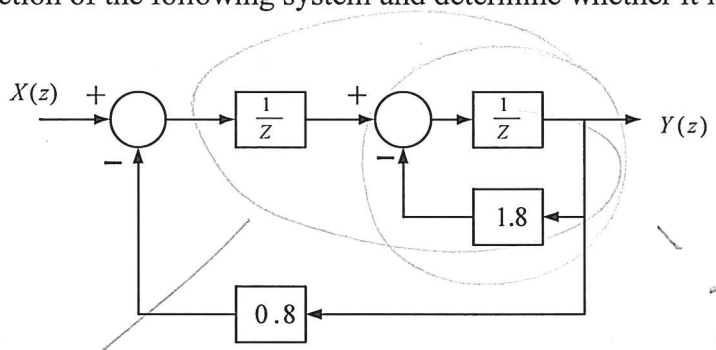
$$Y(z) = \left(\frac{z^2 + 4z}{z^2 + 5z + 6}\right)\left(\frac{z}{z-1}\right)$$

Find the z-inverse of $Y(z)$

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Class Activity 23: You may discuss it in groups of 2 to 3 but report your own response

Find the transfer function of the following system and determine whether it is stable, marginally stable, or unstable.



$$\frac{\frac{1}{z}}{1+\frac{1.8}{z}} = \frac{1}{z+1.8}$$

$$\frac{1}{z(z+1.8)} = \frac{1}{z^2+1.8z}$$

$$H(z) = \frac{\frac{1}{z^2+1.8z}}{1+\frac{0.8}{z^2+1.8z}} = \frac{1}{z^2+1.8z+0.8}$$