

Solution to ECE Test #9 S09

1. The z transform of $x[n] = (2/3)^n u[n-2]$ can be expressed in the form

$X(z) = \frac{Az^b}{z-c}$. Find the numerical values of A , b and c .

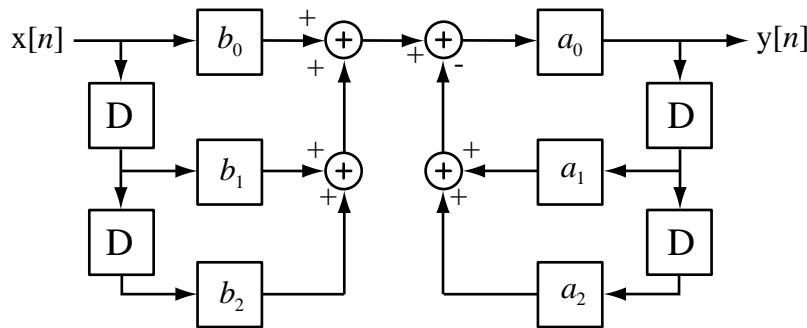
$$A = \underline{4/9} \quad b = \underline{-1} \quad c = \underline{2/3}$$

$$x[n] = (2/3)^n u[n-2] = (2/3)^2 (2/3)^{n-2} u[n-2]$$

$$X(z) = \left(\frac{2}{3}\right)^2 z^{-2} \frac{z}{z-2/3} = \frac{4}{9} \frac{z^{-1}}{z-2/3}$$

2. A DT system has a transfer function $H(z) = 5 \frac{(2z^2/5) + 4}{z^2 + 3z/4}$. Find the values of the constants, a_0, a_1, a_2, b_0, b_1 and b_2 in the system diagram below which would realize this transfer function.

$$a_0 = \underline{1}, a_1 = \underline{3/4}, a_2 = \underline{0}, b_0 = \underline{2}, b_1 = \underline{0}, b_2 = \underline{20}$$



$$\frac{Y(z)}{X(z)} = 5 \frac{(2z^2/5) + 4}{z^2 + 3z/4} \Rightarrow z^2 Y(z) + (3/4)z Y(z) = 2z^2 X(z) + 20 X(z)$$

$$Y(z) = 2 X(z) + 20z^{-2} X(z) - (3/4)z^{-1} Y(z)$$

$$y[n] = 2x[n] + 20x[n-2] - (3/4)y[n-1]$$

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1. The z transform of $x[n] = (3/5)^n u[n-1]$ can be expressed in the form $X(z) = \frac{Az^b}{z-c}$. Find the numerical values of A , b and c .

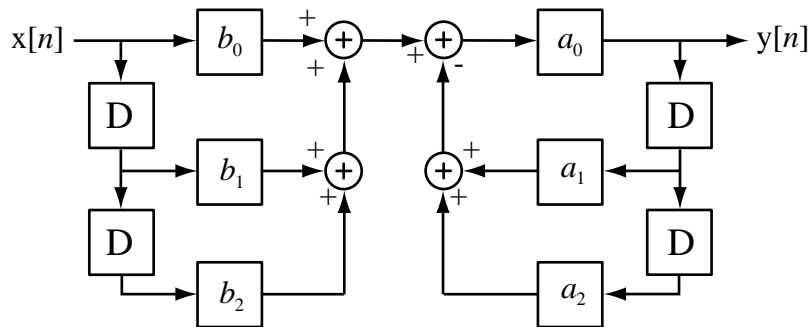
$$A = \underline{3/5} \quad b = \underline{0} \quad c = \underline{3/5}$$

$$x[n] = (3/5)^n u[n-1] = (3/5)(3/5)^{n-1} u[n-1]$$

$$X(z) = \frac{3}{5} z^{-1} \frac{z}{z-3/5} = \frac{3}{5} \frac{1}{z-3/5}$$

2. A DT system has a transfer function $H(z) = 3 \frac{(z/7)+2}{z^2+2/3}$. Find the values of the constants, a_0, a_1, a_2, b_0, b_1 and b_2 in the system diagram below which would realize this transfer function.

$$a_0 = \underline{1}, \quad a_1 = \underline{0}, \quad a_2 = \underline{2/3}, \quad b_0 = \underline{0}, \quad b_1 = \underline{3/7}, \quad b_2 = \underline{6}$$



$$\frac{Y(z)}{X(z)} = 3 \frac{(z/7)+2}{z^2+2/3} \Rightarrow z^2 Y(z) + (2/3)Y(z) = (3/7)zX(z) + 6X(z)$$

$$Y(z) = (3/7)z^{-1} X(z) + 6z^{-2} X(z) - (2/3)z^{-2} Y(z)$$

$$y[n] = (3/7)x[n-1] + 6x[n-2] - (2/3)y[n-2]$$