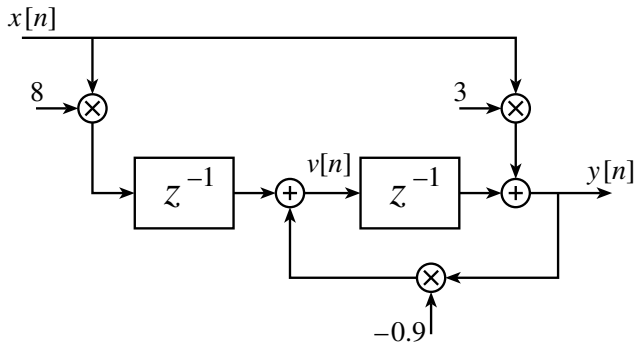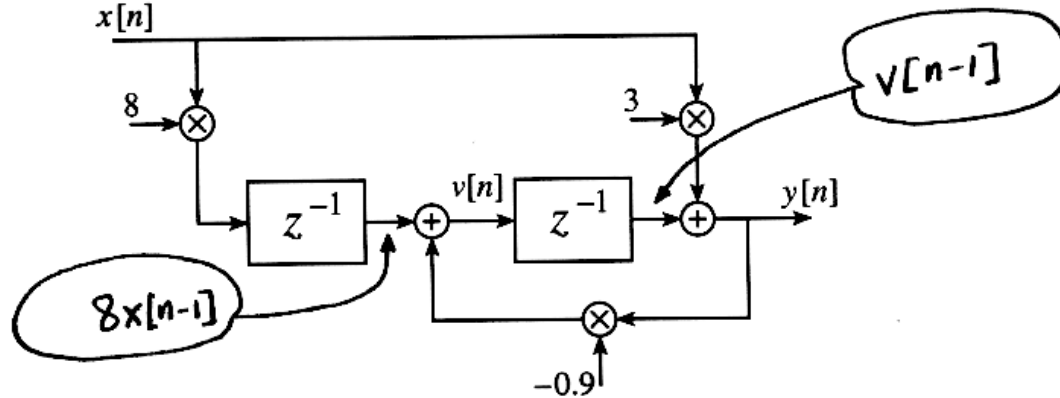## PROBLEM:

The following signal flow graph structure defines a linear time-invariant system:

(a) Write the two difference equations defined by the signal flow graph—one for $y[n]$ and one for $v[n]$.

(b) Determine the z-transform system function $H(z)$ from the input $x[n]$ to the output $y[n]$.

SOLUTION

(a)

$$v[n] = -0.9\, y[n] + 8x[n-1]$$

$$y[n] = 3x[n] + v[n-1]$$

(b) "Delay" the first equation & substitute

$$v[n-1] = -0.9\, y[n-1] + 8x[n-2]$$

$$y[n] = 3x[n] + \left(-0.9\, y[n-1] + 8x[n-2] \right)$$

$$= -0.9\, y[n-1] + 3x[n] + 8x[n-2]$$

Get the filter coefficients to define $H(z)$

$$H(z) = \frac{3 + 8z^{-2}}{1 + 0.9\, z^{-1}}$$