Answer Keys to HW 9

1) a) $X_a(z) = \dfrac{-1.2z}{z^2 - 2.8z + 1.6}, \qquad 0.8 < |z| < 2.$

b) $X_b(z) = \dfrac{2z^2 - 5z}{z^2 - 5z + 6}, \qquad 2 < |z| < 3.$

c) $X_c(z) = \dfrac{-1.5z}{z^2 - 2.5z + 1}, \qquad 0.5 < |z| < 2$

2) a) $X_a(z) = \dfrac{z}{z^m(z-1)}, \qquad |z| > 1$

b) $X_b(z) = \dfrac{\gamma z}{(z-\gamma)^2}, \qquad |z| > |\gamma|$

3) a) $x_a[n] = \dfrac{2}{5}(-2)^n u[n] + \dfrac{3}{5}(0.5)^n u[n] \qquad$ when $|z| > 2.$

$x_a[n] = -\dfrac{2}{5}(-2)^n u[-n-1] + \dfrac{3}{5}(0.5)^n u[n] \qquad$ when $0.5 < |z| < 2.$

$x_a[n] = -\dfrac{2}{5}(-2)^n u[-n-1] - \dfrac{3}{5}(0.5)^n u[-n-1] \qquad$ when $|z| < 0.5.$

b) $x_b[n] = 2\cos\left(\dfrac{\pi}{2}n\right) u[n] - \delta[n] \qquad$ when $|z| > 1.$

$x_b[n] = -2\cos\left(\dfrac{\pi}{2}n\right) u[-n-1] - \delta[n] \qquad$ when $|z| < 1$

4) a) $x_a[n] = [2(2)^n - (3)^n]\, u[n].$

b) $x_b[n] = \left[(2)^n - \dfrac{1}{3}(3)^n\right] u[n] - \dfrac{2}{3}\delta[n]$

c) $x_c[n] = [3(-1)^n - 3(2)^n + 2n(2)^n]\, u[n].$

d) $x_d[n] = 2\cos\left(\dfrac{\pi}{3}n + \dfrac{\pi}{3}\right) u[n].$

5) $X(z) = \dfrac{1}{z^7(z-1)^2}\left[z^8 - 2z^4 + 1\right]$

or

$X(z) = \dfrac{z^6 + 2z^5 + 3z^4 + 4z^3 + 3z^2 + 2z + 1}{z^7}.$

6) a) $$y[n] = \left[\frac{1}{3} + \frac{5}{2}(0.5)^n - \frac{4}{3}(0.25)^n\right] u[n]$$

b) $$y_{\text{zir}}[n] = \left(-1 + \frac{1}{2}(0.5)^n\right) u[n].$$

$$y_{\text{zsr}}[n] = \left[\frac{4}{3} + 2(0.5)^n - \frac{4}{3}(0.25)^n\right] u[n].$$

c) $$y_{\text{transient}}[n] = \left[\frac{5}{2}(0.5)^n - \frac{4}{3}(0.25)^n\right] u[n]$$

$$y_{\text{steady-state}}[n] = \frac{1}{3}u[n].$$

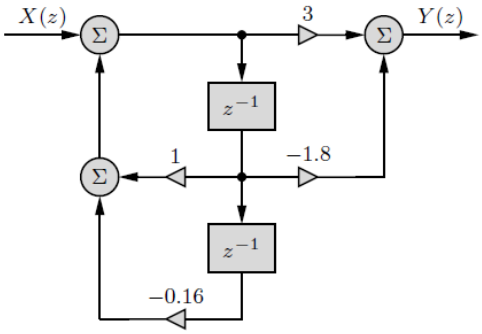
7) a) Since the system poles are located at $z = 0.8$ and $z = -0.2$, the system is asymptotically stable.

b) $$y_{\text{zsr}}[n] = [1.3199(e)^n - 1.1336(0.8)^n - 0.1863(-0.2)^n]\, u[n].$$

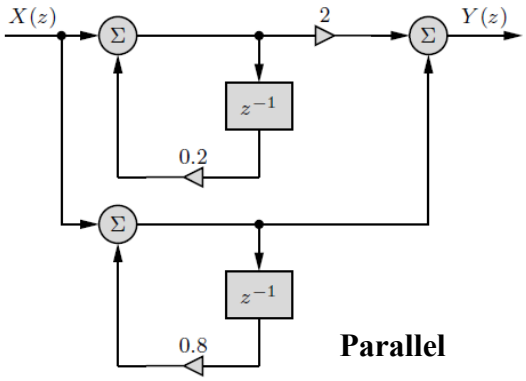
c) $$y[n] - 0.6y[n-1] - 0.16y[n-2] = x[n-1].$$

d) $$h[n] = [(0.8)^n - (-0.2)^n]\, u[n].$$

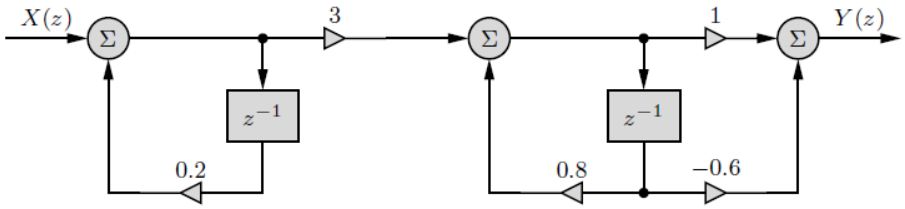
8)



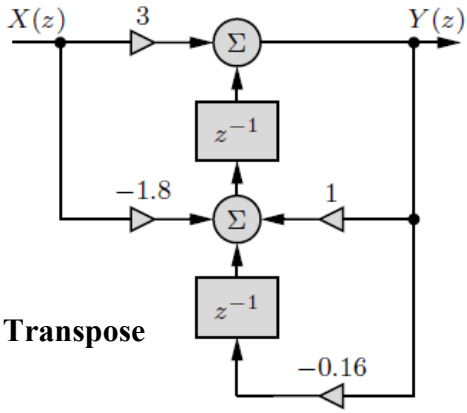
Direct Form II



Parallel



Cascade



b) Transpose