ENGR 4333/5333: Digital Signal Processing

HW 10: Ch 7

1) (a) Show the canonic direct form, a parallel realization, and a series realization of $H(z) = \frac{z(3z-1.8)}{z^2-z+0.16}$

(b) Find the transpose of the realizations obtained in part (a).

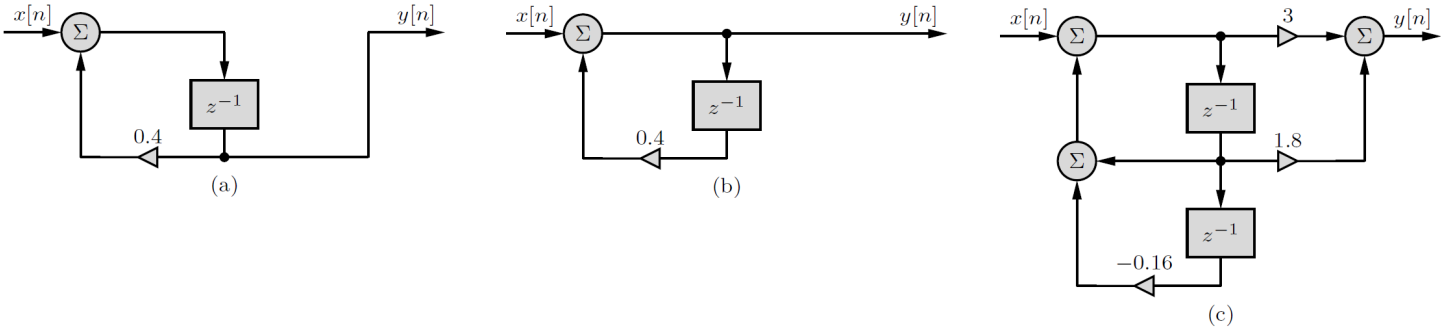
2) Consider a system with transfer function $H(z) = \frac{z}{(z+0.2)(z-0.8)}$ $\quad |z| > 0.8$

Determine the zero-state responses to the inputs

(a) $x_a[n] = e^n u[n]$ **(b)** $x_b[n] = 2^n u[-n-1]$ **(c)** $x_c[n] = e^n u[n] + 2^n u[-n-1]$

3) Realize a system with transfer function $H(z) = \frac{2z^4+z^3+0.8z^2+2z+8}{z^4}$

4) Determine and plot the magnitude and phase responses of the digital filters depicted in Figure below. State the type (highpass, lowpass, etc.) of each filter.



5) Consider an LTID system specified by the equation $y[n+1] - 0.5y[n] = x[n+1] + 0.9x[n]$.

(a) Sketch the poles/zero plot for this system. Is this system primarily LP, HP, BP, or BS?

(**b**) Determine the frequency response $H(e^{j\Omega})$ and sketch the magnitude and phase responses.

(c) Find the system response $y[n]$ to the input $x[n] = 1 + \cos(0.5\pi n - \pi/3)$ using the locations of poles/zero found in part (**a**) and using the equations found in part (**b**).

6) Design a (real) digital notch filter that rejects 5000-Hz content completely and sharply recovers on either side of 5000 Hz to a gain of unity. The highest frequency to be processed is 20 kHz ($f_{max} = 20000$ Hz). Provide a canonic realization of the filter, and determine the filter's magnitude response.