EE 470 – Extra Practice Problem Set #5

1. Convert the following filter to discrete-time filter with f_s= 10 kSa/s:

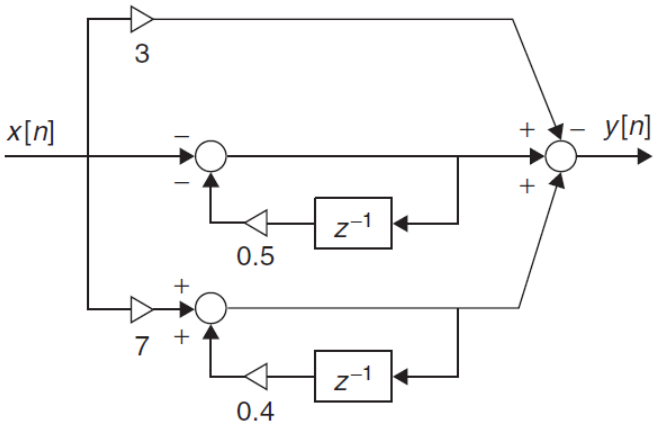
$$H(s) = \frac{s^2}{s^2 + \sqrt{2}s + 1}$$

2. It is desired to design a low-pass digital filter using an analog filter design tool and the bilinear transformation. If the digital filter cutoff frequency is ω_p (= $f_p/0.5f_s$) is 0.1π rad/s and the sampling frequency is 200 Sa/s, determine the analog filter cutoff frequency to be used.

3. Draw the realization of the following digital filter:

$$H(z) = \frac{1 + 1.2z^{-1} + 0.2z^{-2}}{1 - 0.4z^{-1} + z^{-2} - 0.4z^{-3}}$$

4. Derive the filter transfer function X(z) of the following realization:



5. Design a low-pass FIR filter of length M = 7 to be used in filtering digital signals and that approximates the following ideal frequency response:

$$H_d(e^{j\omega}) = \begin{cases} 1 & 0 \le f \le 125\ Hz \\ 0 & 0 \le f \le f_s/2 \end{cases}$$

Note that $\omega = 2\pi f / f_s$ and $f_s = 1000$ Hz is the sampling rate.
(Hint: Use the window design method with a rectangular window)