Homework #6
Due Th. 4/18

1. (OS 6.26)
2. (OS 6.32)
3. Consider the implementation of a causal filter with system function

$$H(z) = \frac{1}{(1 - 0.63z^{-1})(1 - 0.83z^{-1})} = \frac{1}{1 - 1.46z^{-1} + 0.5229z^{-2}}.$$

   The system is to be implemented with $(B + 1)$-bit two's-complement rounding arithmetic. Products are rounded before additions are performed. The system input is a zero-mean, white, wide-sense stationary random process with values uniformly distributed between $-x_{\max}$ and $x_{\max}$.

   (a) Draw the Direct Form flow graph implementation of the filter. All coefficient multipliers are rounded to the nearest tenth.

   (b) Draw an implmentation as a cascade of two 1$^{\text{st}}$-order systems. All coeficient multipliers are rounded to the nearest tenth.

   (c) Only one of the the implmentations from (a) and (b) is actually useable. Determine which implmentation is useable and explain your choice.

   (d) Redraw the flow diagram from (c) and include linearized noise models to represent the round-off error.

4. Consider a filter with the pole/zero plot shown in Fig. 1. The system function for this filter (ignoring scaling) is

$$H(z) = \frac{(z-1)^3(z+1)^3}{(z - 0.72e^{j1.3})(z - 0.72e^{-j1.3})(z - 0.78e^{j2.5})(z - 0.78e^{-j2.5})(z - 0.45e^{j2.0})(z - 0.45e^{-j2.0})}.$$

   Design a cascade structure to implement the filter when round-off quantization noise is considered. Label each of the poles p_i and call the zeros z_1 when they occur at $z = 1$ and z_{-1} when they occur at $z = -1$. Indicate the pole zero pairs in the table below (not all stages have to be used).

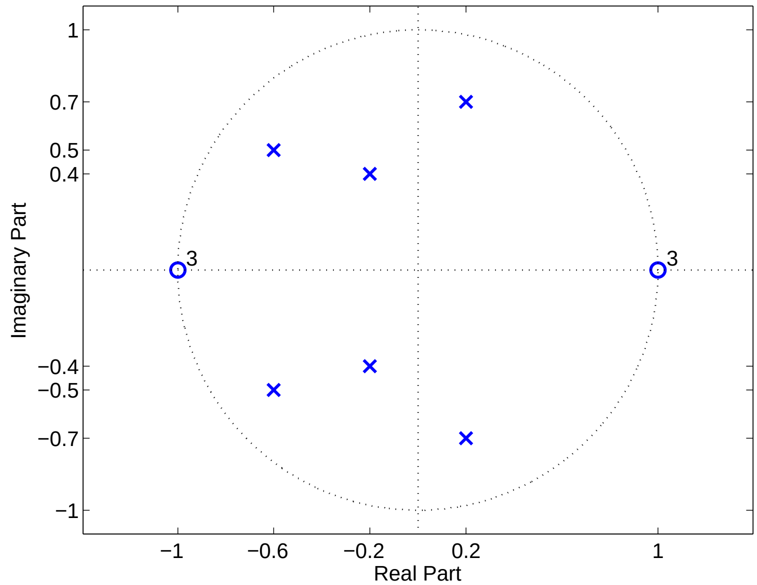

Figure 1: Pole/Zero Plot

Stage	Poles	Zeros
1		
2		
3		
4		
5		
6		