# SDP Sample Exam (only the exercises)

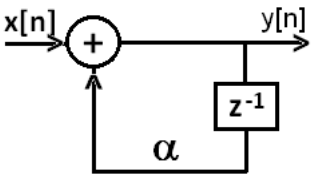
**Exercises: 20p**

I. Consider the system with the following system function

$$H(z) = \frac{(1+3z^{-1})(1-z^{-1})}{(1-0,5z^{-1})(1+0,3z^{-1})}$$

a) Implement the system in direct form I
b) For the above implementation, draw the noise sources corresponding to product quantization (multiplicative noise, and write the expression of the output noise power (variance)
c) Implement the system H(z) in state space Type II

II. Consider this filter implemented in fixed point with 4 bits, 1 bit for sign, 0 for integer part, 3 for fractionary part. Quantization is done by rounding.




If the input signal is $x[n] = 0,2\delta[n]$ , then determine:

a. For n=0,1,2,3,4, find the output of the system and the quantization error, considering $\alpha_1 = 0,5$
b. Based on the values found in a), specify if the filter enters a limit cycle, and at what moment
c. For $\alpha_2 = 0,75$ compute the total output noise power caused by product quantization (multiplicative noise)

**Theory: 10p**