Homework 3

Hani Mehrpouyan

QUESTION 1 (5 POINTS)

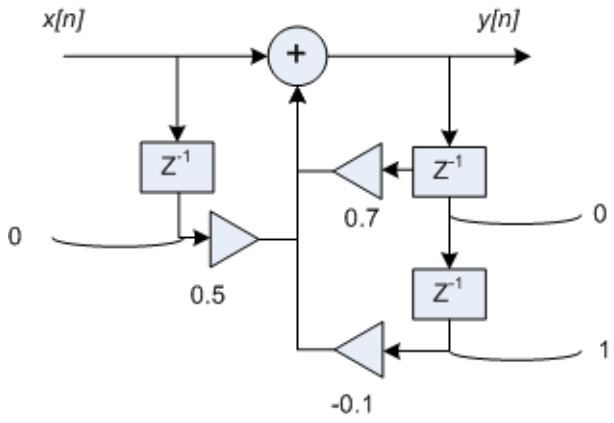
Consider the LTI system described by the difference equation

$$y[n] = p_0 x[n] + p_1 x[n-1] - d_1 y[n-1], \tag{1}$$

where, $x[n]$ and $y[n]$ denote, respectively, its input and output. Determine the difference equation representation of its inverse system.

QUESTION 2 (5 POINTS)

Consider the system illustrated in the figure below. The initial conditions of the state variables (the outputs of the delays) are shown at time $n = 0$, indicated by the curved arrows in the figure:



With $x[n] = (2^n)\mu[n]$, what is $y[n]$?

Verify your answer in Matlab.

QUESTION 3 (5 POINTS)

Is the cascade connection of two stable LTI systems also stable? Justify your answer.

QUESTION 4 (5 POINTS)

Complete the followings:

1) Evaluate the autocorrelation sequence of each of the sequences below.

$$x[n] = \{2, 0, -1, 6, -3, 2, 0\}$$

$$y[n] = \{8, 2, -7, -3, 0, 1, 1\}$$

$$w[n] = \{3, 6, -1, 2, 6, 6, 1\}$$

2) Evaluate the cross-correlation $r_{xy}[\ell]$ between the sequences $x[n]$ and $y[n]$, and the cross-correlation sequence $r_{xw}[\ell]$ between the sequences $x[n]$ and $w[n]$.