Name and surname:		Student number:		Signature:	
Course: BME3161 Biosignal Processing		**Date / Time:** 29 November 2020 14:00		**Time:** 110 minutes	
Exam Type:		**Midterm1** x	**Midterm2**	**Make-up** for Midterms	**Final**	**Make-up**
Title Name-Surname: Assist. Prof. Dr. İsmail CANTÜRK **(Instructor)**					

1. An ECG signal sample x[n] will be processed by using the below discrete time system. Verify your answers by sketching the required signals for every step of your solutions. Direct answers without solution steps will not get any point.
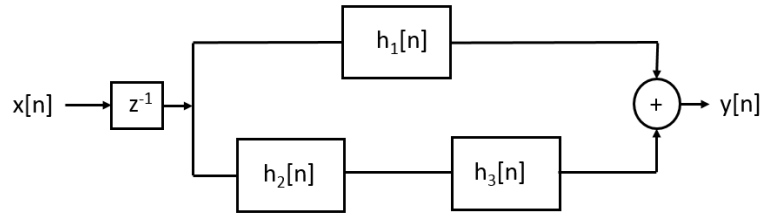
a) If $h_2[n] = \delta[n] - \delta[n-1]$ and $h_3[n] = \mu[n]$, determine the total response $h_{23}[n]$ for below channel.

b) If $h_1[n] = \mu[n-1] - \mu[n-5]$, determine total response $h_T[n]$ for the channel.

c) If $x[n] = [1 \quad 0 \ -1 \quad 5 \ -2 \quad 0 \quad 2]$, find $y[n]$.
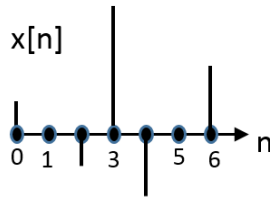
2. During a scientific experiment one channel EEG signal x[n] of a participant was recorded.
$$x[n] = [0.8 \quad 0.9 \quad 0.1 \quad 0.3 \quad 0.6]$$
$$\uparrow$$

a) Find the autocorrelation of x[n]. Show your solution steps. Direct answers without solution steps will not get any point.

b) EEG signals of 5 different subjects were also recorded. Rank them depending on their similarity to x[n]. Show your solution steps. Direct answers without solution steps will not get any point. (Hint: Energy)

$$x1[n] = [0.6 \quad 0.0 \quad 0.8 \quad 0.9 \quad 0.6]$$
$$\uparrow$$
$$x2[n] = [0.7 \quad 0.7 \quad 0.3 \quad 0.6 \quad 0.1]$$
$$\uparrow$$
$$x3[n] = [0.7 \quad 0.0 \quad 0.2 \quad 0.0 \quad 0.1]$$
$$\uparrow$$
$$x4[n] = [0.8 \quad 0.9 \quad 0.1 \quad 0.3 \quad 0.6]$$
$$\uparrow$$
$$x5[n] = [0.4 \quad 0.3 \quad 0.7 \quad 0.7 \quad 0.1]$$
$$\uparrow$$

3. Consider the below system.

a) Derive the difference equation for below system.

b) If input signal is unit sample sequence, determine the impulse response of the LCCDE.