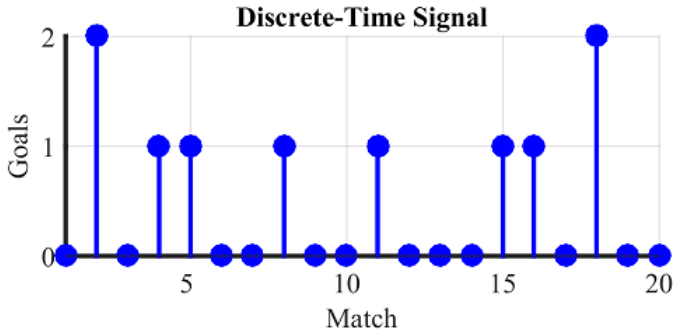
Signal Processing **Assignment- 1** Monsoon 2023

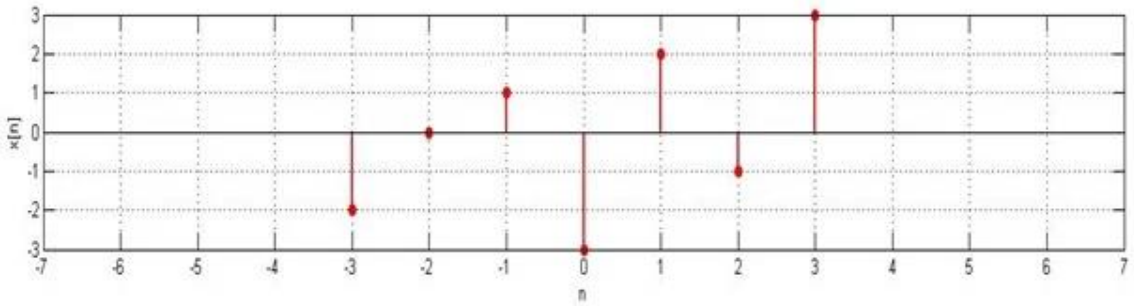
1. Consider the following sequence which is the number of goals scored in 20 matches played by a team.



   a. Is there a time point over which this sequence is symmetric? Explain.
   b. Write the mathematical representation for the "Goals" sequence in terms of unit sample functions.
   c. What is the average number of goals scored by this team over first 10 matches and all matches?
   d. Can the answers to part c be found using a system whose unit sample response is a unit step function? Explain.

2. A signal y[n] is the output of a system whose input is x[n] = u[n]. Write y[n] in terms of u[n] if
   a. y[n] = 1 for $n \leq 0$ and y[n] = 0 otherwise.
   b. y[n] = -1 for odd values of n and y[n] = 1 for even values of n.
   c. y[n] = δ[n].
   d. y[n] = n for $n \geq 0$ and y[n] = 0 otherwise.
   e. y[n] = 1 for $4 \leq n \leq 10$ and y[n] = -3 for $11 \leq n \leq 16$

3. Given the sequence x[n] below find the result of the following operations.



   a. x[2n-3]

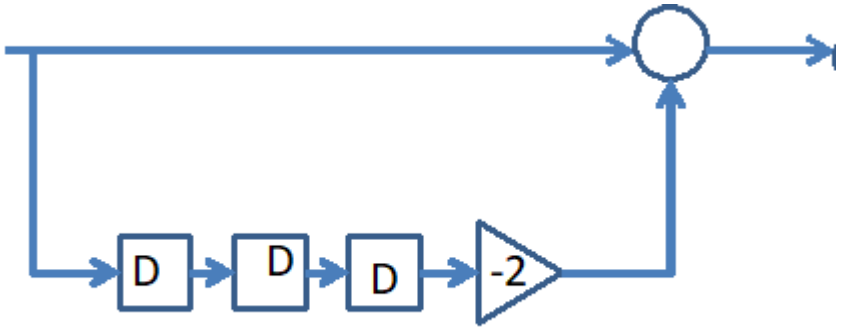
   b. x[1-2n]

   c. x[n-1]δ[n-2]

   d. -0.5x[n+4]

4. In the block diagram shown below the square blocks labelled as D indicate unit Delay elements and triangle indicates a scalar and the circle denotes a summer.

Note: this notation is slightly different from the one used in the class.



a. Write the difference equation for this system.
b. Use the operator notation and express the relation between Y and X.
c. Find y[n] if x[n] is (i) $\delta[n]$ and (ii) as given in Question 3.
d. Find an alternate implementation for this system and state its advantages over the given one.