

Exercises Week 2

DSP

1. Consider the following discrete signal $x[n]$:

$$x[n] = \begin{cases} 1 + \frac{n}{3}, & -3 \leq n \leq -1 \\ 1, & 0 \leq n \leq 3 \\ 0, & \text{elsewhere} \end{cases}$$

- Find the values of $x[n]$ and represent the signal graphically
 - Represent graphically the signal $x[-n + 4]$
 - Write the expression of $x[n]$ based on the signal $\delta[n]$
 - Write the expression of $x[n]$ based on the signal $u[n]$
2. Consider the following signal:

$$x[n] = \begin{cases} 1, & -1 \leq n \leq 2 \\ \frac{1}{2}, & 3 \leq n \leq 4 \\ 0, & \text{elsewhere} \end{cases}$$

Represent graphically the following signals:

- $x[n - 2]$
 - $x[n + 2]$
 - $x[4 - n]$
 - $x[n] \cdot u[2 - n]$
 - $x[n - 1] \cdot \delta[n - 3]$
 - $x[n^2]$
 - The even part of $x[n]$
 - The odd part of $x[n]$
3. Characterize the following systems with respect to:
- Memory
 - Linearity

- Time invariance
- Causality
- Stability

- a. $y[n] = n \cdot x[n^2]$
- b. $y[n] = x[n] \cdot \cos(\omega_0 n)$
- c. $y[n] = \sin(x[n])$
- d. $y[n] = x[n] + n \cdot x[n + 1]$