Quiz 1

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Download all python codes from

https://github.com/YashasTadikamalla/EE3900/blob/main/Quiz1/codes

and latex-tikz codes from

https://github.com/YashasTadikamalla/EE3900/blob/main/Quiz1/Quiz1.tex

1 Problem (2.29 (c,d))

A discrete-time signal $x[n]$ is shown in figure below

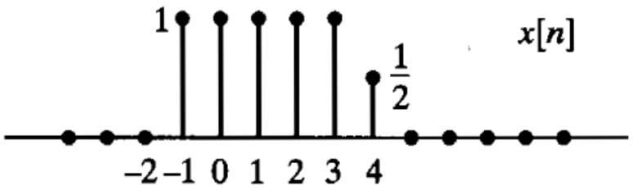

Fig. 0: $x[n]$

Sketch and label carefully, each of the following signals:

1) $x[2n]$
2) $x[n]u[2-n]$

2 Solution

Given, $\forall n \in \mathbb{Z}$

$$x[n] = \begin{cases} 0, & n \le -2 \\ 1, & -1 \le n \le 3 \\ \frac{1}{2}, & n = 4 \\ 0, & n \ge 5 \end{cases} \tag{2.0.1}$$

Also, $\forall n \in \mathbb{Z}$

$$u[n] = \begin{cases} 0, & n \le -1 \\ 1, & n \ge 0 \end{cases} \tag{2.0.2}$$

1) To find: $x[2n]$. From (2.0.1),

$$x[n] = 0, n \le -2 \text{ and } n \ge 5 \tag{2.0.3}$$
$$\Rightarrow x[2n] = 0, 2n \le -2 \text{ and } 2n \ge 5 \tag{2.0.4}$$
$$\Rightarrow y[n] = 0, n \le -1 \text{ and } n \ge 3 \, (\because n \in \mathbb{Z}) \tag{2.0.5}$$

Now, we just need to check for values of $x[2n]$ for $n = 0, 1, 2$.

$$x[2 * 0] = x[0] = 1 \tag{2.0.6}$$
$$x[2 * 1] = x[2] = 1 \tag{2.0.7}$$
$$x[2 * 2] = x[4] = \frac{1}{2} \tag{2.0.8}$$

Hence, $\forall n \in \mathbb{Z}$

$$x[2n] = \begin{cases} 0, & n \le -1 \\ 1, & 0 \le n \le 1 \\ \frac{1}{2}, & n = 2 \\ 0, & n \ge 3 \end{cases} \tag{2.0.9}$$

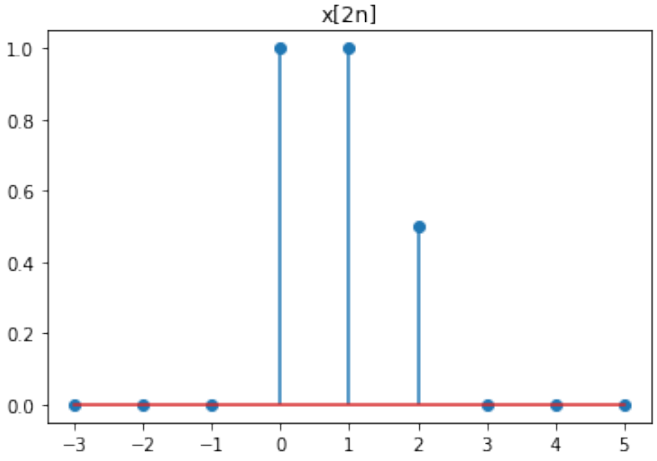

Fig. 1: Plot of $x[2n]$

2) To find: $x[n]u[2-n]$. From (2.0.2)

$$u[2-n] = \begin{cases} 0, & n \ge 3 \\ 1, & n \le 2 \end{cases} \tag{2.0.10}$$

From (2.0.1),(2.0.10)

$$x[n]u[2-n] = 0, n \leq -2 \text{ and } n \geq 3 \quad (2.0.11)$$

Now, we just need to check for values of $x[n]u[2-n]$ for $n = -1, 0, 1, 2$.

$$x[-1]u[2-(-1)] = x[-1]u[3] = 1 \quad (2.0.12)$$
$$x[0]u[2-0] = x[0]u[2] = 1 \quad (2.0.13)$$
$$x[1]u[2-1] = x[2]u[1] = 1 \quad (2.0.14)$$
$$x[2]u[2-2] = x[4]u[0] = 1 \quad (2.0.15)$$

Hence, $\forall n \in \mathbb{Z}$

$$x[n]u[2-n] = \begin{cases} 0, & n \leq -2 \\ 1, & -1 \leq n \leq 2 \\ 0, & n \geq 3 \end{cases} \quad (2.0.16)$$

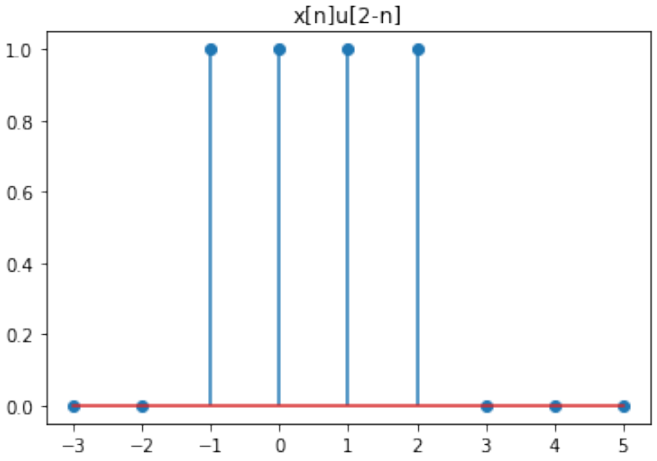

Fig. 2: Plot of $x[n]u[2-n]$