College of Engineering and Physics

Electrical Engineering Department

EE562 - Digital Signal Processing I

Second Semester (212)

Homework Assignment 1

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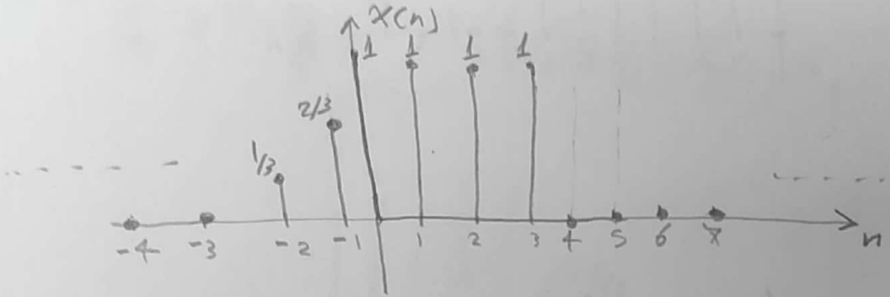
P2.1

(a) $x(n) = \{\cdots 0, \frac{1}{3}, \frac{2}{3}, \underset{\uparrow}{1}, 1, 1, 1, 0, 0, \cdots\}$

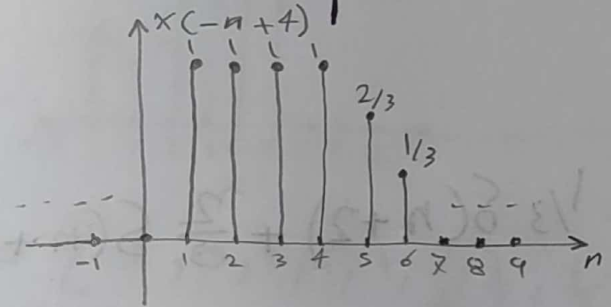


(b)

1. $x(-n) = \{\cdots 0, 1, 1, 1, \underset{\uparrow}{1}, \frac{2}{3}, \frac{1}{3}, 0, \cdots\}$

→ then delay by four samples:

$x(-n+4) = \{\cdots 0, \underset{\uparrow}{0}, 1, 1, 1, 1, \frac{2}{3}, 1/3, 0, \cdots\}$

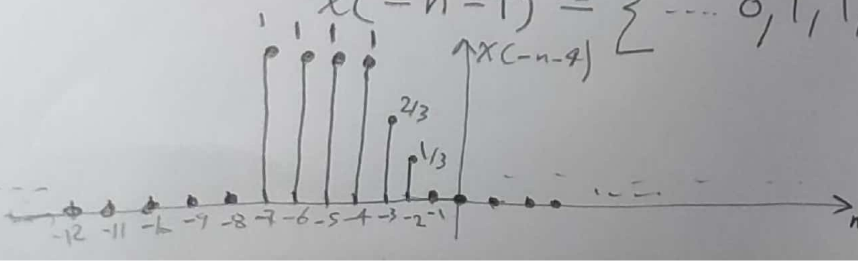


2. → First delay $x(n)$ by four samples:

$x(n-4) = \{\cdots \underset{\uparrow}{0}, 0, 1/3, 2/3, 1, 1, 1, 1, 0, \cdots\}$

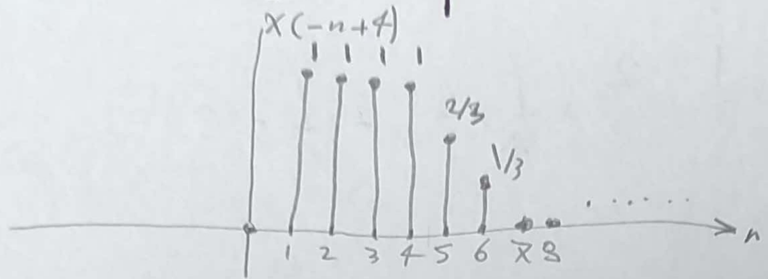
→ then folding:

$x(-n-4) = \{\cdots 0, 1, 1, 1, 1, \frac{2}{3}, 1/3, 0, \underset{\uparrow}{0}, \cdots\}$



(c)

$$x(-n+4) = \{\ldots, \underset{\uparrow}{0}, 1, 1, 1, 1, \tfrac{2}{3}, \tfrac{1}{3}, 0, \ldots\}$$



(d) for Calculate $x(-n+k)$:

$\boxed{1}$ fold $x(n)$ $\longrightarrow$ toget $x(-n)$

$\boxed{2}$ then shif $x(-n)$ → right by k $\quad k>0$

→ left by k $\quad k<0$

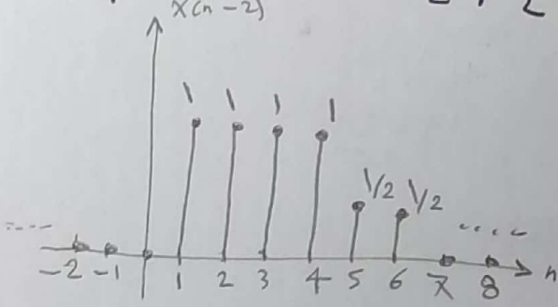
(e) we can express $x(n)$ in terms of $\delta(n)$ & $u(n)$ as follows:

$$x(n) = \tfrac{1}{3}\,\delta(n+2) + \tfrac{2}{3}\,\delta(n+1) + u(n) - u(n-4)$$

P2.2

$$x(n) = \{\ldots, 0, 1, \underset{\uparrow}{1}, 1, 1, 1/2, 1/2, 0, \ldots\}$$

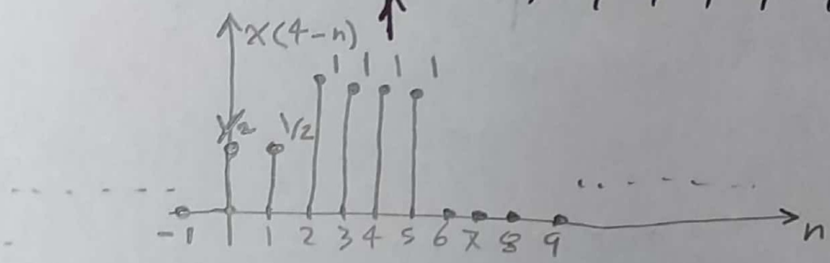
(a) $x(n-2) = \{\ldots, 0, \underset{\uparrow}{0}, 1, 1, 1, 1, \frac{1}{2}, \frac{1}{2}, 0, \ldots\}$



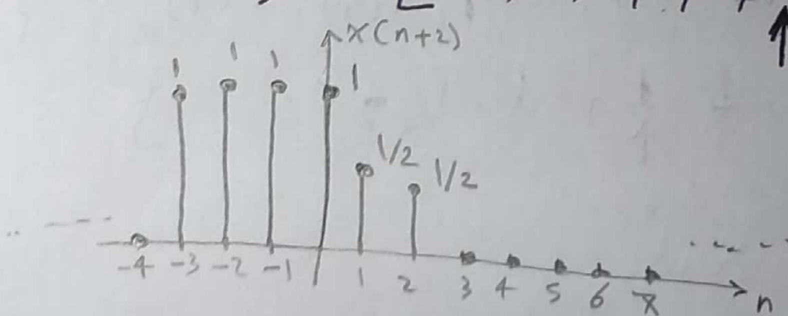
(b) $x(4-n)$

$x(-n) = \{\ldots, 0, 1/2, 1/2, 1, 1, \underset{\uparrow}{1}, 1, 0, 0, \ldots\}$

$x(-n+4) = \{\ldots, 0, \underset{\uparrow}{1/2}, 1/2, 1, 1, 1, 1, 0, 0, \ldots\}$



(c) $x(n+2) = \{\ldots, 0, 1, 1, 1, \underset{\uparrow}{1}, \frac{1}{2}, \frac{1}{2}, 0, \ldots\}$

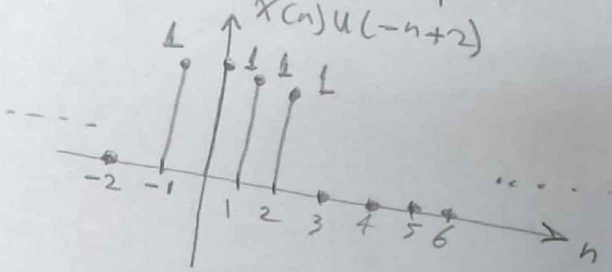


(d) $x(n)u(2-n)$

$$x(n) = \{ 0, 1, \underset{\uparrow}{1}, 1, 1, \tfrac{1}{2}, \tfrac{1}{2}, 0, \dots \}$$

$$u(-n+2) = \{ \dots\dots, 1, \underset{\uparrow}{1}, 1, 1, 0, 0, 0 \}$$

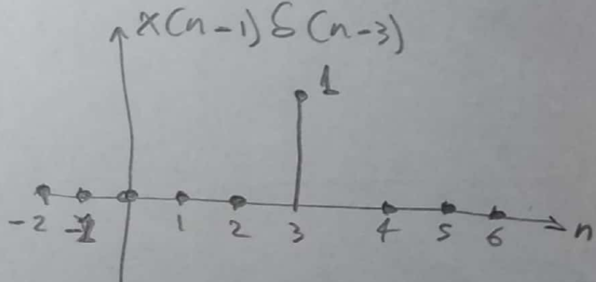
$$x(n)u(-n+2) = \{ \dots, 0, 1, \underset{\uparrow}{1}, 1, 1, 0, \dots \}$$



(e) $x(n-1)\delta(n-3)$

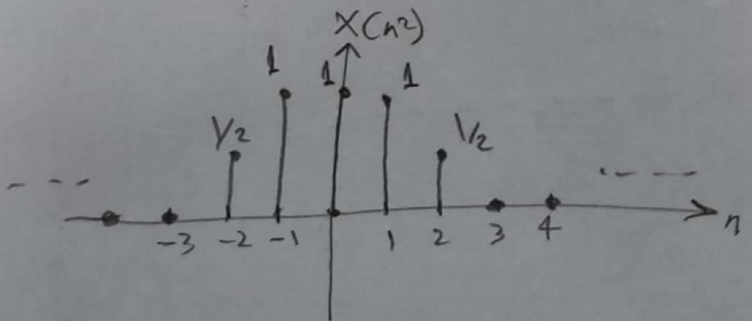
$$x(n-1) = \{ 0, \underset{\uparrow}{1}, 1, 1, 1, \tfrac{1}{2}, \tfrac{1}{2}, 0, \dots \}$$

$$\therefore x(n-1)\delta(n-3) = \{ \dots, \underset{\uparrow}{0}, 0, 0, 1, 0, 0, 0, \dots \}$$



(f) $x(n^2) = \{ \dots x(9), x(4), x(1), x(0), x(1), x(4), x(9), \dots \}$

$$= \{ \dots, 0, \tfrac{1}{2}, 1, \underset{\uparrow}{1}, 1, \tfrac{1}{2}, 0, \dots \}$$



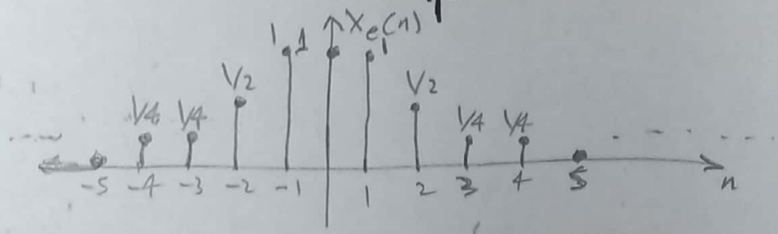
(g) $x_e(n) = \dfrac{x(n) + x(-n)}{2}$

$x(n) = \{0, 1, \underset{\uparrow}{1}, 1, 1, \frac{1}{2}, \frac{1}{2}, 0, \dots\}$

$x(-n) = \{\dots, 0, \frac{1}{2}, \frac{1}{2}, 1, 1, \underset{\uparrow}{1}, 1, 0, 0, 0\}$

$x(n) + x(-n) = \{\dots, 0, \frac{1}{2}, \frac{1}{2}, 1, 2, \underset{\uparrow}{2}, 2, 1, \frac{1}{2}, \frac{1}{2}, 0, 0, \dots\}$

$\therefore x_e(n) = \{\dots, 0, \frac{1}{4}, \frac{1}{4}, \frac{1}{2}, 1, \underset{\uparrow}{1}, 1, \frac{1}{2}, \frac{1}{4}, \frac{1}{4}, 0, 0\}$



(h) $x_o(n) = \dfrac{x(n) - x(-n)}{2}$

$= \{\dots, 0, \frac{-1}{4}, \frac{-1}{4}, -\frac{1}{2}, 0, \underset{\uparrow}{0}, 0, \frac{1}{2}, \frac{1}{4}, \frac{1}{4}, 0, \dots\}$