[illegible]

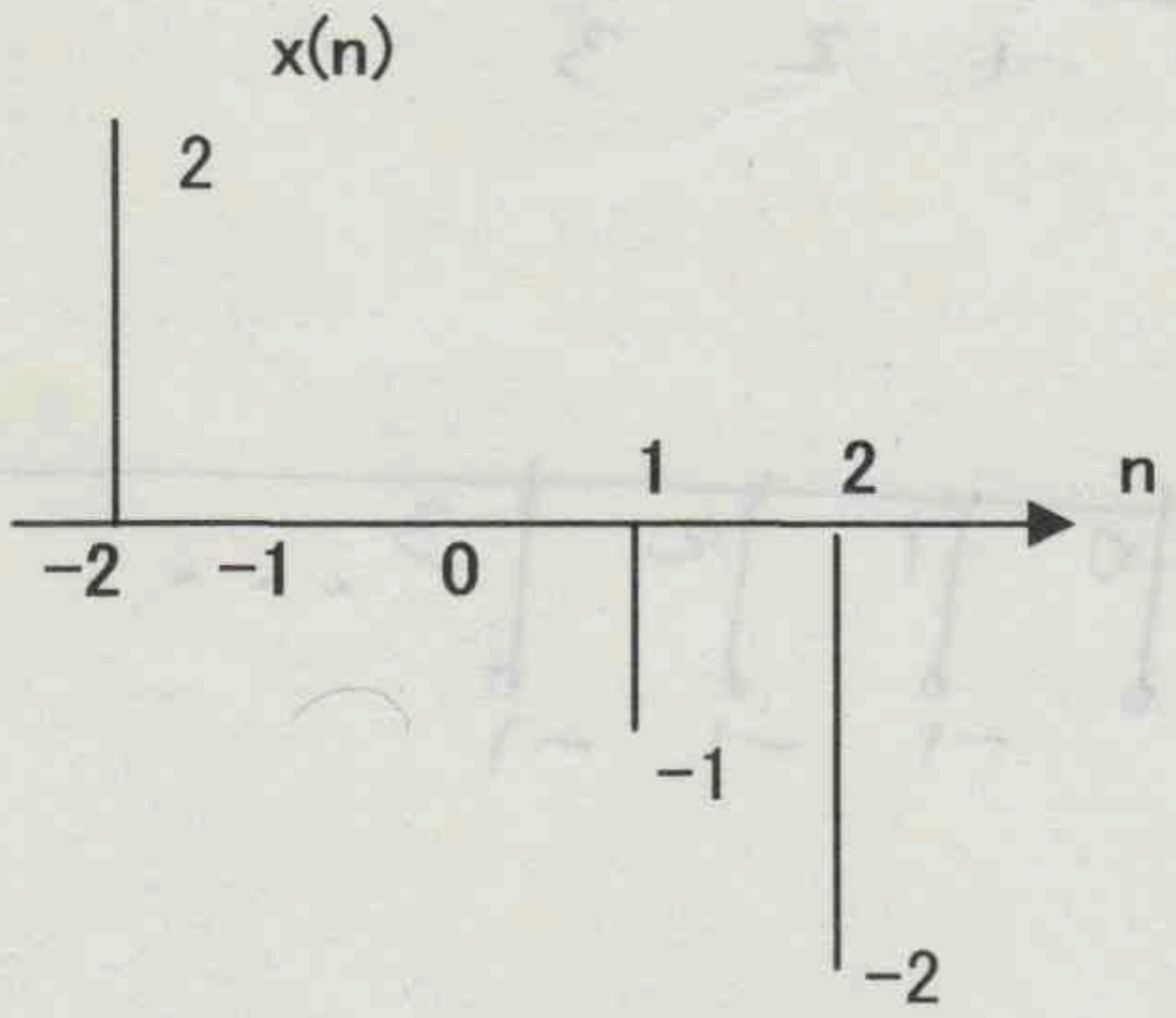
2011/6/12

My solution
M.R.Asharif

Digital Signal Processing **University of the Ryukyus**
Undergraduate Course **Student's Name:** **Faculty of Engineering**
Mid-Term Examination **Sudent's No.** **Dept. of Information Eng.**
2011.6.17 [write your answer in the blocks, each one 10 score] **Prof. M.R. Asharif**

~~~~~~

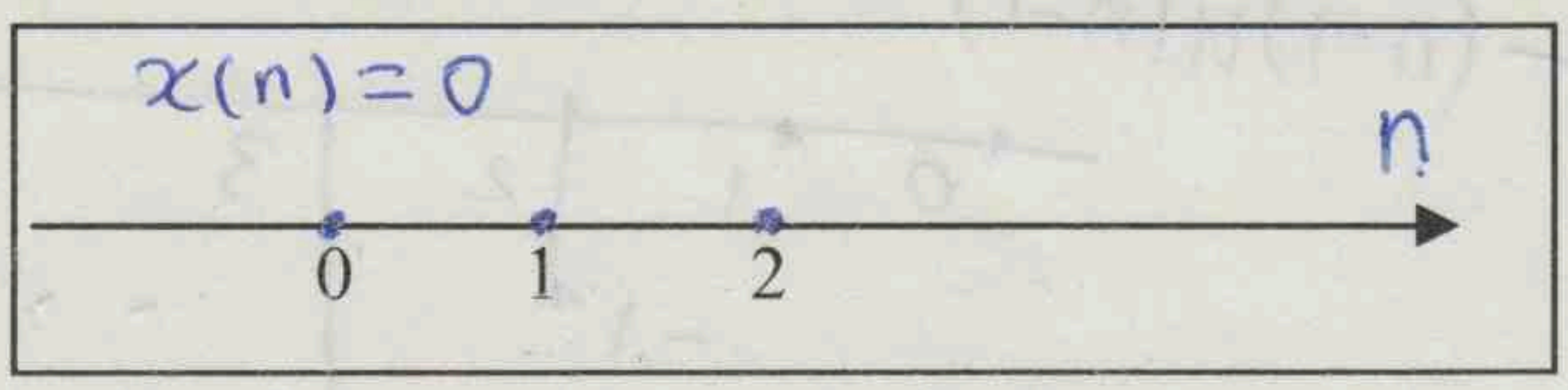
1. 図で信号、x(n)、を δ(n)、関数を用いて表現せよ。
ただし $-2 \le n \le 2$



x(n)= $2\delta(n+2) - \delta(n-1) - 2\delta(n-2)$

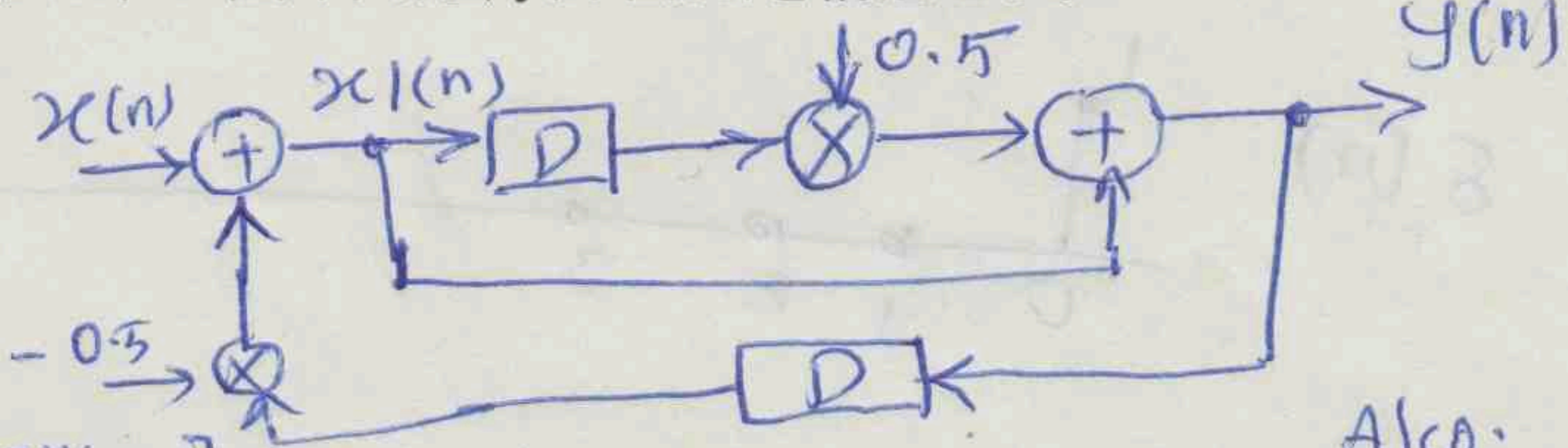
2・次の信号をプロットせよ。

$$x(n) = nu(n) - u(n) - (n-1)u(n-1) + \delta(n)$$



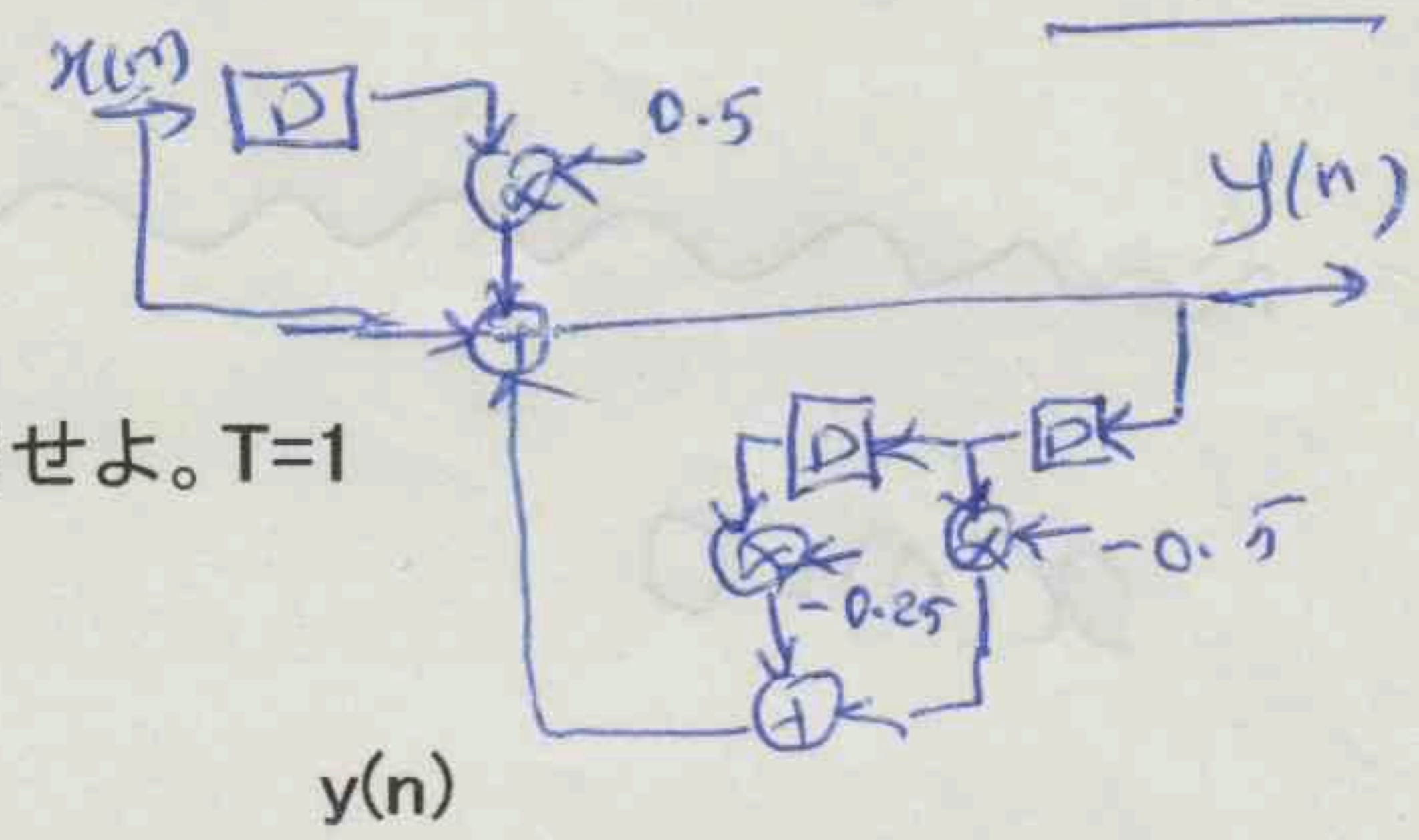
3・以下の二つ差分方程式を満足する離散時間システム(x(n):入力、y(n):出力)を構成せよ。T＝1

$x1(n) = x(n) - 0.5\,y(n-1)$
$y(n) = x1(n) + 0.5\,x1(n-1)$

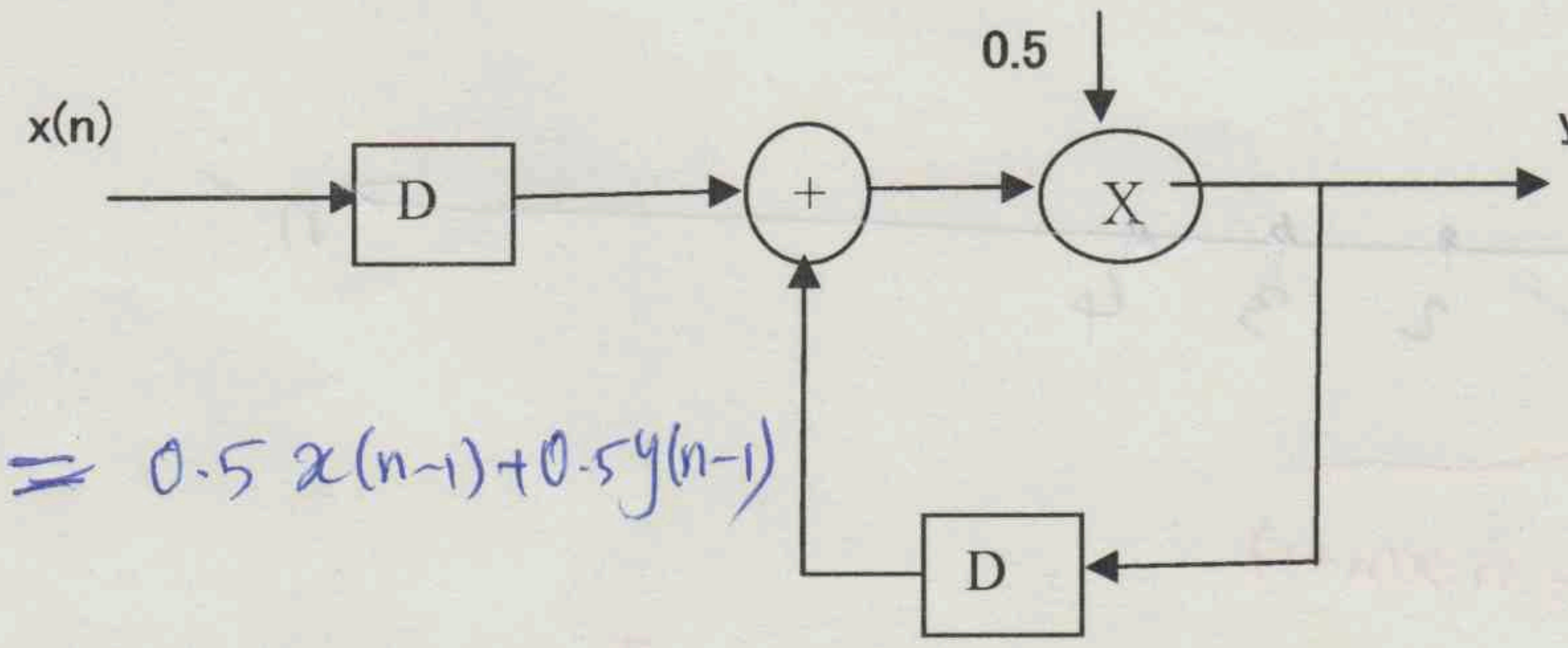


Also :
$y(n) = x(n) - 0.5y(n-1) + 0.5[x(n-1) - 0.5y(n-2)]$
$y(n) = x(n) + 0.5x(n-1) - 0.5y(n-1) - 0.25y(n-2)$

Also:



4−図に示す離散時間システム(IIR Digital Filter) の差分方程式を指出せよ。T=1



$y(n) = 0.5x(n-1) + 0.5y(n-1)$

y(n) = $0.5x(n-1) + 0.5y(n-1)$

5・以下3個の入出力を示すシステムの線形性、時不変性、因果性、安定性を判定し、○か×で示せよ。

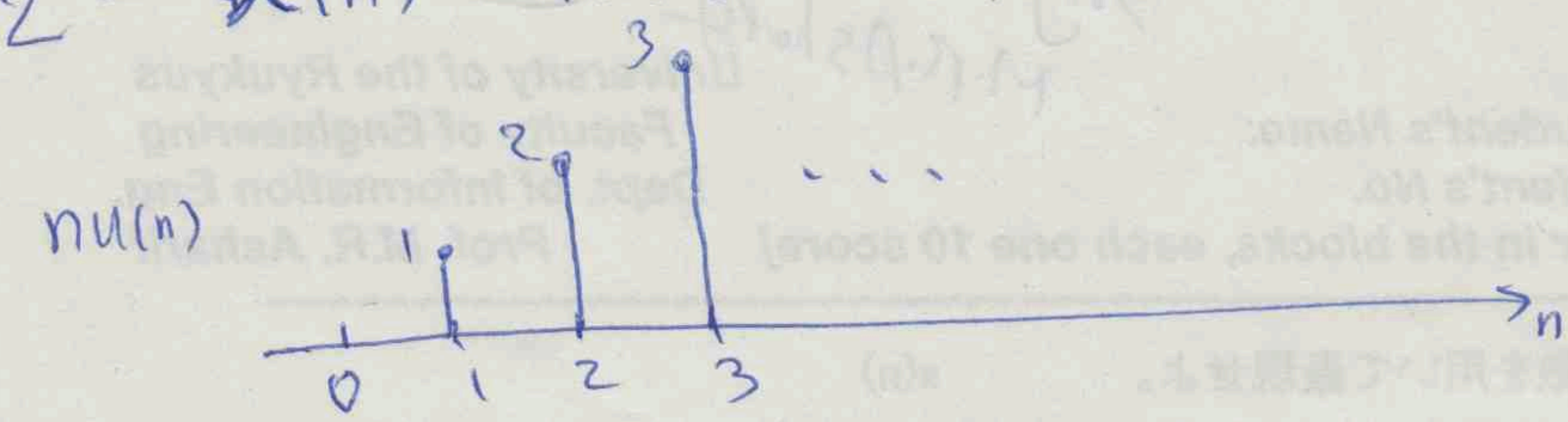
y (n) = n x (n+1)

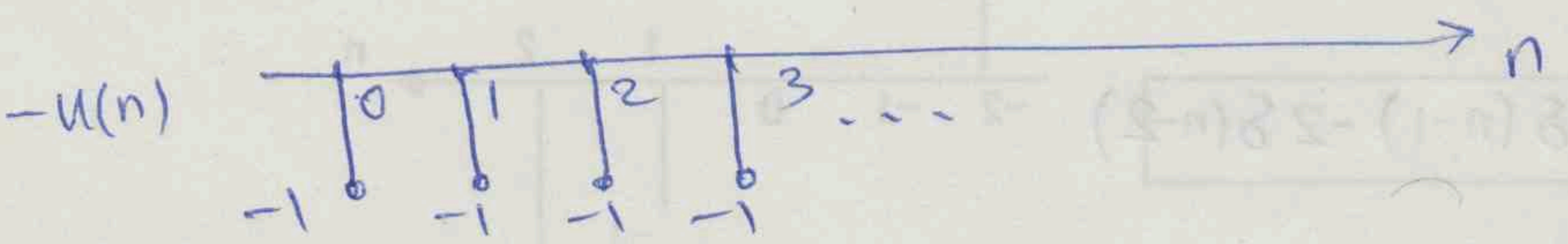
Linearity,	Shift Invariance,	Causality,	Stability
○	×	×	×

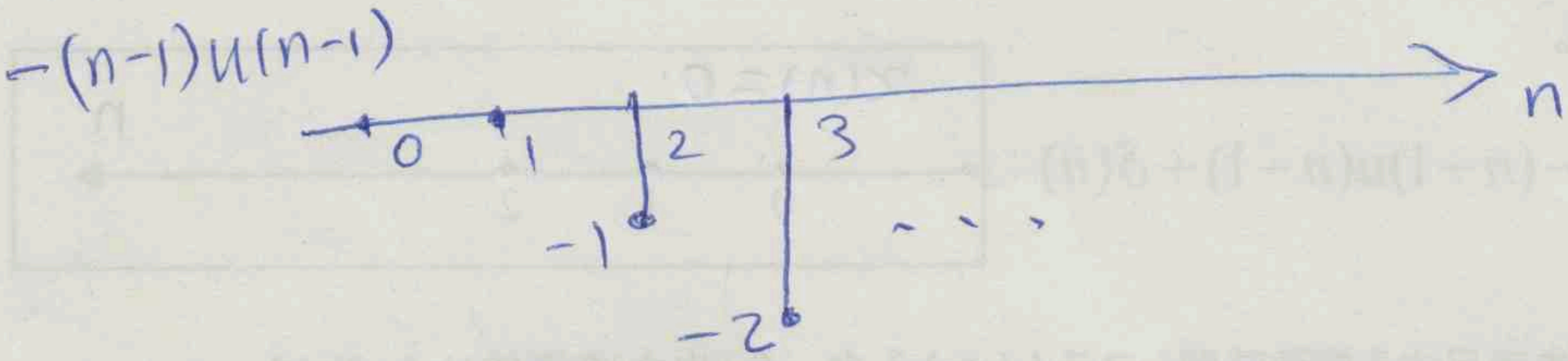
$R[ax_1(n) + bx_2(n)] = nax_1(n+1) + nbx_2(n+1)$
$aR[x_1(n)] + bR[x_2(n)] = anx_1(n+1) + bnx_2(n+1)$

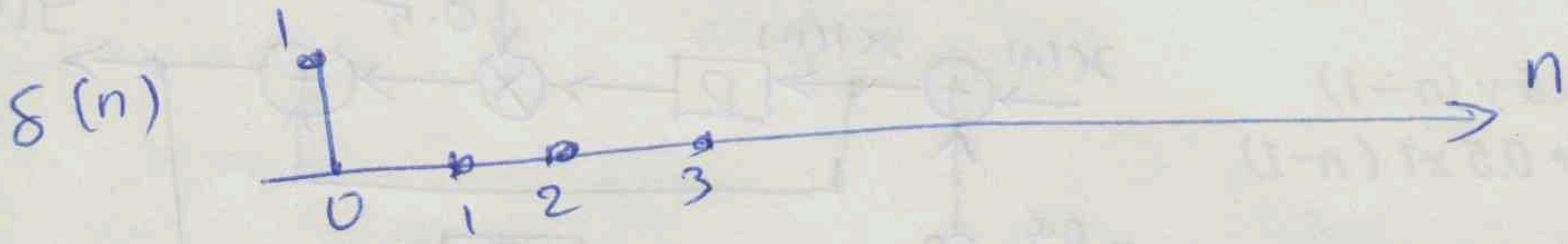
Linear ○
~~~~~~

2 - $x(n) = nu(n) - u(n) - (n-1)u(n-1) + \delta(n)$

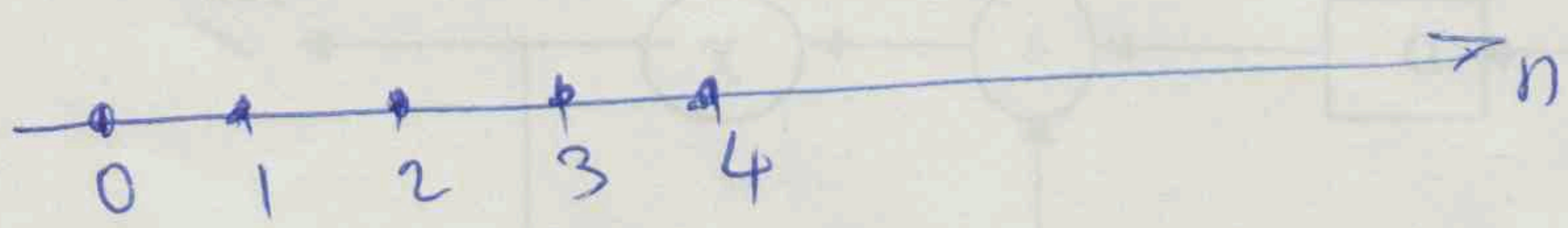


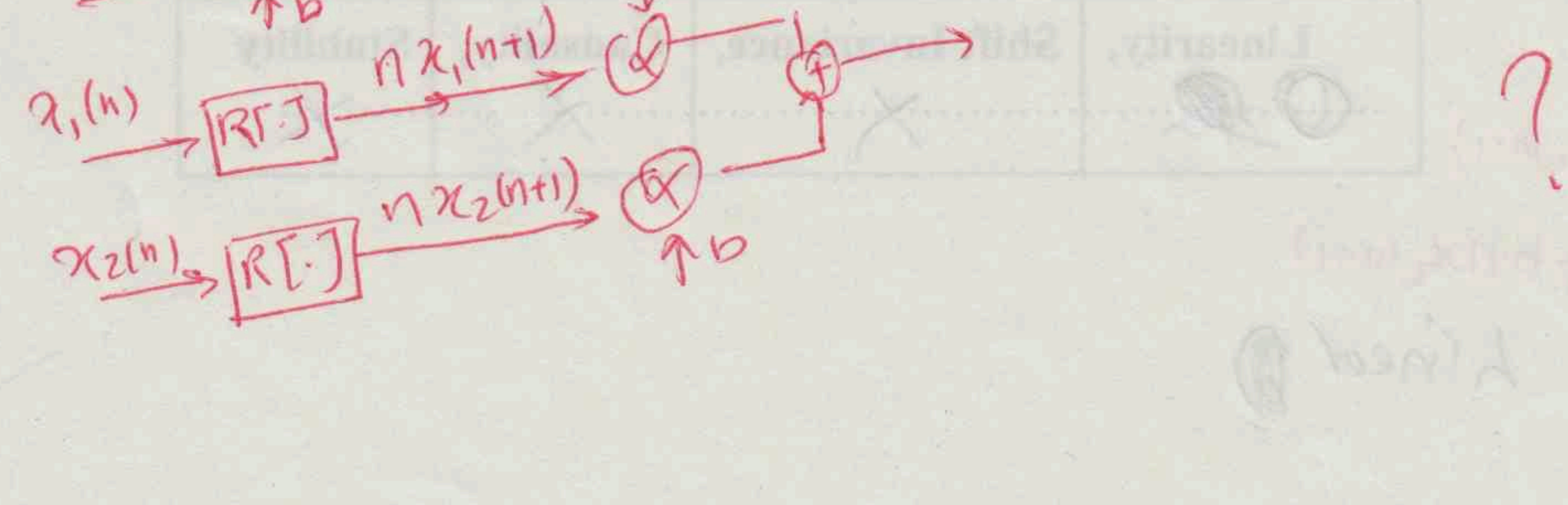






$x(n)=0$





?

DSP_Mid-Term

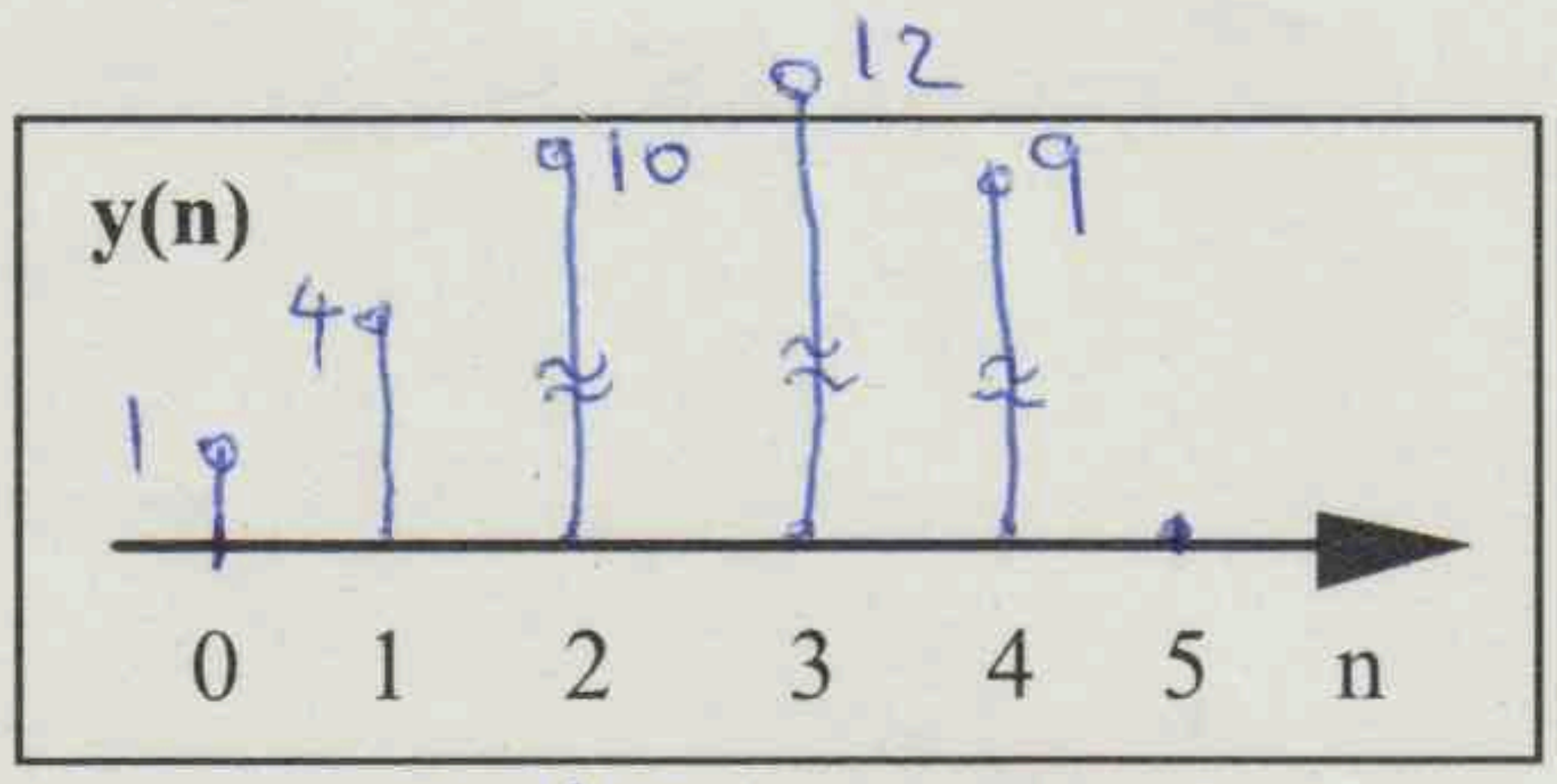
2011/6/17

My Solution 2011/6/15

6・次のシステムでは *h(n)* はインパルス応答、*x(n)* は入力で、出力 *y(n)* を計算せよ。

$h(n) = [1, 2, 3]$ ↑ n=0

$x(n) = [1, 2, 3]$ ↑ n=0



$y(n) = \sum_{K=0}^{2} h(i)\,x(n-i)$

$n=0:\ y(0) = h(0)\cdot x(0) = 1$

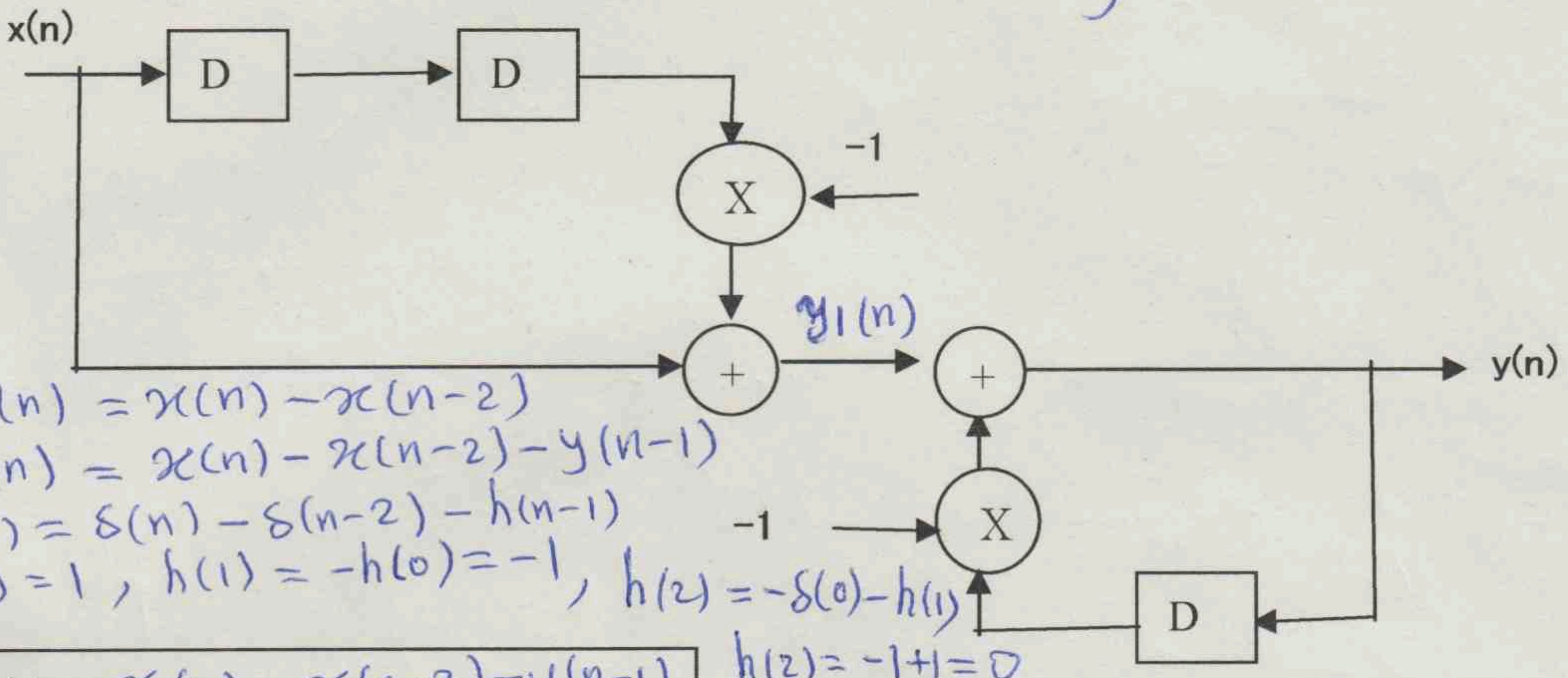
$n=1:\ y(1) = h(0)x(1) + h(1)x(0) = 2+2=4$

$n=2:\ y(2) = \underbrace{h(0)}_{1}\underbrace{x(2)}_{3} + \underbrace{h(1)}_{2}\underbrace{x(1)}_{2} + \underbrace{h(2)}_{3}\underbrace{x(0)}_{1} \rightarrow = 3+4+3=10$

$n=3:\ y(3) = \underbrace{h(1)}_{2}\underbrace{x(2)}_{3} + \underbrace{h(2)}_{3}\underbrace{x(1)}_{2} = 6+6=12$

$n=4:\ y(4) = h(2)x(2) = 3\times 3 = 9$

7. 次の回路の差分方程式とインパルス応答を求めよ。 y(−1)=0 , ~~x~~y1(−1)=0



$y1(n) = x(n) - x(n-2)$

$y(n) = x(n) - x(n-2) - y(n-1)$

$h(n) = \delta(n) - \delta(n-2) - h(n-1)$

$h(0) = 1,\ h(1) = -h(0) = -1,\ h(2) = -\delta(0) - h(1)$

$h(2) = -1+1 = 0$

y(n)= $x(n) - x(n-2) - y(n-1)$

h(n)= $[\overset{\uparrow n=0}{1}, -1, 0 \cdots] = \delta(n) - \delta(n-1)$

8.‒つぎのインパルス応答を持つシステムは、安定かどうか判断せよ。(T=1)

$S_{n\to\infty} = \log(0) = -\infty \rightarrow$ Not stable

$$h(n) = [\log\frac{1}{2^n}]u(n)$$

$S = \sum_{n=0}^{\infty} |h(n)| = \log 1 + \log\frac{1}{2} + \cdots + \log\frac{1}{2n} = \log(1\times\frac{1}{2}\times\cdots\times\frac{1}{2n})$

安定 [✓ 不安定]

9‒次の離散時間システムのフーリエ変換 H(w)を求めよ。

$$h(nT) = 0.5\delta(nT+T) + 0.5\delta(nT-T)$$

1‒ T=0.1msの時、｜H(w)｜をプロットせよ。

2‒ Arg[H(w)] をもとめよ。

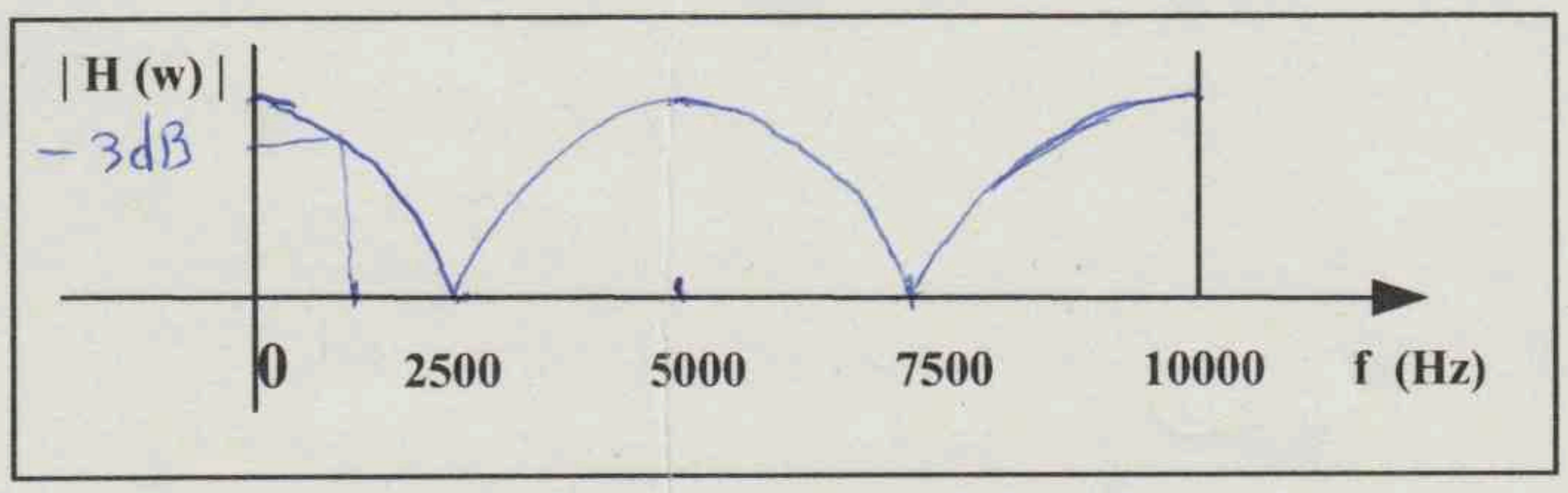
3‒ f＝1250 Hz で ｜H(w)｜(dB)を求めよ。

$H(w) = \sum_{n=-1}^{1} h(nT)\, e^{-jwnT} = 0.5e^{jwT} + 0.5e^{-jwT} = \cos\omega T$

$H(w) = \cos(2\pi f \times 0.1\times 10^{-3}) = \cos(\frac{2\pi f}{10,000})$

$|H(\omega)|_{f=0} = 1,\ H(\omega)|_{f=2500,7500} = 0,\ |H(\omega)|_{f=5000} = |-1| = 1$

$H(w)|_{f=1250} = \cos\frac{\pi}{4} = \frac{\sqrt{2}}{2},\ 20\log_{10}\frac{\sqrt{2}}{2} = -3dB$



| H (w) | = $|\cos\omega T|$

$\mathbf{20\log_{10} |H(w)|_{f=1250}} = -3dB$

arg [H (w)] = $0, \pi$