Exercises Week 2

(3) a) $y[n] = n \cdot (x[n])^2$

- M : memoryless
- Linear? $x[n] = a x_1[n] + b x_2[n]$

$$H\{\underbrace{a \cdot x_1[n] + b \cdot x_2[n]}_{\stackrel{?}{=} x[n]}\} = n \cdot \left(a \cdot x_1[n] + b \cdot x_2[n]\right)^2 \neq \Rightarrow \text{non-linear}$$

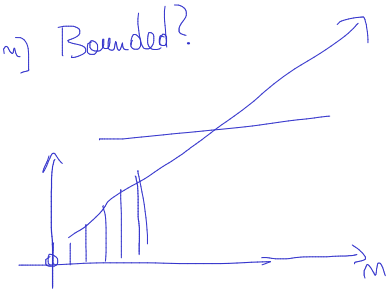
$$a \cdot H\{x_1[n]\} + b \cdot H\{x_2[n]\} = a \cdot n \cdot (x_1[n])^2 + b \cdot n \cdot (x_2[n])^2$$

- Time Invar? Not T.i. because of n:

$$\left.\begin{array}{l} \cdot\ y[n-k] = (n-k) \cdot (x[n-k])^2 \\ \quad\ \stackrel{?}{=} \quad\ \neq \\ \cdot\ H\{x[n-k]\} = n \cdot (x[n-k])^2 \end{array}\right\} \neq \text{Not T.i.}$$

- Causal? Yes
- stable? If $x[n] \in [-M, M]$, is $y[n]$ Bounded? is Bounded

If $x[n] = 1$ (Bounded) $\Rightarrow$ $y[n] = n$ (Unbounded)



Unstable

b). $y[n] = (x[n] + x_2[n]) \cdot \cos(w_0 n)$

- M : memoryless
- L : linear ✓
- T.i : no, it is Time Variant
- C. : Yes
- S : yes

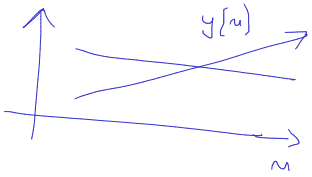
c). $y[n] = \sin(x[n])$ (+1 / −1)

M : memoryless
L : No
T.i : yes
C : Yes
S : Yes

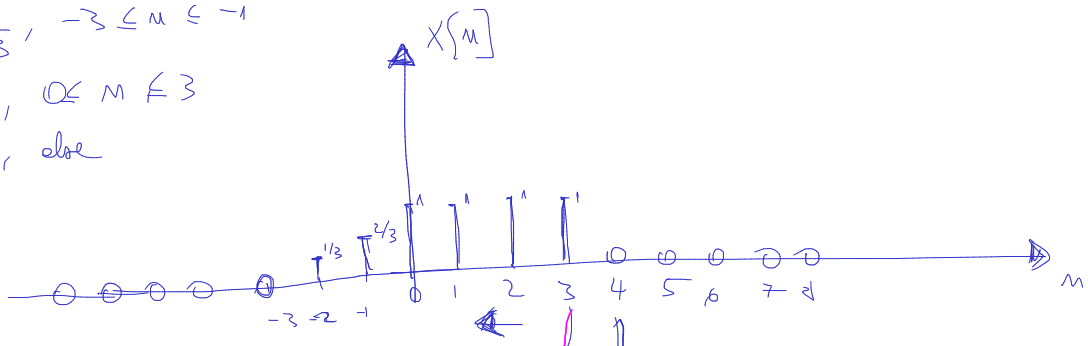
d). $y[n] = x[n] + n \cdot x[n+1]$

- M : with memory
- L : linear
- T.i. : Not
- C : Not
- S : Not $x[n] = 1$

$y[n] = 1 + n \cdot 1$



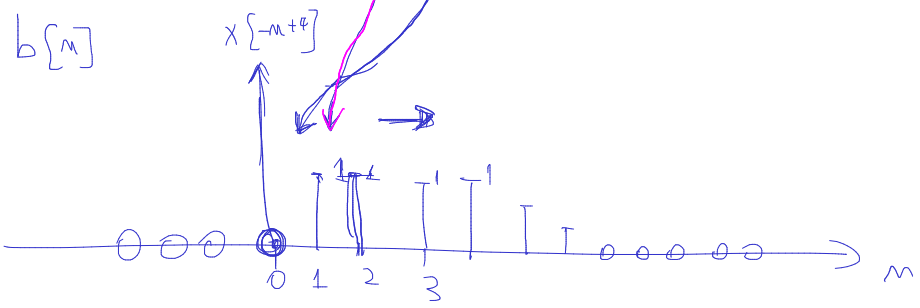
(1) $x[n] = \begin{cases} 1 + \frac{n}{3}, & -3 \le n \le -1 \\ 1, & 0 \le n \le 3 \\ 0, & \text{else} \end{cases}$



b). $x[-n+4] = ? = b[n]$

$b[0] = x[4]$

$b[1] = x[3]$



$\{0, 0, 1, 1, 1, 1, \frac{2}{3}, \frac{1}{3}, 0 \dots\}$

c).

d).