Signal Processing – İÖ Midterm-Mazeret Fall'2015

Solutions

1

a-15

...	-6	-5	-4	-3	-2	-1	0	1	2	... n
0	-1	1	-1	-2	1	-2	1	2	2	0

$x[n+2]$

-3	-2	-1	0	1	n
-1	-1	1	1	2	

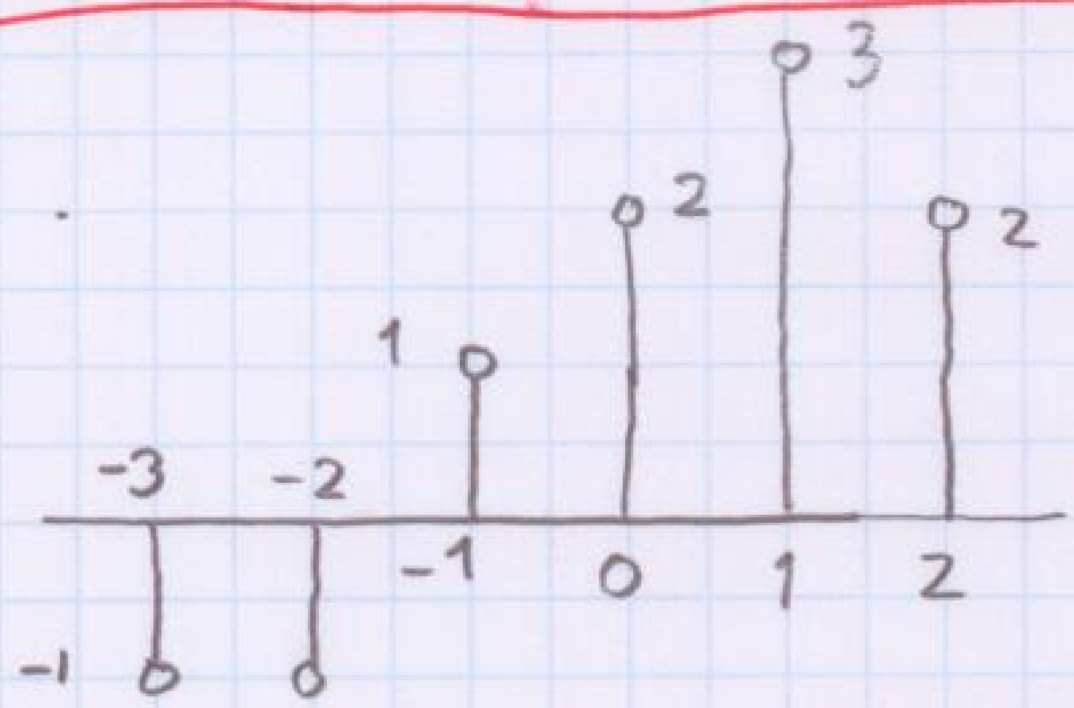
$x[2n+2]$

	-1	0	1	2	3	4	5	6	7	
0	-1	1	-1	-2	1	-2	1	2	2	0

$x[n-3]$

0	1	2
1	1	2

$x[3n-3]$



$x[2n+2] + x[3n-3]$

b-10 non-periodic

c-15 $E = 1+1+1+4+1+4+1+4+4 = \boxed{21}$ Energy Signal.

2

$$y[n] = \sum_{k=-\infty}^{n} x[k+2]$$

$$y[n] = \cdots + x[n-2] + x[n] + x[n+2]$$

$\boxed{i-3}$ not-memoryless

$\boxed{ii-3}$ not causal

$\boxed{iii-3}$ $|x[n]| < M_x$

$$|y[n]| \leq \sum_{k=-\infty}^{+n} M_x = \infty \quad \text{not-stable}$$

$\boxed{iv-3}$ Superposition

$$\mathcal{H}\{x_1[n] + x_2[n]\} = \sum_{k=-\infty}^{n} (x_1[k+2] + x_2[k+2])$$

$$= y_1[n] + y_2[n] \checkmark$$

Homogenity

$$\mathcal{H}\{a\,x[n]\} = \sum_{k=-\infty}^{n} a \cdot x[k+2] = a\,y[n] \checkmark$$

linear

v-3

$$H\{x[n-n_0]\} = \sum_{k=-\infty}^{n-n_0} x[k+2] = y[n-n_0]$$

$\boxed{\text{Time-Invariant}}$

$$y(t) = x(t/2)$$

i-3 not-memoryless

ii-3 causal

iii-3 $|x(t)| \leq M_x \rightarrow |x(t/2)| < M_x$ stable

iv-3 $\mathcal{H}\{x_1(t) + x_2(t)\} = x_1(t/2) + x_2(t/2)$

$= y_1(t) + y_2(t)$ superposition satisfied

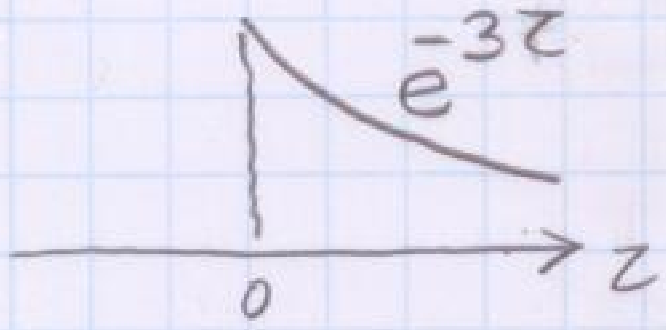
$\mathcal{H}\{a\,x(t)\} = a\,x(t/2) = a\,y(t)$ homogenity satisfied

Linear

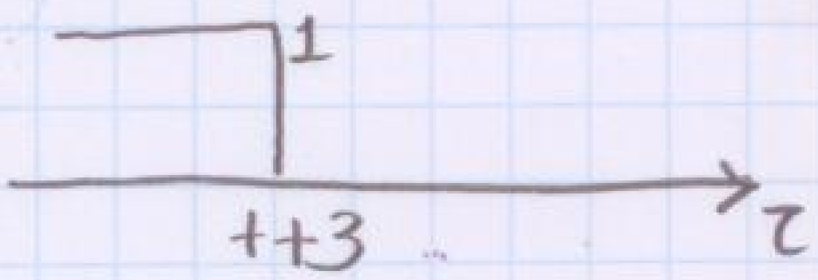
v-3 $H\{x(t - t_0)\} = x\left(\frac{t - t_0}{2}\right) \neq y(t - t_0)$ T-I.

$y(t - t_0) = x\left(\frac{t}{2} - t_0\right)$

3-30p



$x(\tau)$



$h(\tau)$

① $t+3<0 \rightarrow t<-3 \qquad y(t)=0$

② $t \geq -3 \qquad y(t) = \int_0^{t+3} e^{-3\tau} \, d\tau$

$$= -\frac{1}{3} \left[e^{-3\tau} \right]_0^{t+3}$$

$$= +\frac{1}{3} \left(1 - e^{-3(t+3)} \right)$$

$$\boxed{y(t) = \begin{cases} 1/3 \left(1 - e^{-3(t+3)} \right) , & t \geq -3 \\ 0 , & t < -3 \end{cases}}$$