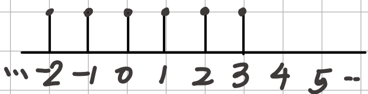
郑方南曦
信息2306
2234412866

1.12



$x[n] = 1 - \sum_{k=3}^{\infty} \delta[n-1-k]$ 可表示为上图

用阶跃函数 $u[-n+3]$ 也可以表达

故 $M=-1$ $n_0 = -3$

1.15 流程可表示为：

$x[n] \rightarrow \boxed{S_1} \rightarrow w[n] \rightarrow \boxed{S_2} \rightarrow y[n]$

(a) $y[n] = w[n-2] + \frac{1}{2} w[n-3]$

$w[n-2] = 2x[n-2] + 4x[n-3]$

$w[n-3] = 2x[n-3] + 4x[n-4]$.

$\therefore y[n] = 2x[n-2] + 4x[n-3] + x[n-3] + 2x[n-4]$

$= 2x[n-2] + 5x[n-3] + 2x[n-4]$

(b) $x[n] \rightarrow \boxed{S_2} \rightarrow w[n] \rightarrow \boxed{S_1} \rightarrow y[n]$.

$\because y[n] = 2w[n] + 4w[n-1]$

$w[n] = x[n-2] + \frac{1}{2} x[n-3]$

$w[n-1] = x[n-3] + \frac{1}{2} x[n-4]$

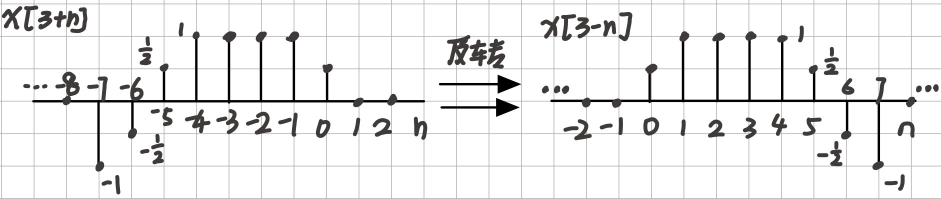
$\therefore y[n] = 2x[n-2] + x[n-3] + 4x[n-3] + 2x[x-4]$

$= 2x[n-2] + 5x[n-3] + 2x[n-4]$

可见次序颠倒不改变输入输出关系

→ LTI系统

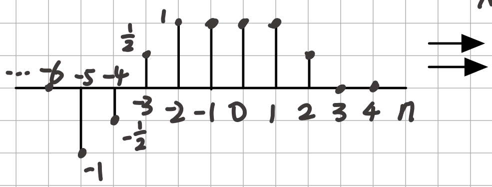
1.22 (b) $x[3-n]$ 为先左移3个单位后反转



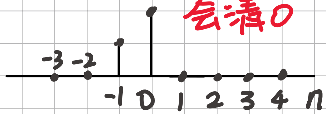
(d) $x[3n+1]$ 为左移1个单位后尺度变换

值得一提的是，3n若非整数信号会清0

$x[n+1]$



$x[3n+1]$

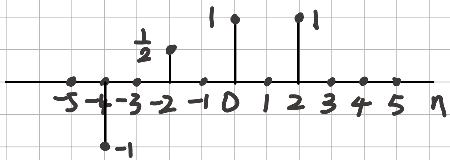


(g) 记 $y[n]=\frac{1}{2}x[n]+\frac{1}{2}(-1)^n x[n]$

$y[-4]=-1$ $y[-3]=-\frac{1}{4}+\frac{1}{2}(-1)(-\frac{1}{2})=0$ $y[-2]=\frac{1}{4}+\frac{1}{2}\cdot\frac{1}{2}=\frac{1}{2}$

$y[-1]=\frac{1}{2}+(-\frac{1}{2})\,1=0$ $y[0]=1$

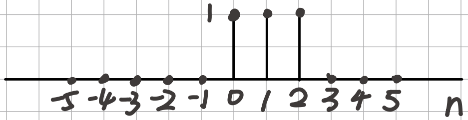
$y[1]=0$ $y[2]=1$ $y[3]=0$ $y[4]=0$ $y[5]=0$



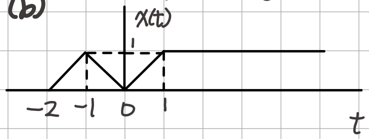
(h) 记 $y[n]=x[(n-1)^2]$ 相当于在看"谱"对着谱填数

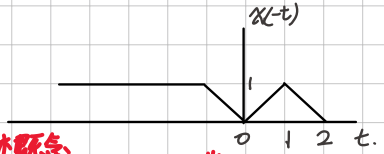
$y[-4]=x[25]=0$ $y[-3]=0$ $y[-2]=0$ $y[-1]=0$ $y[0]=1$ $y[1]=1$

$y[2]=1$ $y[3]=0$ $y[4]=0$ $y[5]=0$.

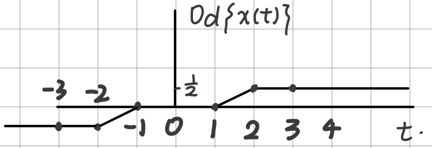


1.23 (b) $Od\{x(t)\} = \frac{1}{2}[x(t) - x(-t)]$

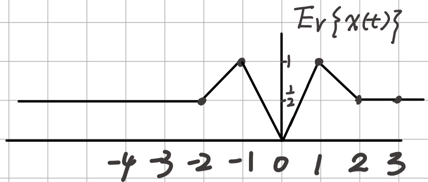




主要是概念这道，只需写好分段函数



$Ev\{x(t)\} = \frac{1}{2}[x(t) + x(-t)]$.



1.26 (a) ∵ $\omega = \frac{6\pi}{7}$ 假如有周期，则 ∃ $m \in Z$ 使:

$$\frac{\omega_0}{2\pi} = \frac{\frac{6\pi}{7}}{2\pi} = \frac{3}{7} = \frac{m}{N}$$

$\frac{3}{7}$ 为有理数，$x[n]=\sin(\frac{6\pi}{7}n+1)$ 是周期的

基波周期 $N_0 = 7$ $(m=3)$

(b). ∵ 对 $\forall m \in Z$. $\frac{\omega}{2\pi} = \frac{1}{16\pi} \notin Q$ 为无理数 故非周期信号

(c). 假设周期 N 存在 $x[n+N]=\cos\frac{\pi}{8}(n+N)^2$
$= \cos(\frac{\pi}{8}n^2+\frac{\pi}{4}nN+\frac{\pi}{8}N^2)$. 如 $\frac{\pi}{4}nN+\frac{\pi}{8}N^2=2k\pi$ 对 $\forall n$ 都成立，
则有 $2nN+N^2=16k$. 则 $2N$, N^2 必须为16整数倍 ★

∴ $N_0=8$ $x[n]$ 是周期的 这题难，因为从定义推周期

$N_0=4$ 不可以 $2nN$ 保不了

(d) $x[n]=\cos(\frac{\pi}{2}n)\cos(\frac{\pi}{4}n) = \frac{1}{2}[\cos(\frac{3}{4}\pi n)+\cos(\frac{1}{4}\pi n)]$

∴ $\frac{\omega_1}{2\pi} = \frac{\frac{3\pi}{4}}{2\pi} = \frac{3}{8}$ $N_1=8$ $\frac{\omega_2}{2\pi} = \frac{\frac{\pi}{4}}{2\pi} = \frac{1}{8}$ $N_2=8$ 均为有理数

∴ $N_0 = 8$ $x[n]$ 是周期的.

(e) ∵ $\frac{\omega_1}{2\pi} = \frac{1}{8}$ $\frac{\omega_2}{2\pi} = \frac{1}{16}$ $\frac{\omega_3}{2\pi} = \frac{1}{4}$ 均为有理数 $N_1=8$ $N_3=4$ $N_2=16$

∴ $x[n]$ 是周期信号 $N_0 = LCD(8,16,4) = 16$.

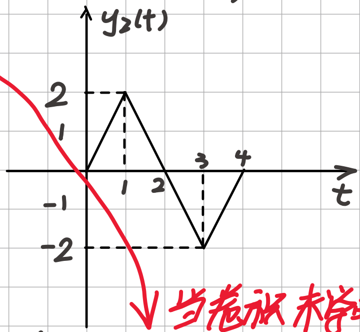
1.31. (a). $x_1(t)=u(t)-u(t-2)$

又∵ $x_2(t)=u(t)-u(t-2)-(u(t-2)-u(t-4))$

$=x_1(t)-x_1(t-2)$

∴ $y_2(t)=y_1(t)-y_1(t-2)$

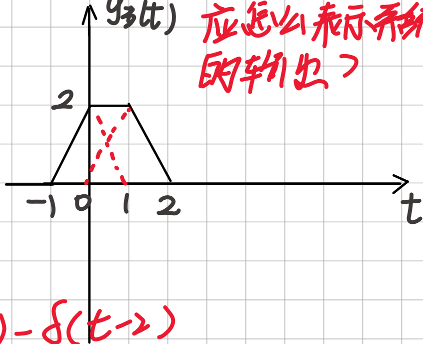
图像如右所示



当卷积未学时应怎么表示系统的输出？

(b) $x_3(t)=x_1(t+1)+x_1(t)$.

∴ $y_3(t)=y_1(t+1)+y_1(t)$



1.31 本质上是一个卷积

$x_2(t)=f(x_1(t))$

$=x_1(t)*(\delta(t)-\delta(t-2))$

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$=x_1(t)*\delta(t)-x_1(t)*\delta(t-2)$.

$=x_1(t)-x_1(t-2)$

⇒ 输出根据线性：

⇒ $y_1(t)\to y_1(t-2)$.

这便会画了

$x_3(t)=x_1(t)*\delta(t+1)+x_1(t)$

$=x_1(t)+x_1(t+1)$

1.47(c)

还要画出 $y_3(t)$ 了