27/7/17

eg $x[n] = 2e^{j3n}$ → $re^{j\theta}$

$|2e^{j3n}|^2$

$= 2^2 = 4$

$E = \lim_{N\to\infty}$

$|e^{j3n}| = \sqrt{\cos^2(3n) + \sin^2(3n)}$

$= 1$

$E = \lim_{N\to\infty} \sum_{n=-N}^{N} |x_n|^2$

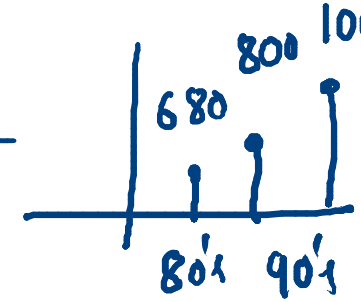
$= |x_e^{j3n}|^2$

$= \lim_{N\to\infty} \sum_{n=-N}^{N} 4 \times 1$

$\therefore E = +\infty$

Signal

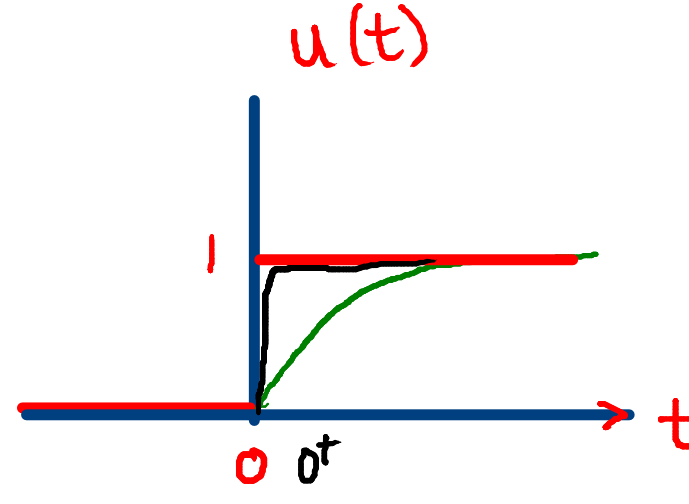
Amplitude | Time | Energy/Power | Deterministic ✓ | Random ✓



Continuous-time unit step signal : $u(t)$

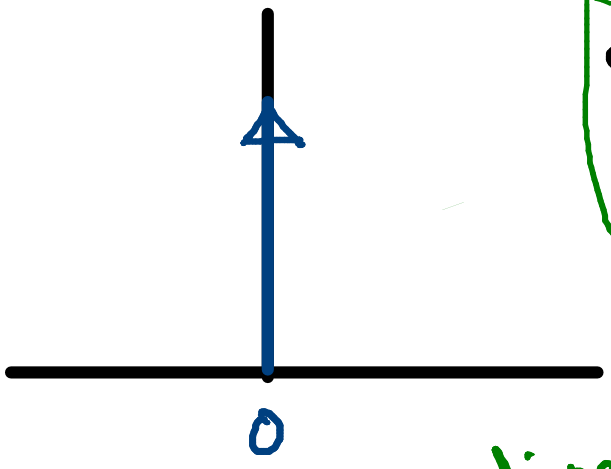
$$u(t) = \begin{cases} 1 & ; \ t > 0 \\ 0 & ; \ t < 0 \\ \text{undefined} & ; \ t = 0 \end{cases}$$

Heaviside function



t

(2) Unit Impulse $\delta(t)$:



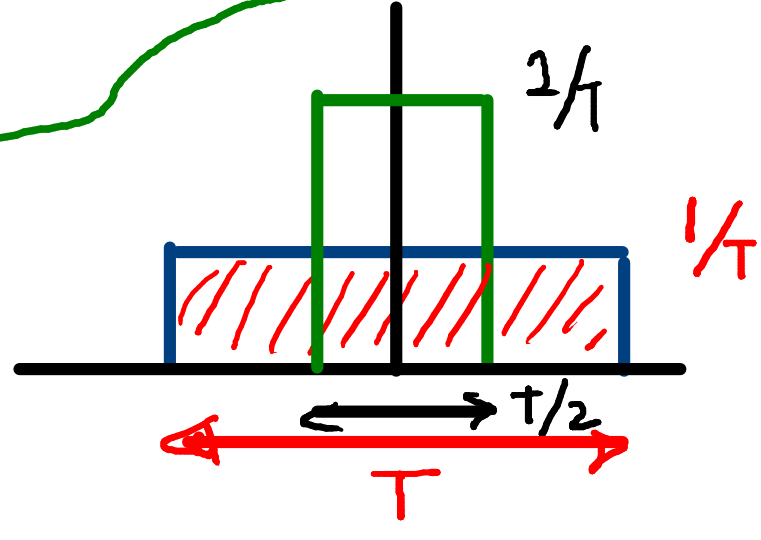
$$\delta(t) = \begin{cases} \infty & ; \ t = 0 \\ 0 & ; \ t \neq 0 \end{cases}$$

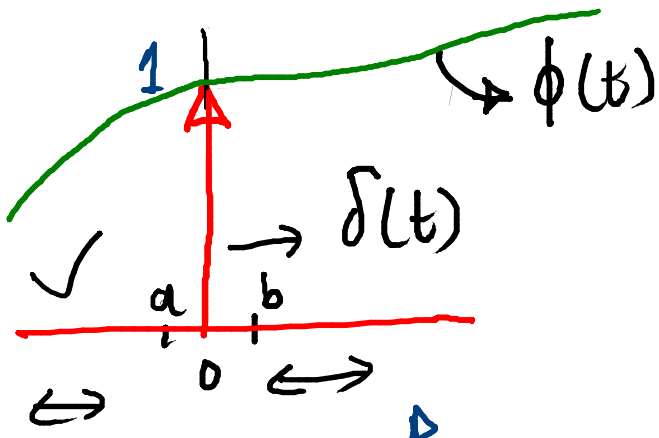
and

$$\int_{-\infty}^{\infty} \delta(t)\, dt = 1$$

This is ordinary function.

$T \to 0$

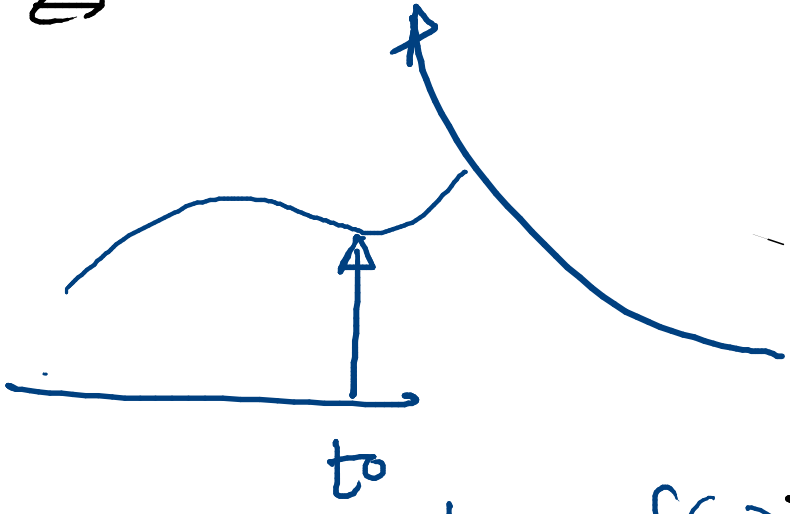




$$\int_a^b \phi(t)\,\delta(t)\,dt$$

$$= \phi(0)\,\delta(t) \quad ; \quad a < 0 < b$$

$$= 0 \quad ; \quad a < b < 0 \text{ or } b > a > 0$$



$$\int_{-\infty}^{\infty} \phi(t)\,\delta(t-t_0)$$

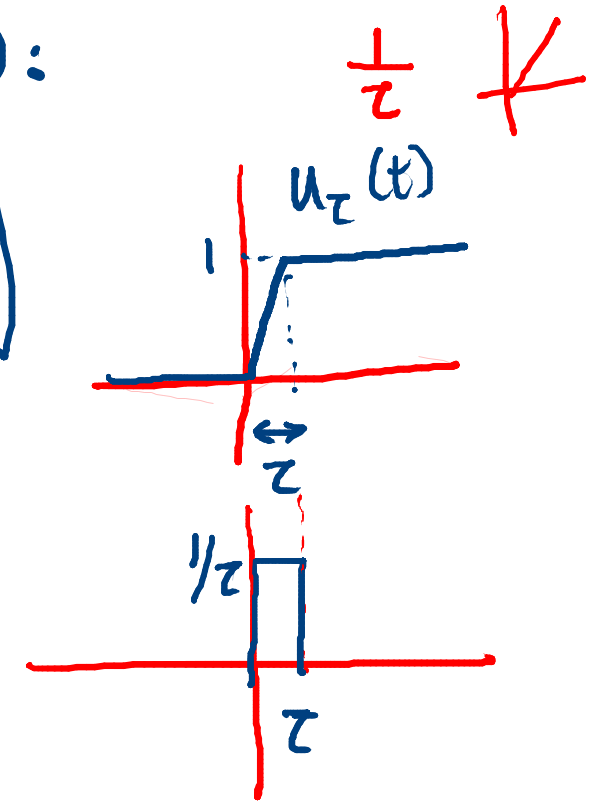
$$\phi(t_0)\,\delta(t-t_0)$$

$$= \phi(t_0)\,\delta(t-t_0)$$

Relating $u(t)$ and $\delta(t)$:

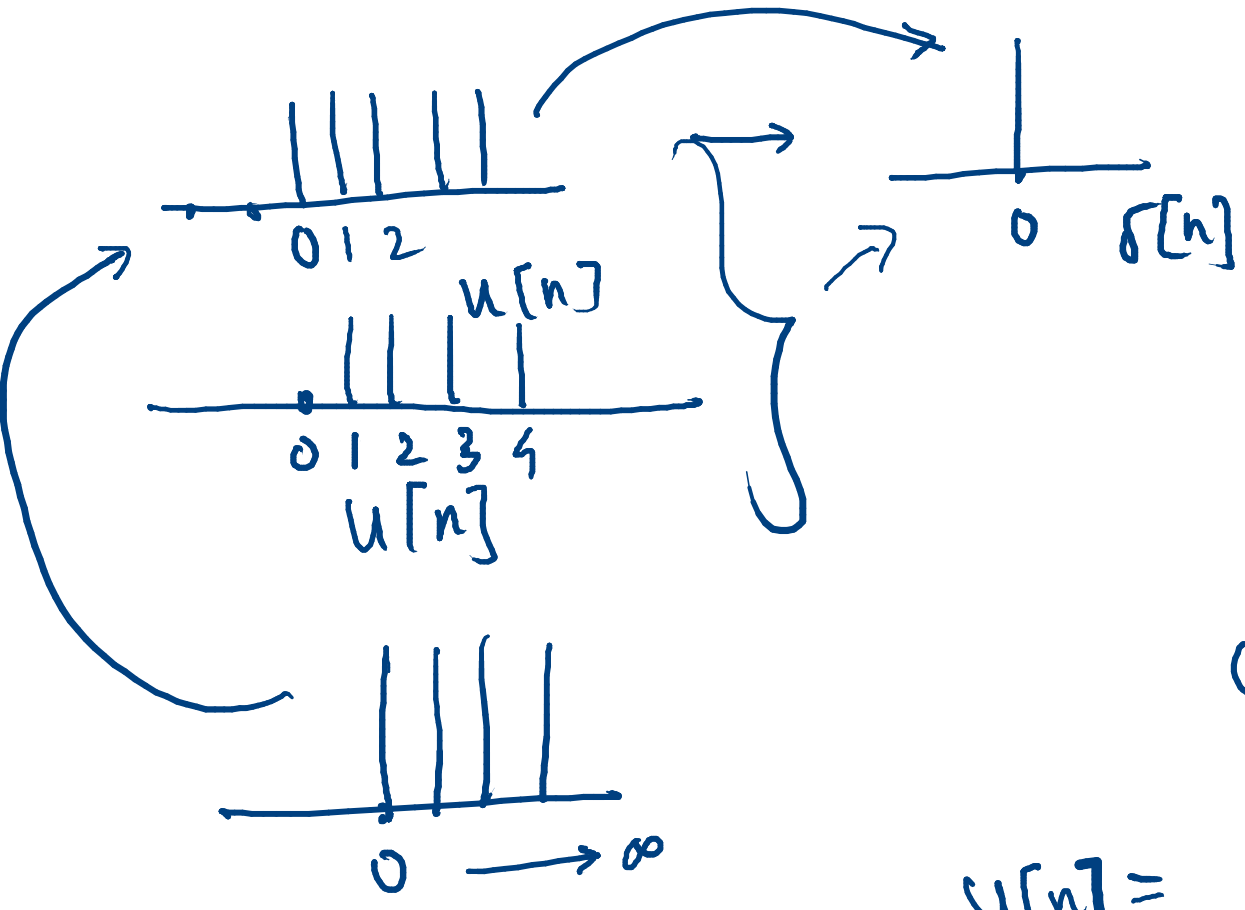
$$\delta(t) = \frac{du(t)}{dt}$$

$$u(t) = \int_{-\infty}^{t} \delta(t)\, dt$$



Questions for further Understanding / Learning

What procedure is followed in the theatre/multiplex to make it echo free.

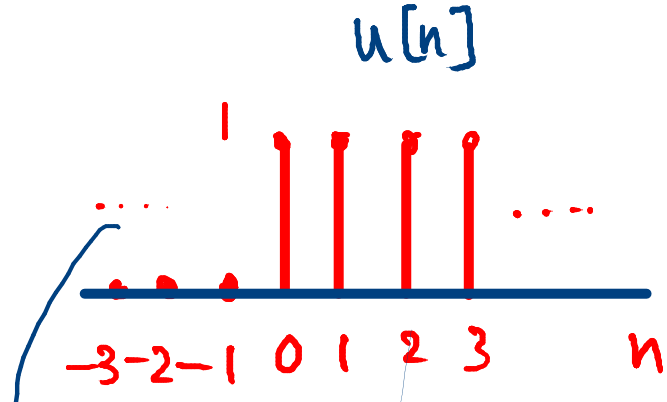


$$\delta[n] + \delta[n-1] + \delta[n-2]$$

$$u[n] = \sum_{k=0}^{\infty} \delta[n-k]$$

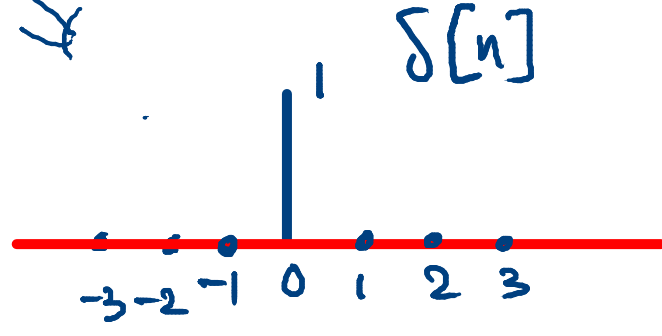
Discrete-time unit step $u[n]$

$$u[n] = \begin{cases} 1 & ; \ n \geq 0 \\ 0 & ; \ \text{otherwise} \end{cases}$$



$$\delta[n] = \begin{cases} 1 & ; \ n = 0 \\ 0 & ; \ n \neq 0 \end{cases}$$

$$\boxed{\delta[n] = u[n] - u[n-1]}$$



$$u[n] = \sum_{K=0}^{\infty} \delta[n-K]$$

Transformation of independent variable:

(1) Time-shift :

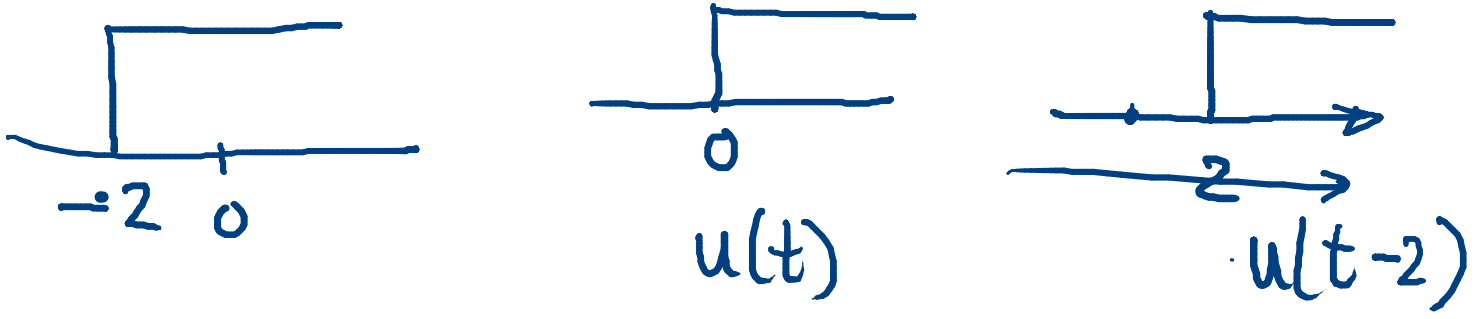
$x[n] \longrightarrow x[n - n_0]$

$x(t) \longrightarrow x(t - t_0)$

$x(t - t_0)$

t_0 is negative → Left shift (advance)

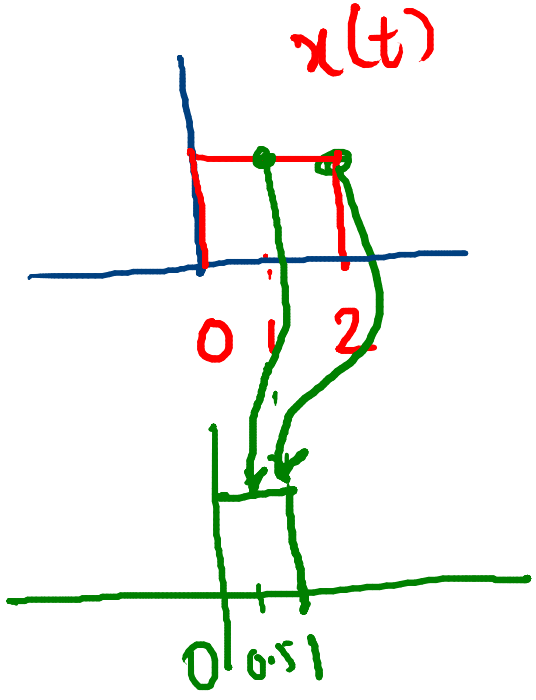
t_0 is +ve → Right shift (Delay)



(2) Scaling : $x(t) \longrightarrow x(at)$

$a > 1$ $x(t)$ is Compressed

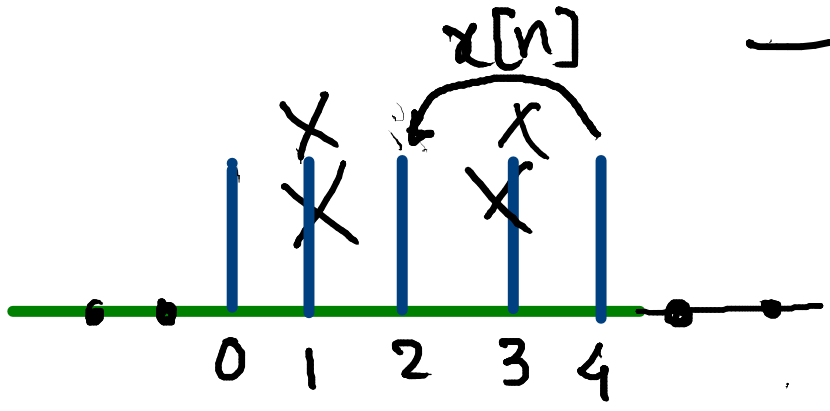
$0 < a < 1$ $x(t)$ is expanded.



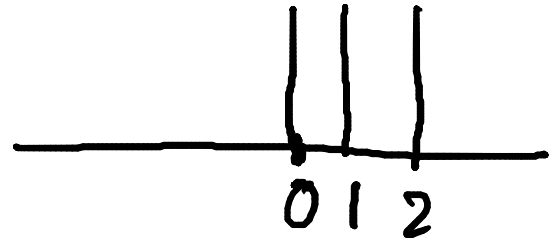
$x(2t)$ $t = 0.5$ $x(1)$

$t = 1$ $x(2)$

$t = 2$



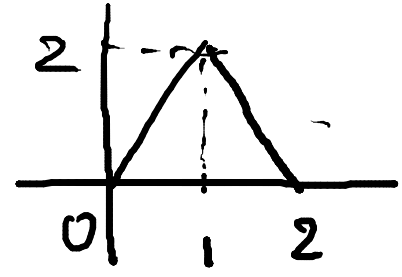
$x[2n]$



$n = 2$

at $n=2$; $x[2n] = x[4]$

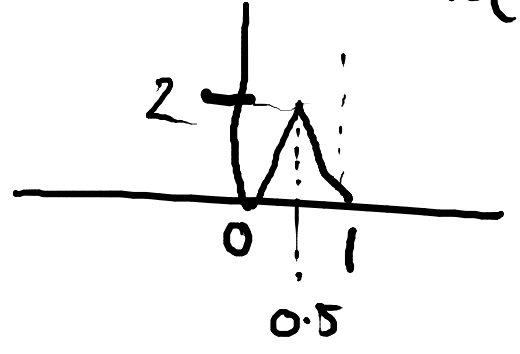
at $n=1$; $x[2n] = x[2]$

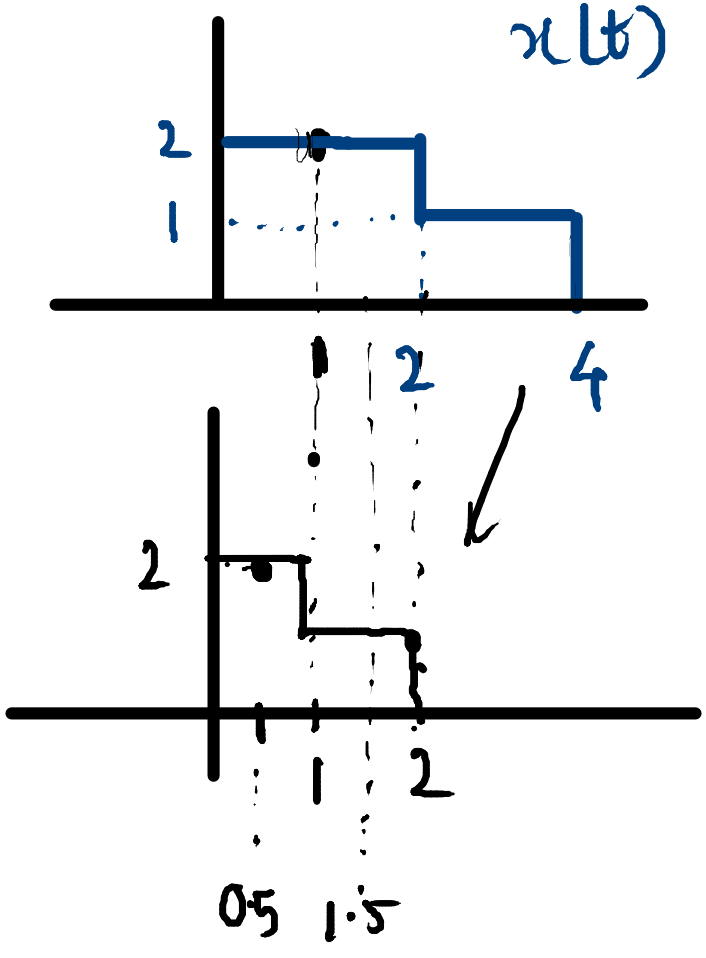


$x(2t)$ at $t = 0.5$

$x(2 \times 0.5)$

$x(t)$





New

$x(2t)$

$t = 0.5$ $x(1)$

$t = 1$

$t = 1.5$

$t = 2$ $x(4)$

$a > 1$

a 0 to 1