7-9 Marks Syllabus

Signal and System :-

- (i) Continous Signals
  (ii) Continous System
  (iii) CT FS (12 hrs)
  (iv) CTFT (18 hrs)
  (v) Laplace Transform (12-15 hrs)
  (vi) Sampling Theorm (3hrs)
  (vii) Discrete signal and system.
  (viii) Z- Transform. (10 hrs)
  (ix) DTFT (6 hrs)
  (x) DFT & FFT (6 hrs)
  (xi) Digital Filters (4 hrs).
  (xii) Miscellaneous.

(i) Introduction to the Signals & System. (20 hrs)
(ii) LTI System. (8 hrs)

Chap 1 Introd

Electrical Engg.

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10/05/22

Chapter - 1 Introduction to the Signals & Systems

* What do you mean by signal.

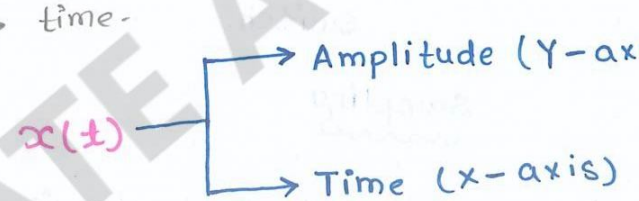
- Signal is an any Indication about which some amount of Information is convey to one Place to other Place.
- A signal is an any quantity having some Information associated with it.
- It may also be defined as function of one or more Independent variable which contains some Information.

Example :- (i) A speech signal would be reprented by accostic pressure as a function of time.

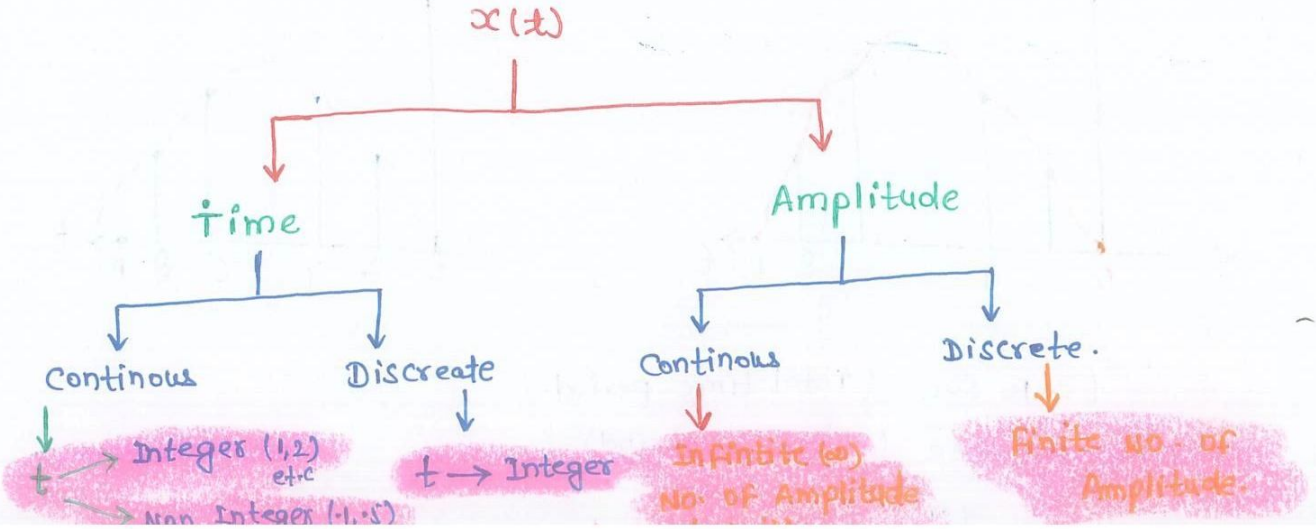
(ii) A voltage signal defined as voltage accross any Element varring as a function of time.

Y axis → Amplitude

x-axis → time.



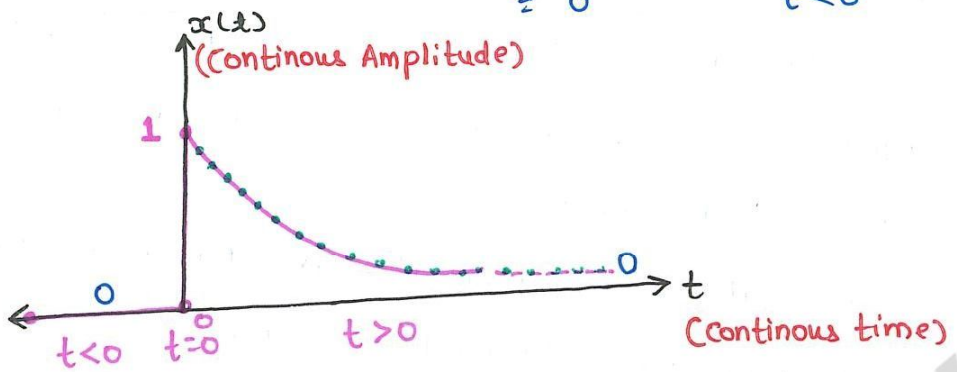
- Both Amplitude and Time can be continous in time and also Discreate with time.



(i) Continous Time & Continous Amplitude Signal.

$$x(t) = e^{-2t} \cdot u(t) = e^{-2t} \cdot 1 \quad t \geq 0$$

$$= 0 \quad t < 0$$



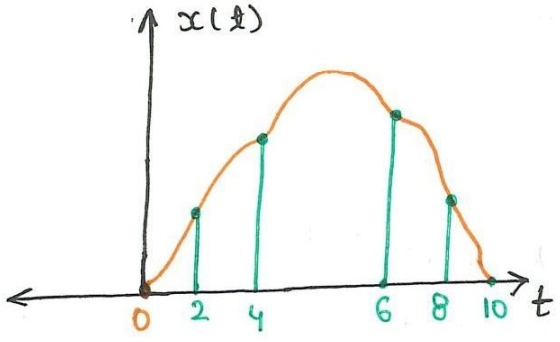
$t = 0 \Rightarrow$ Amplitude $= e^{0} = 1$

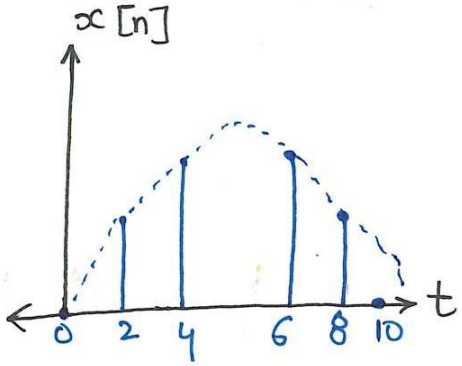
$t = \infty \Rightarrow$ Amplitude $= e^{-\infty} = 0$

Sampling :-

Sampling

- The Timing of switch OFF to ON is called sampling period.





$t = 10$ sec (Total time period.

$T_s = 2$ sec (Sampling period)

$n = 5$ (No. of sample)

$t = n \cdot T_s$

$\frac{1}{T_s} = f_s = \text{sample/sec} = \frac{1}{2}$ Sample/sec.

Cont. Time $\longleftrightarrow$ Discr. time.

$x(t) \longleftrightarrow t = n \cdot T_s \longrightarrow x[n]$

$x(t) = e^{-2t} u(t)$

$t = n \cdot T_s$

$x(n \cdot T_s) = e^{-2(n \cdot T_s)} \cdot u[n \cdot T_s]$

Let $T_s = 1$ sec

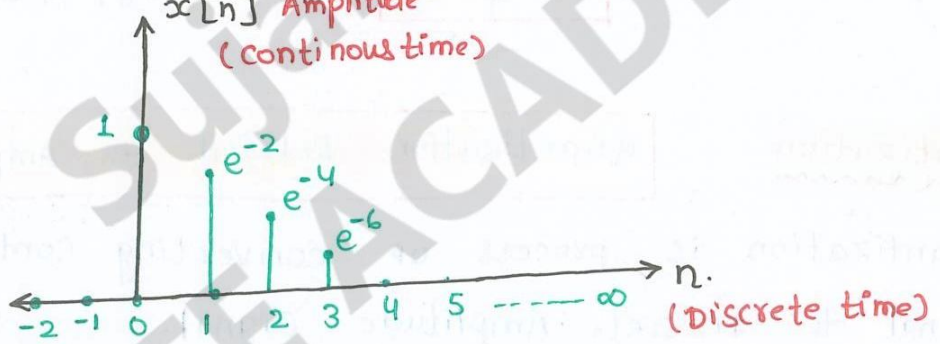
$x[n] = e^{-2n} u[n]$

where, n :- Integer only.

(2) Discreate time & Continous Amplitude Signal

$x[n] = e^{-2n} \cdot u[n] = e^{-2n} \cdot 1, \quad n \geq 0$

$= 0, \quad n < 0$



(No. of sample) n : $0 \longrightarrow \infty$

Amplitude = $1 \longrightarrow 0$

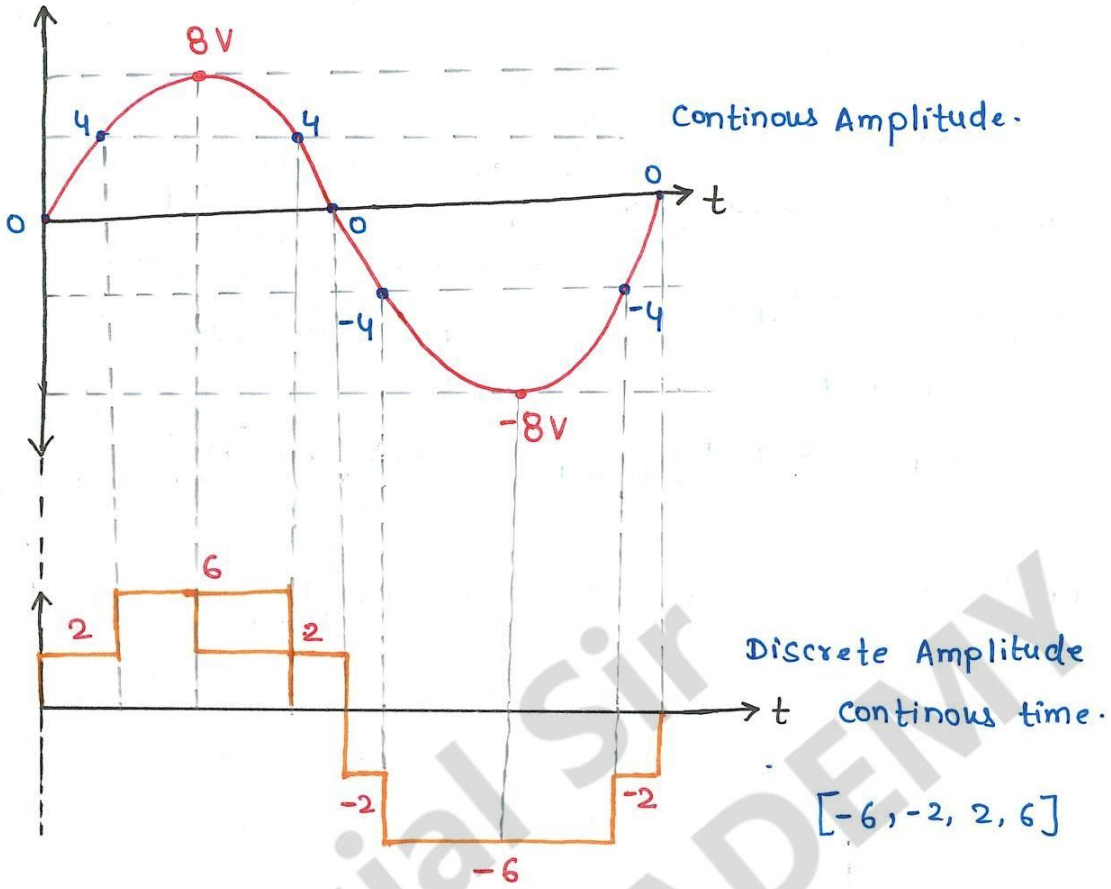
CT $\xrightarrow{\text{Convert}}$ DT

Sampling related to time.

Note :-

- Sampling is the process of Converting continous time signal into Descrete time signal.

(3) Discrete Amplitude & Continous time signal

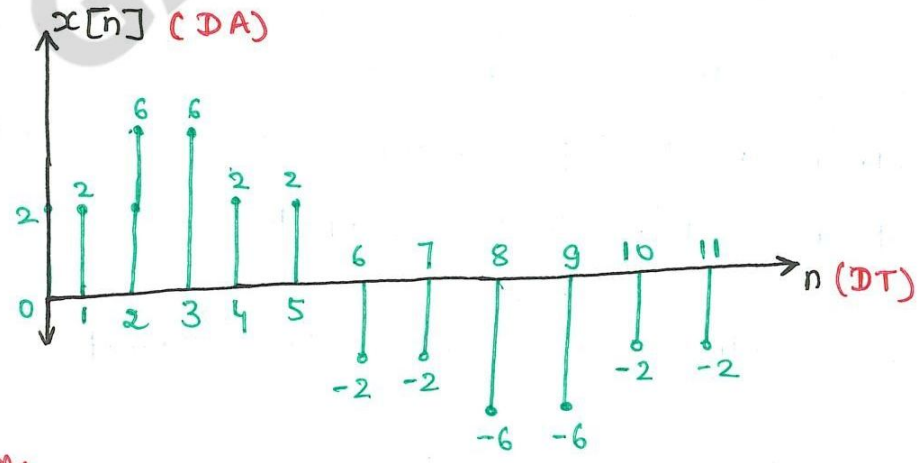


Continous Amplitude.

Quantization — Quantization Related to Amplitude.

- Quantization is process of converting Continous Amplitude Signal to Discrete Amplitude Signal.

(4.) Discrete time & Discrete Amplitude Signal



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Continous Amplitude ⟶ Analog Signal

Discrete Amplitude ⟶ Digital Signal

- If signal Nature is Analog or digital depends upon Nature of Amplitude of Any signal.

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- In Above four Classification:-

By default
Decrete → DT
Continous → CT

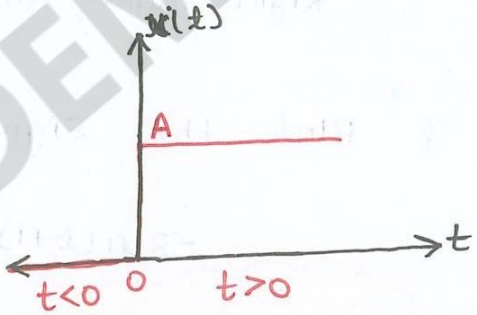
(i) CT & CA → Analog Signal
(ii) DT & CA → Analog Signal
(iii) DA & CT → Digital signal
(iv) DA & DT → Digital signal.

Standard Elementry Signals :-

(1.) Step Signal

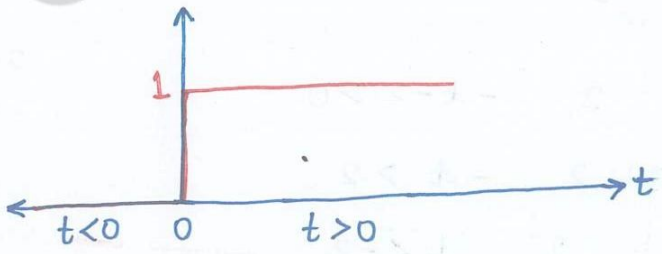
$x(t) = A \cdot u(t) = A \quad t > 0$

$A \cdot u(t) = 0 \quad t < 0$



Note :-
- At $t=0$ (Sudden change in Amplitude (discontinuity) thats why signal Amplitude is not defined at $t=0$.

- If $A=1$ (unit step signal).



$x(t) = u(t) = 1 \quad , t > 0$

$0 \quad t < 0$

Q. Plot the signal.

$x(t) = 2 \cdot u(t-2)$.

Delayed → Right Hand

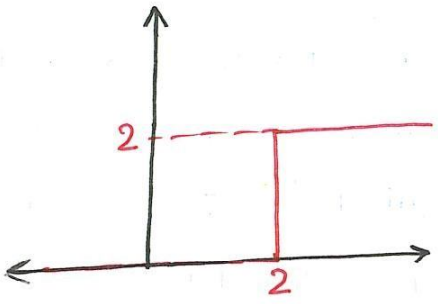
$2 \cdot u(t-2) = 2 \quad , \; t-2 > 0$

$= 0 \quad t-2 < 0$

Change all (t) to $(t-2)$.

$2 \cdot u(t-2) = 2 \quad , \; t > 2$

$0 \quad , \; t < 2$



Key :- any signal $(t-2)$ sign is Negative then signal sifted to Right hand and delayed signal with time.

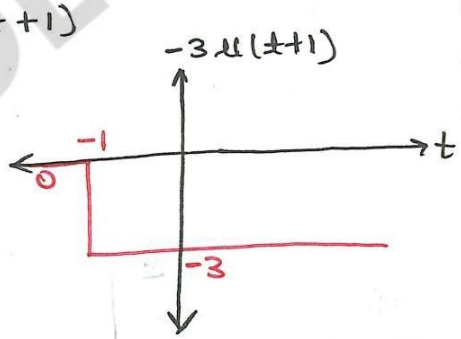
Q. Plot the signal. $x_2(t) = -3 \cdot u(t+1)$

$-3\,u(t+1) = -3 \quad , \; t+1 > 0$

$= -3 \quad t > -1$

$= 0 \quad t < -1$

Advance → Left hand



Key :- any signal is time added with any value then signal Shifted to Left hand side and Signal Advance with time.

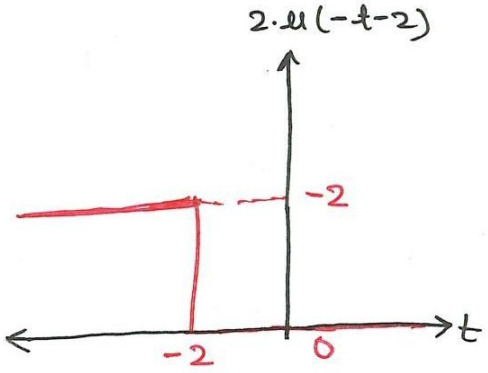
Q. $x_3(t) = 2 \cdot u(-t-2)$

$2 \cdot u(-t-2) = 2 \quad -t-2 > 0$

$= 2 \quad -t > 2$

$= 2 \quad t < -2$

$= 0 \quad t > 0$



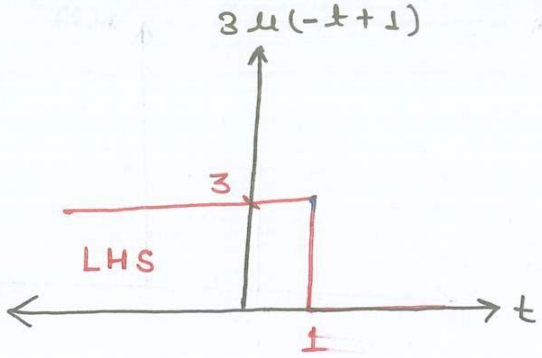
Q. Draw $x_4(t) = 3 \cdot u(-t+1)$

$3\,u(-t+1) = 3 \quad -t+1 > 0$

$= 3 \quad -t > -1$

$= 3 \quad t < +1$

$= 0 \quad t > 1$

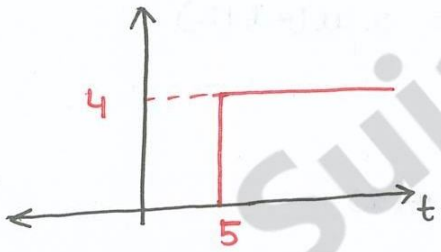


key point :-

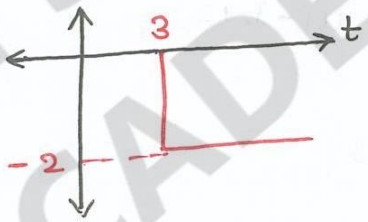
V.V.I

- IF t sign is Negative then signal is Left sided move. but constant term is same as started point.
- IF t sign is positive then signal is Right sided move. but constant term is reversed.

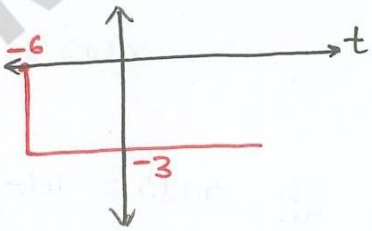
Q. $x_1(t) = 4 \cdot u(t-5)$



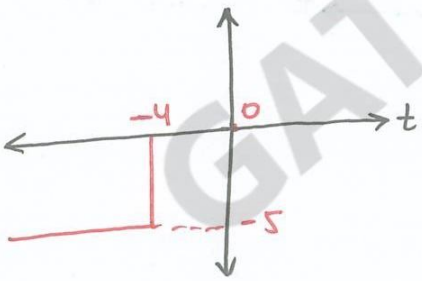
Q. $x(t) = -2 \cdot u(t-3)$



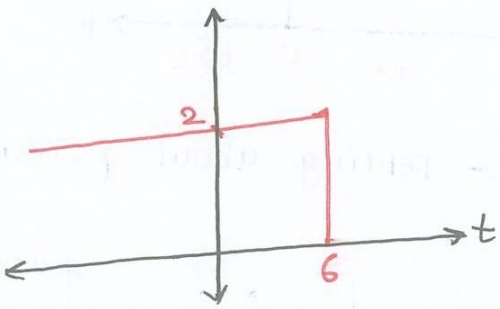
Q. $x(t) = -3\,u(t+6)$



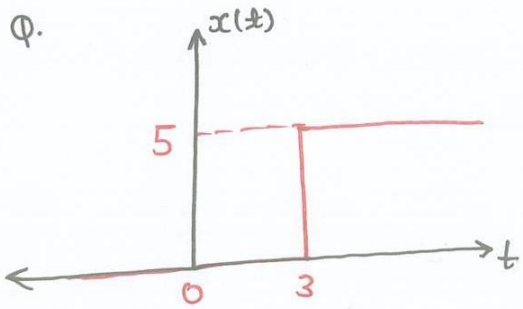
Q. $x(t) = -5\,u(-t-4)$



Q. $x(t) = 2 \cdot u(-t+6)$



Q.



$x(t) = 5 \cdot u(t-3)$

$x(t) = 5 \quad t > 3$

$= 5 \quad t-3 > 0$

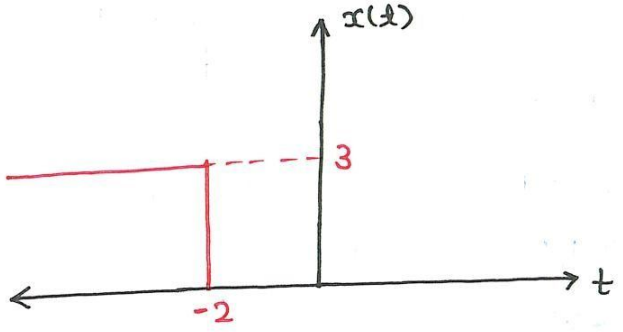
$= 0 \quad t-3 < 0$

$x(t) = 5\,u(t-3)$

$u(t) = 1, \quad t > 0$

$= 0, \quad t < 0$

Q.



$x(t) = 3, t < -2$

$= 3, -t-2 > 0$

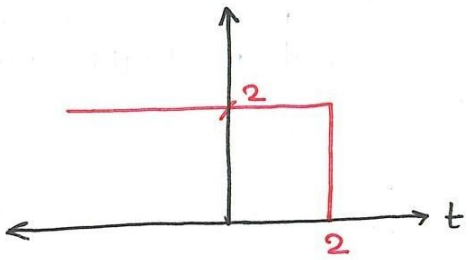
$= 0, -t-2 < 0$

$x(t) = 3\,u(-t-2)$

$x(t) = 3\,u(-t-2)$

(D)

Q.



$x(t) = 2 \quad t \leq 2$

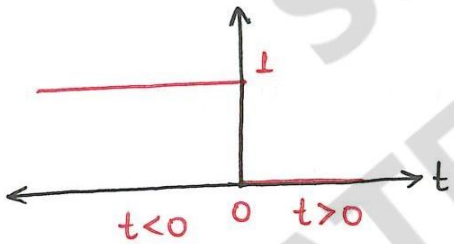
$= 2, -t+2 > 0$

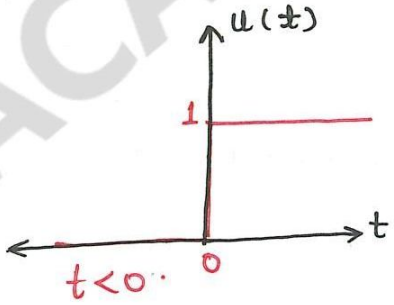
$= 0, -t+2 < 0$

$x(t) = 2\,u(-t+2)$

$x(t) = 2\,u(-t+2)$

Q. $x(t) = u(-t)$





- Folding about y-axis.