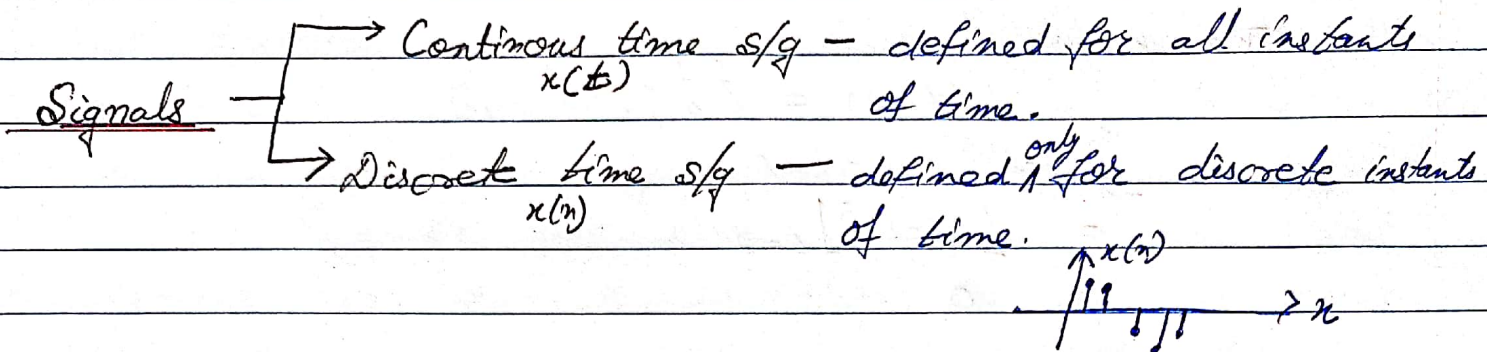
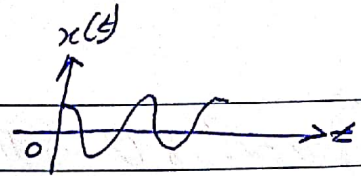


(4)

Date
14/09/21Lecture - 3

* Meaning of discrete — individually separate & distinct.

Continuous time signals are represented by $x(t)$ and discrete time signals are represented by $x(n)$, where t and n are independent variables in time domain.

There are 'four' ways of representing discrete-time signals. They are —

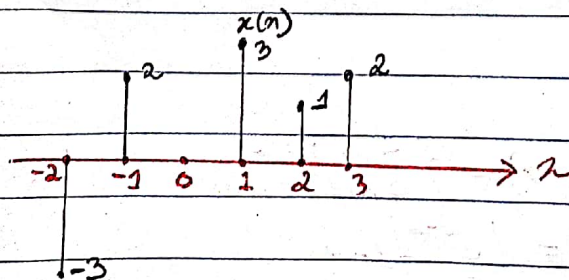
- ① Graphical Representation,
- ② Functional Representation,
- ③ Tabular Representation,
- ④ Sequence Representation.

① Graphical Representation :-

Let us consider a s/g $x(n)$ with values,

$$x(-2) = -3, \quad x(-1) = 2, \quad x(0) = 0, \quad x(1) = 3, \\ x(2) = 1 \quad \& \quad x(3) = 2$$

Graphically,



② Functional Representation :-

In this, the amplitude of the signal is written against the value of 'n'.

$$\text{Ex: ① } x(n) = \begin{cases} -3 & \text{for } n = -2 \\ 2 & \text{for } n = -1 \\ 0 & \text{for } n = 0 \\ 3 & \text{for } n = 1 \\ 1 & \text{for } n = 2 \\ 2 & \text{for } n = 3 \end{cases}$$

$$\text{② } x(n) = \begin{cases} 2^n, & \text{for } n \geq 0 \\ 0, & \text{for } n < 0 \end{cases}$$

* Sampling is defined as the process of measuring the instantaneous values of continuous time s/g in a discrete form.

③ Tabular Representation :-

Sampling instant 'n' and the magnitude of the signal at the sampling instant are represented in tabular form.

n	-2	-1	0	1	2	3
x(n)	-3	2	0	3	1	2

④ Sequence Representation :-

$$x_n = \{-3, 2, \underset{\uparrow}{0}, 3, 1, 2\}$$

* Arrow mark '↑' denotes the $n=0$ term. When no arrow is indicated, the first term corresponds to $n=0$.

6

Sum & Product of Discrete-Time Sequence :-

$$\{c_n\} = \{a_n\} + \{b_n\} \longrightarrow c_n = a_n + b_n$$

$$\{c_n\} = \{a_n\} \cdot \{b_n\} \longrightarrow c_n = a_n \cdot b_n$$

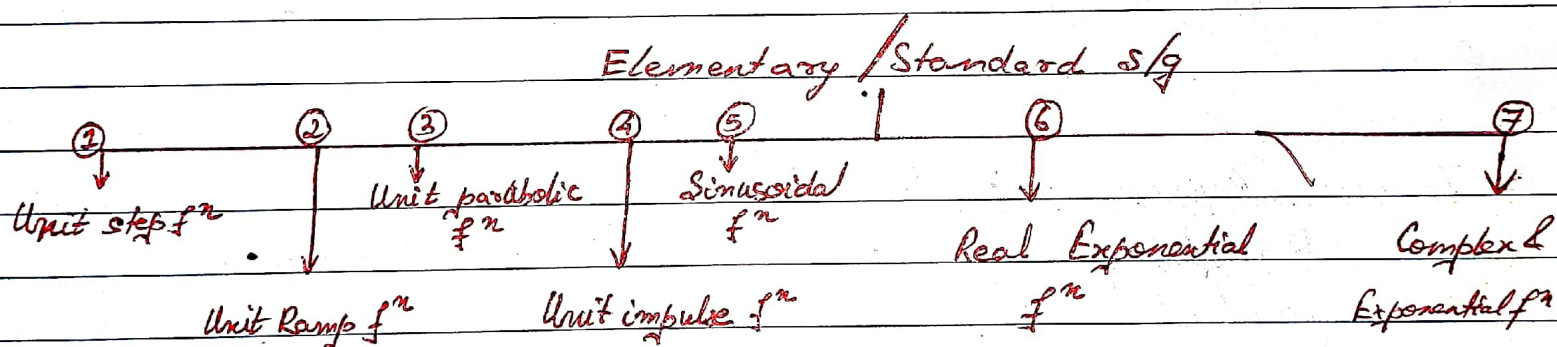
$$\{c_n\} = k\{a_n\} \longrightarrow c_n = k \cdot a_n$$

↳ multiplication of a sequence by a constant, k is obtained by multiplying each element of the seq. by that constant.

$$\{c_n\} = k\{a_n\}$$

$$\rightarrow c_n = k a_n$$

Elementary Signals :-



① Unit Step-function :-

Step function :- exists only for the positive time
It is zero for negative time

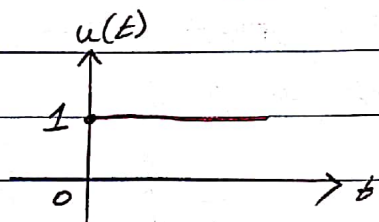
Unit step function :- A step f^n that has unity magnitude

Continuous time unit f^n $u(t)$ is defined as,

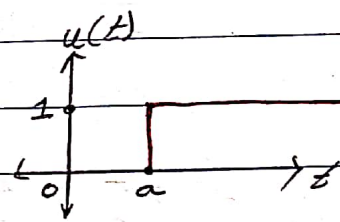
$$u(t) = \begin{cases} 1 & , \text{ for } t \geq 0 \\ 0 & , \text{ for } t < 0 \end{cases}$$

Shifted unit-step $f^n u(t-a)$ is defined as,

$$u(t-a) = \begin{cases} 1, & t \geq a \\ 0, & t < a \end{cases}$$



(a) Unit step f^n

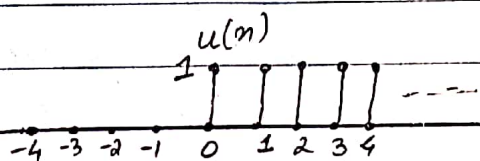


(b) Delayed unit step f^n

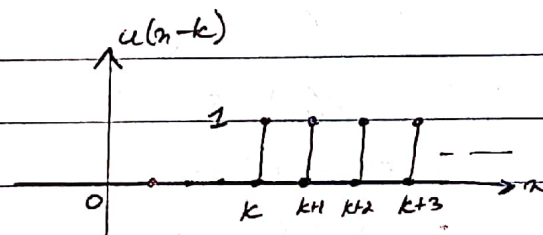
Discrete-time unit step function :-

$$u(n) = \begin{cases} 1, & n \geq 0 \\ 0, & n < 0 \end{cases}$$

$$u(n-k) = \begin{cases} 1, & n \geq k \\ 0, & n < k \end{cases}$$



$u(n)$



$u(n-k)$

Q. Draw $u(n-2)$.

Solⁿ:-

