Note Title 29-07-2013

EE 5330 DSP Lecture 1, 29.07.13

$\boxed{\text{Review basic discrete-time signals and systems}}$

Refer to standard textbooks such as Lathi or Oppenheim, et al.

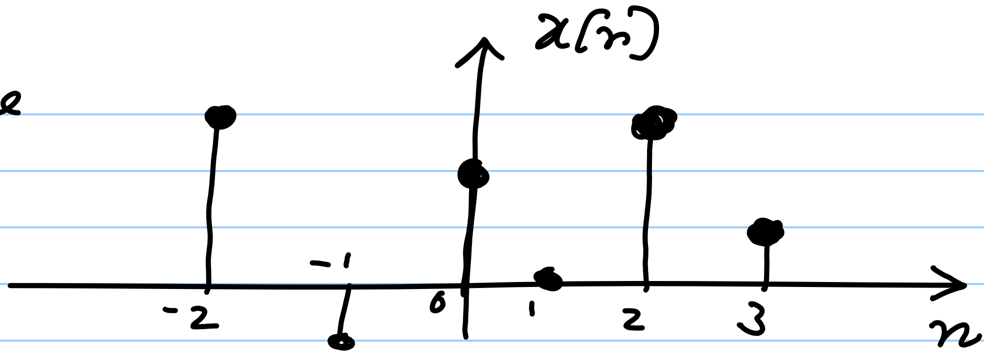
Discrete-Time Sequence:

$$x[n] \in \mathbb{C} \qquad n \in \mathbb{Z} = \{0, \pm 1, \pm 2, \cdots \}$$

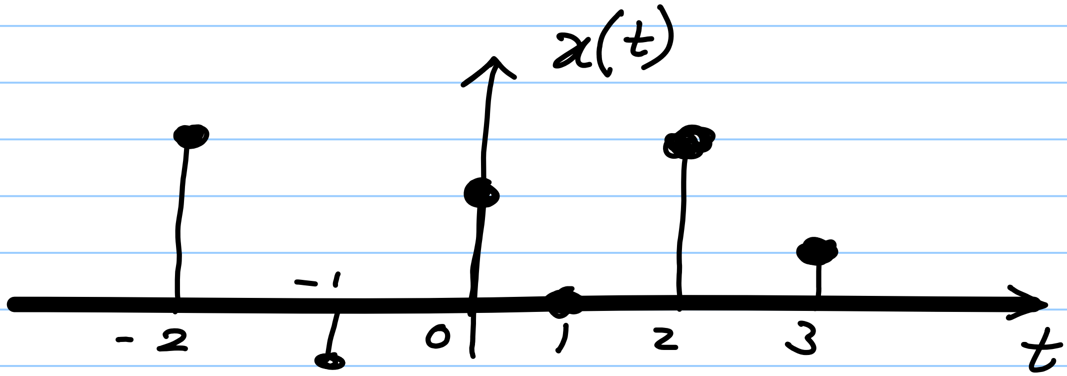
$x[a]$ = undefined if $a \notin \mathbb{Z}$

Note that "undefined" is not the same as saying it is zero.

A discrete-time sequence :



What's wrong with the following framework for DT signals?



$x(t) \in \mathbb{C}$ if $t \in \mathbb{Z}$

$x(t) = 0$ if $t \notin \mathbb{Z}$

Why do we need the new discrete-time framework introduced earlier?

Review the basic discrete-time signals

Exponential class is an important class

i.e., $x[n] = z_0^n$ where $z_0 \in \mathbb{C}$

Note that z_0^n defined over all 'n' is an everlasting exponential. It is not the same as

$$x[n] = \begin{cases} z_0^n & n \geq 0 \\ 0 & n < 0 \end{cases}$$

$x[n] = e^{j\omega_0 n}$ is a complex sinusoid

$x[n] = x[n+N]$ iff $\dfrac{\omega_0}{2\pi} = \dfrac{k}{N}$

There can be only N distinct complex exponentials with period N, corresponding to $k = 0, 1, \ldots, N-1$.

Recall & understand the differences between DT and CT complex sinusoids.

Does a DT sinusoid's rapidity of oscillations keep on increasing with increase in frequency?

In the CT case, the period of the k-th harmonic is k times smaller than the fundamental.

Is the same true of the DT harmonics also ?

Are the sinusoids $e^{j\omega_0 n}$ & $e^{-j\omega_0 n}$ independent ?

That is, if $a_1 e^{j\omega_0 n} + a_2 e^{-j\omega_0 n} = 0$, does it mean that $a_1 = a_2 = 0$ is the only solution ?