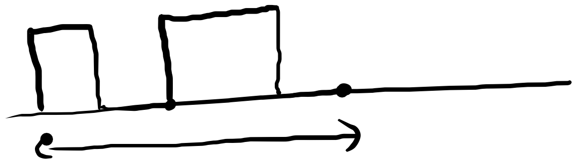
Lec-4 DC

coded symbols:-

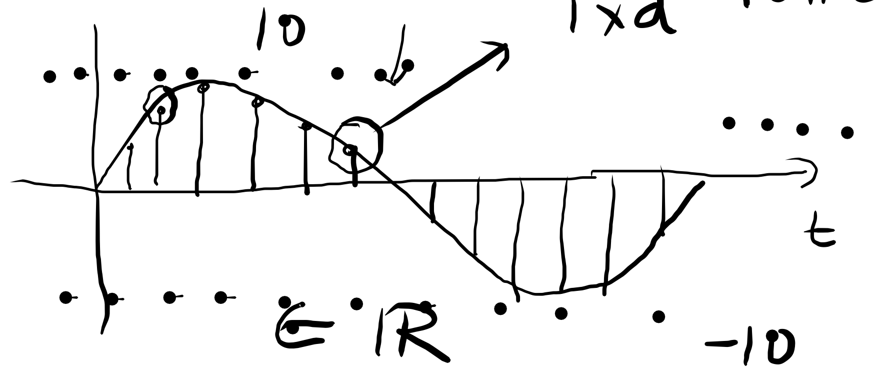


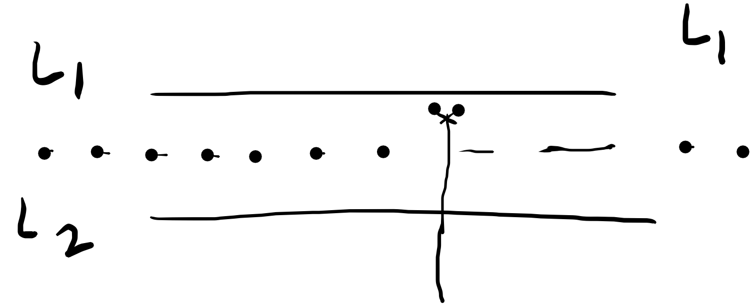
20 fixed points

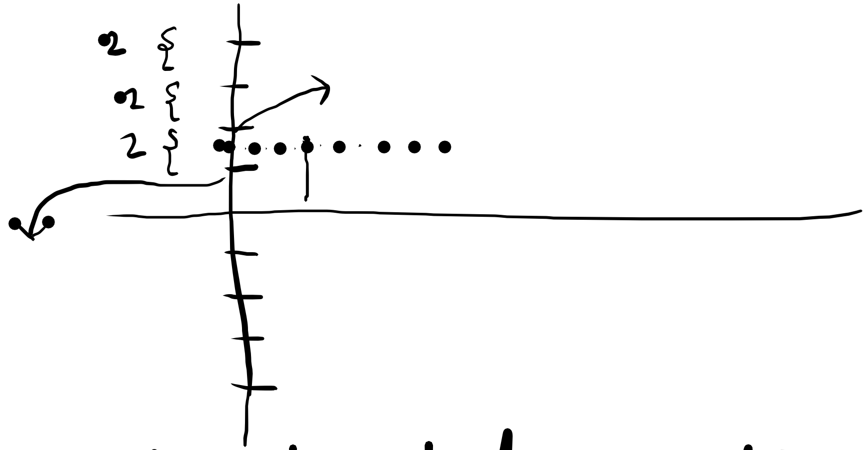
5 bits

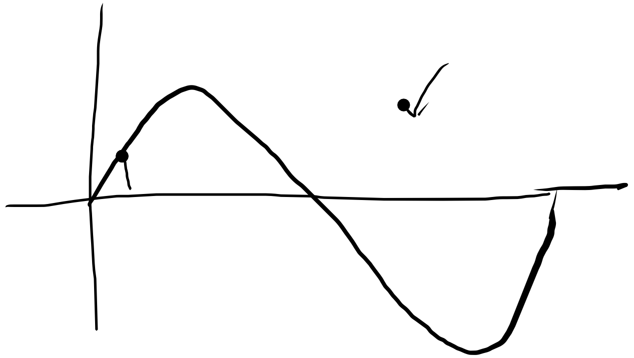
$2^4 = 16$

$2^5 = 32$



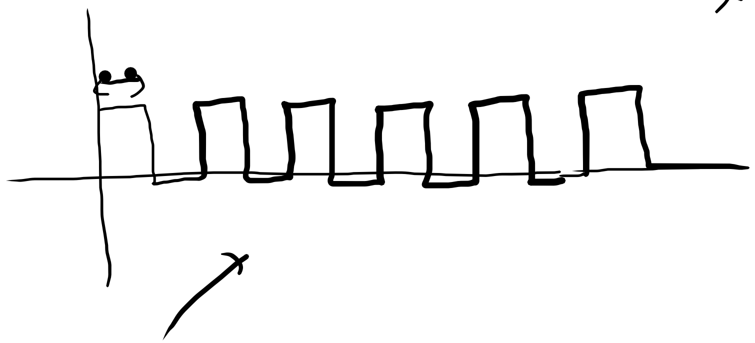


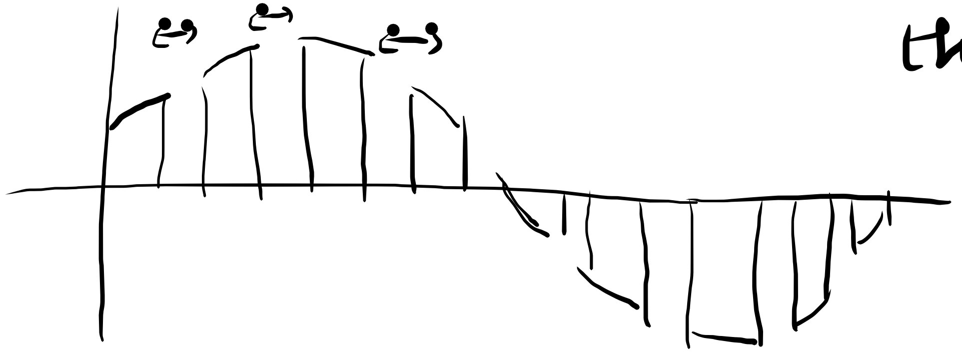




at receiver

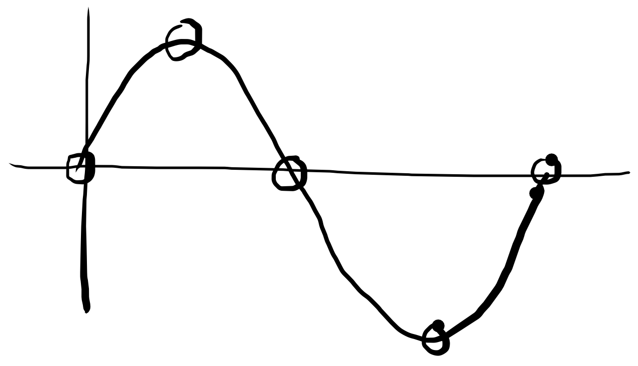
If L_1 is correctly decoded, can you tell the exact value?



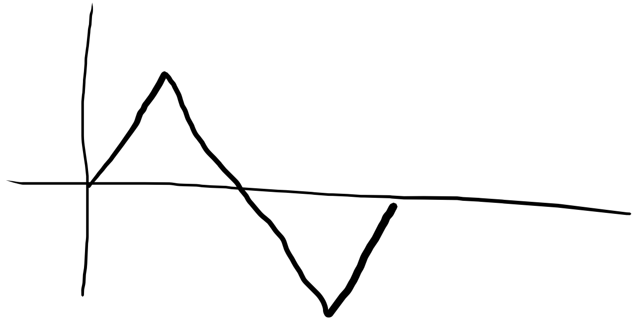


agenda for any sampling process / way :- rate or procedure such that seq. of samples "uniquely" define the original analog signal.

one-many mapping should not be there.

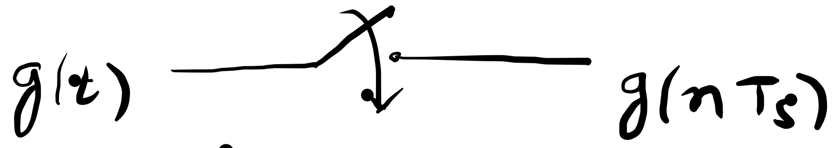


→ Let us take an arbitrary signal $g(t)$ of finite energy, 'specified for all time' ≡ physically realizable



→ sample the signal $g(t)$ instantaneously & at a uniform rate, once every T_s seconds — $\{g(nT_s)\}$, $n \in$ set of integers ($\mathbb{Z}$)

T_s : sampling period — why



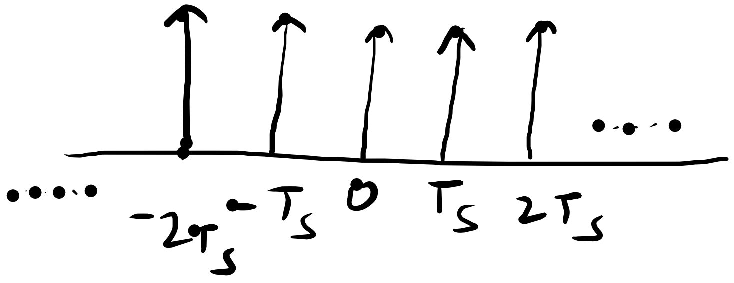
as you get infinite seq. of samples spaced T_s sec. apart

$f_s = 1/T_s$:- sampling rate - no. of samples you get every second.

$g_\delta(t) \triangleq$ instantaneously sampled signal
↳ denotes

$$g_\delta(t) = \sum_{n=-\infty}^{\infty} g(nT_s)\,\delta(t - nT_s)$$ ✓

draw $\sum_{n=-\infty}^{\infty} \delta(t-nT_s)$

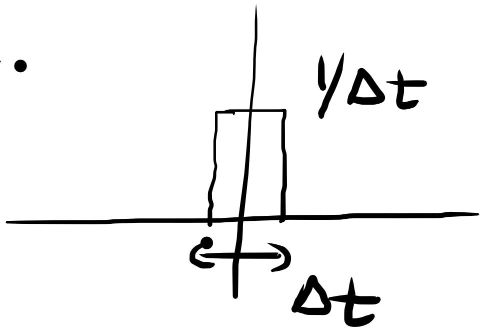


$$g(t) \times \sum_{n=-\infty}^{\infty} \delta(t-nT_s) \overset{?}{=} g_\delta(t)$$ ✓

(1) $\delta(t) = 0, \quad t \neq 0$

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

Closest approx.



as $\Delta t \to 0$

$\longrightarrow \delta(t)$

$$x(t)\,\delta(t-t_0) \overset{?}{=} x(t_0)$$

$$\overset{?}{=} x(t_0)\,\delta(t-t_0)$$ ✓

$g_\delta(t)$:= this is like weighting (individually) the elements of a periodic seq of delta functions spaced ® T_s sec. apart by seq. of numbers $\{g(nT_s)\}$.

$g_\delta(t) \doteq$ 'ideal sampled signal'

$$g_\delta(t) = \sum_{n=-\infty}^{\infty} g(nT_s)\,\delta(t-nT_s)$$

Now, from S&S

$$\sum_{i=-\infty}^{\infty} \delta(t-iT_0) \xrightarrow{FT} \frac{1}{T_0} \sum_{n=-\infty}^{\infty} \delta\left(f-\frac{n}{T_0}\right)$$

$$g_\delta(T_s) = \sum_{n=-\infty}^{\infty} g(nT_s)\,\delta(T_s-nT_s)$$

$$g_\delta(t) = g(t) \times \sum_{n=-\infty}^{\infty} \delta(t-nT_s)$$

$$\ldots\; g(-T_s)\,\delta(T_s+T_s) + g(0)\,\delta(T_s) + g(T_s)\,\delta(T_s-T_s) + g(2T_s)\,\delta(T_s-2T_s)\;\ldots$$

$\downarrow 0$ $\quad$ $\to 0$ $\quad$ $\downarrow 0$

$\delta(0) = \infty$

$$g(T_s)\,\delta(0) = g(T_s)\,.$$

$\hookrightarrow$ we will discuss

$$FT\{g_\delta(t)\} = FT(g(t)) * FT \sum_{n=-\infty}^{\infty} \delta(t-nT_s)$$

$$= G(\omega) * \frac{1}{T_s} \sum_{m=-\infty}^{\infty} \delta\left(f-\frac{m}{T_s}\right)$$

$\because f_s = 1/T_s$

$$f_s \sum_{m=-\infty}^{\infty} G(f-mf_s)$$