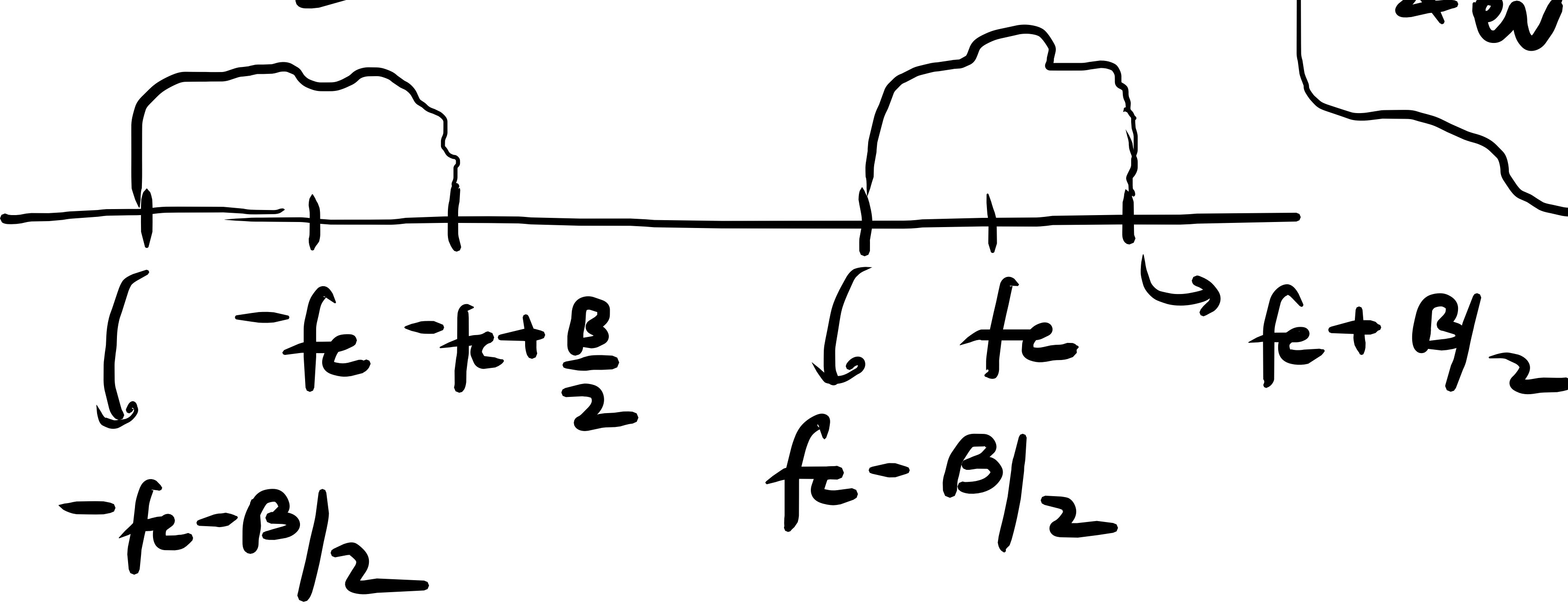
Lec-10, DC, 24-25, Sec A

③ b

$f_c - \frac{B}{2} < |f| < f_c + B/2$

$f_c - \frac{B}{2} < f < f_c + \frac{B}{2}$

$-f_c - \frac{B}{2} < f < -f_c + B/2$



* Reverse the prop. of FT of a real valued signal, real value & even, real value & odd

In inequality ③, $f_c >> 0$, $f_c >> B$

→ Sample at 2B.

→ bring the PB signal to baseband in Inphase & quadrature

$a < b$

$a < |f| < b$

$|f| < b$

$f < b$ — ①

$f > -b$ — ②

$|f| > a$

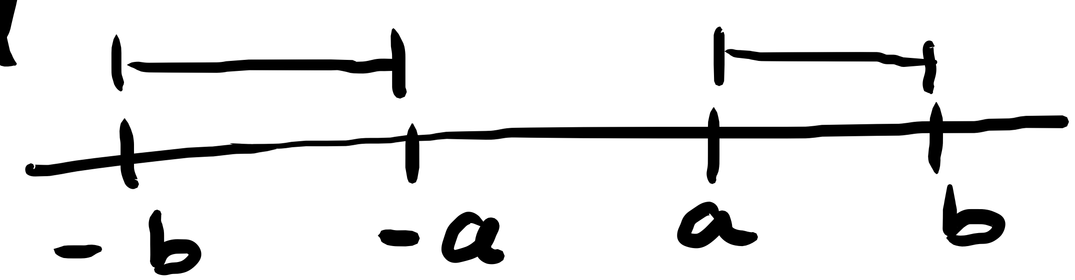
$f > a$ — ①

$f < -a$ — ②

Combine ① & ②

$a < f < b$

$-b < f < -a$



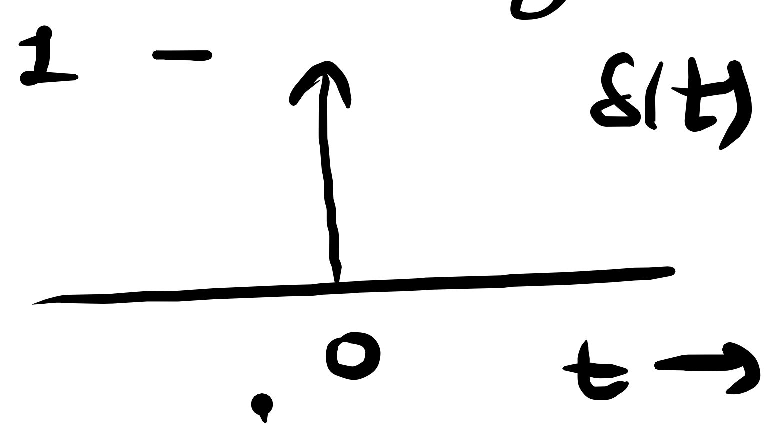
phase components, sample at 2B as BL to B Hz., regenerate BP signal.

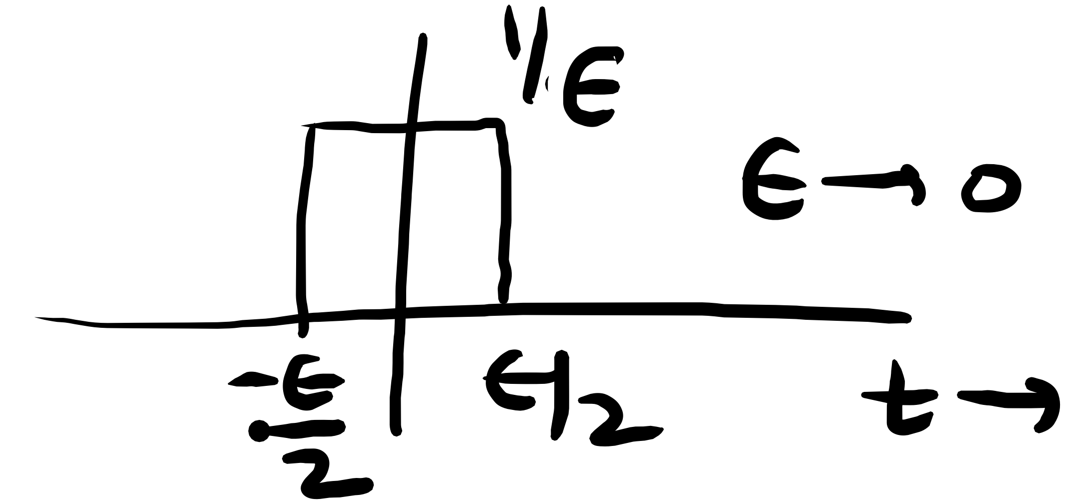
<u>one pending discussion</u>:– Unit Impulse signal. defined by Dirac (Dirac Delta func.)

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

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

visualization





$a\delta(t)$ → area under this func. stays as a, with values at $t \neq 0$ as 0 & at $t=0$, unde-fined.

with area under the function fixed at 1, the value at $t=0$, is undefined.

Suppose $\phi(t)$ is a function continuous at $t=0$, then

$$\phi(t)\,\delta(t) = \phi(0)\,\delta(t)$$

$$\phi(t)\,\delta(t-T_0) = \phi(T_0)\,\delta(t-T) \rightarrow$$ provided $\phi(t)$ is defined at $t=T_0$

Sifting prop.

$$\int_{-\infty}^{\infty} \phi(t)\,\delta(t-T_0)\,dt = \phi(T_0)\underbrace{\int_{-\infty}^{\infty} \delta(t-T_0)\,dt} = \phi(T_0)$$

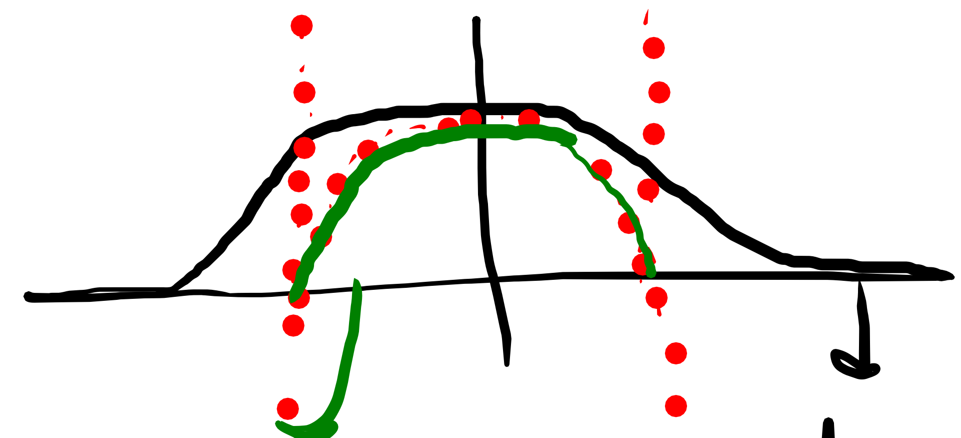
$$\int_{a}^{b} \phi(t)\,\delta(t-T_0)\,dt = \begin{cases} \phi(T_0), & a \le T_0 < b \\ 0, & T_0 < a \le b \text{ or } T_0 \ge b > a \end{cases}$$

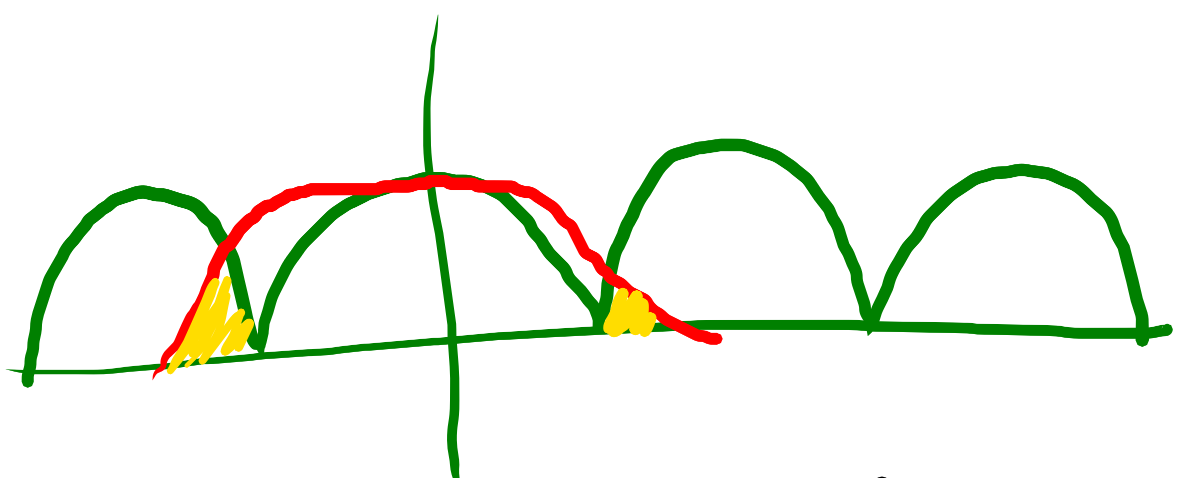
$$= \phi(T_0)\int_{a}^{b} \delta(t-T_0)\,dt$$

(Ques. for In-Sem I explain the above solution)

From the sampling process:-

1. Realizing ideal-DL filters is not practically possible. Problems are causality & Paley-Wiener theorem.





Signal's Spectrum.

goes to zero as $f \to \infty$ but values are very close to zero.

Due to the above displayed issue, we should sample at rate >> Nyquist rate

should use $f_s > 2B$

$$g(t) \longrightarrow \boxed{AA} \longrightarrow \boxed{\text{Sampler}} \longrightarrow$$

Quantization:- The existence of a finite number of discrete amplitude levels is a basic condition of Pulse-Code-modulation (PCM)

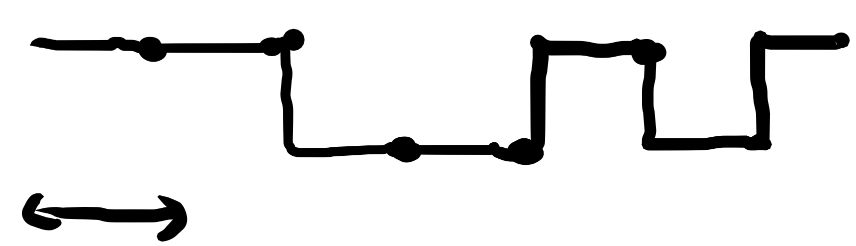
Amplitude quantizn:- process of transforming the sample amplitude $m(nT_s)$ of a message signal $m(t)$ at $t = nT_s$ into a discrete amplitude $V(nT_s)$ taken from a finite set of possible amplitudes

→ process is assumed to be

(seq. of bits converted into a CT waveform) in BB

1 1 0 0 1 0 1

T_s as the bit time

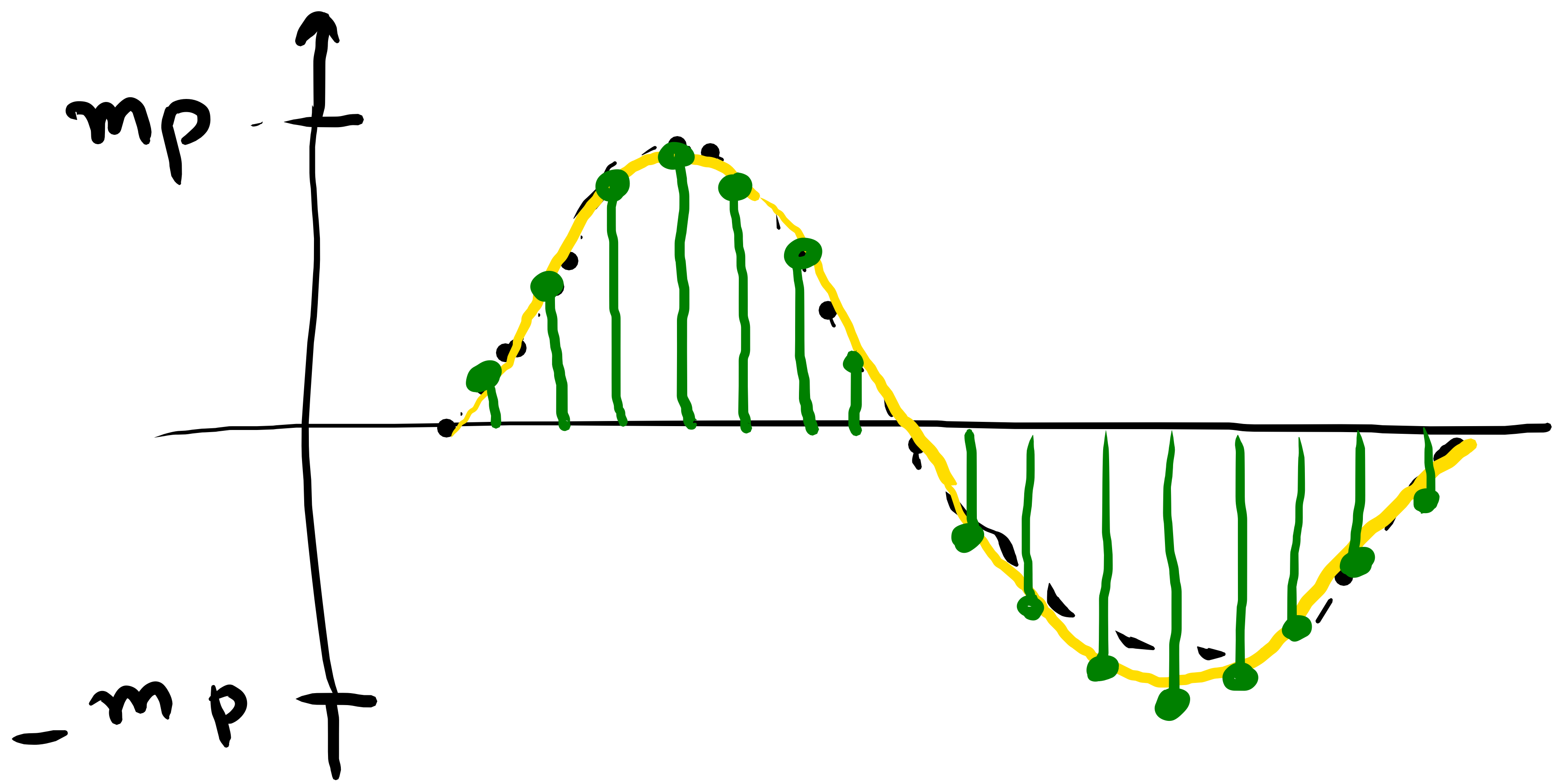


T_s

"memoryless & instantaneous" (Scalar & not Vector)

for sample at $t = nT_s$, quantization is not affected by earlier or later samples. It is called Scalar Quant.

Continuous valued sample m → Quantizer $g(\cdot)$ → Discrete sample v



• → samples

we divide the range $[-m_p, m_p]$ into L levels.