$$x[n] \xleftrightarrow{DFT_N} X[k] = \sum_{n=0}^{N-1} x[n] e^{-j\frac{2\pi kn}{N}}$$

$k = 0, 1, \ldots, N-1$

$X[k_0]$ Which freq. ?

C.T.F.T.

$$X_a(\Omega) = \int_{-\infty}^{\infty} x_a(t) e^{-j\Omega t} dt$$

$\Omega = 2\pi f$

$$X_a(\Omega) \cong \sum_{n=-\infty}^{\infty} x_a(nT_s) e^{-j\Omega n T_s} \; T_s$$

Normalized angular freq $\underline{\omega = \Omega T_s}$

$$X_a(\Omega) \cong \sum_{n=-\infty}^{\infty} T_s x[n] e^{-j\omega n}$$

where $x[n] = x_a(nT_s), \quad n = 0, \mp 1, \ldots$

D.T.F.T.

$$X(e^{j\omega}) = \sum_{n=-\infty}^{\infty} x[n] e^{-j\omega n}$$

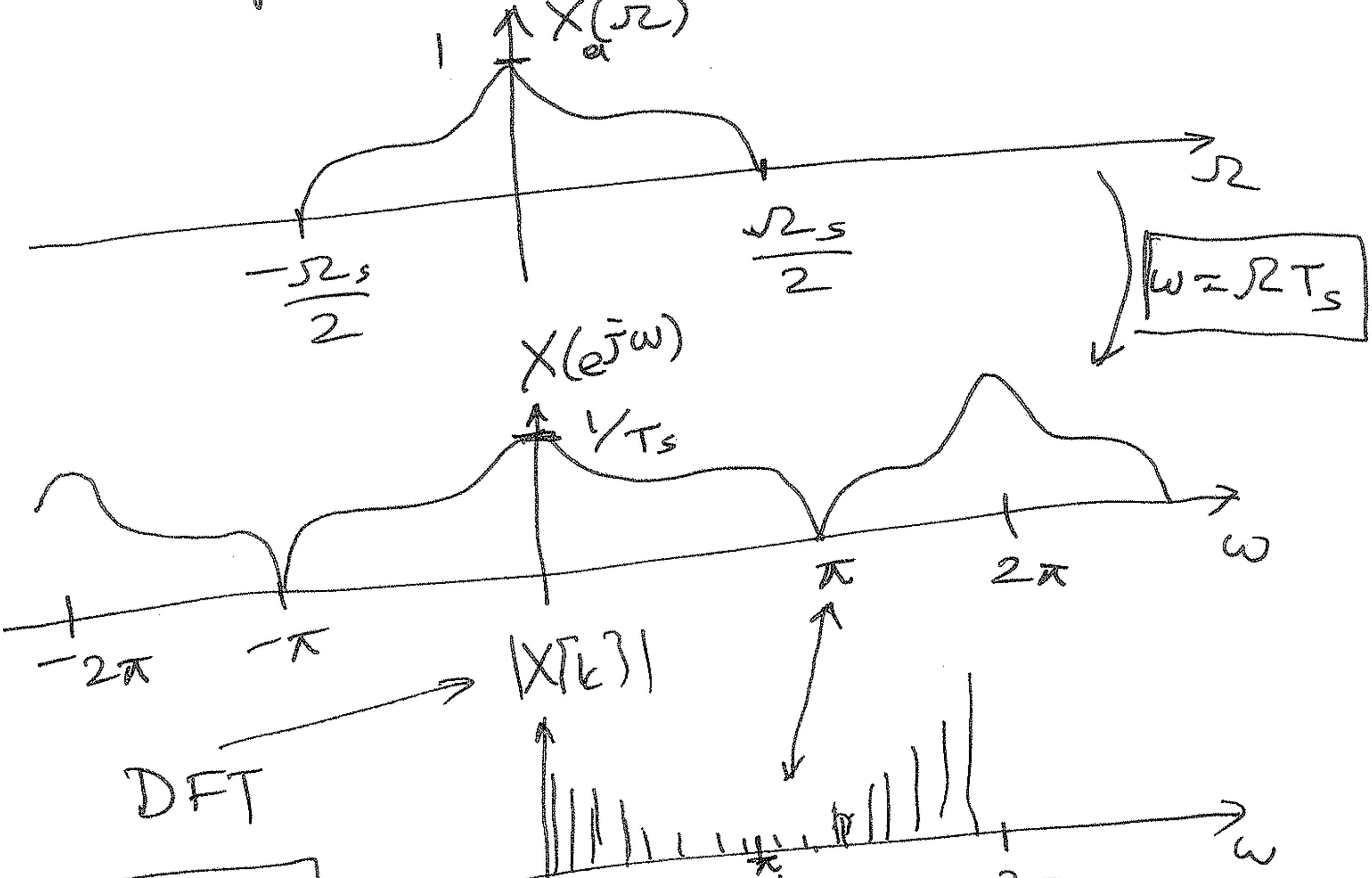
D.F.T :

$$X[k] = \sum_{n=0}^{N-1} x[n] e^{-j\frac{2\pi kn}{N}}, \quad k = 0, 1, \ldots, N-1$$

$$X[k] \cong X(e^{j\omega})\Big|_{\omega = \frac{2\pi k}{N}}, \quad k = 0, 1, \ldots, N-1$$

Shannon's theorem: Sampling period: $T_s = \frac{1}{f_s}$

Highest freq: $\frac{f_s}{2}$, $\frac{\Omega_s}{2}$



$$\boxed{\omega = \frac{2\pi k}{N}}$$

$X[k_0]$ $\quad k_0 = \frac{\omega N}{2\pi} = \frac{\Omega T_s N}{2\pi}$