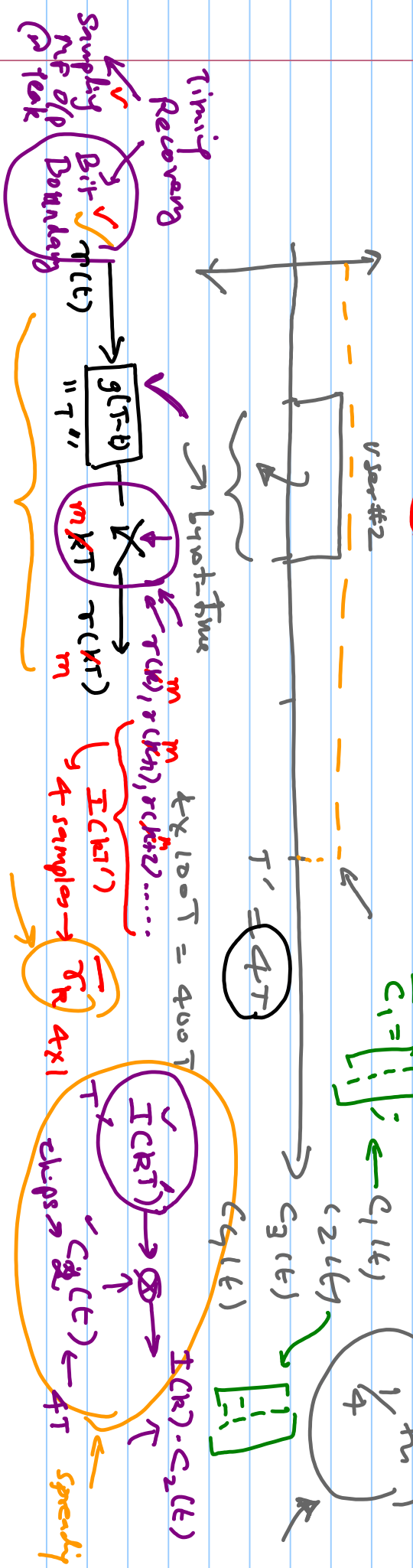
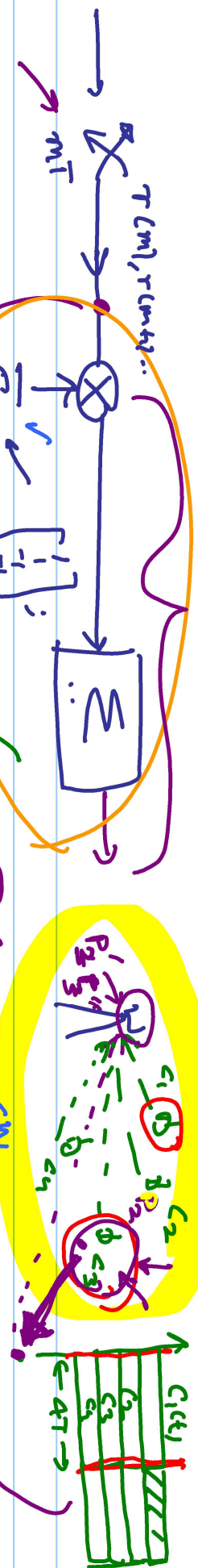


Direct Sequence CDMA (DS-SS)

- Basic Rx structure (for uplink)
- DS-SSMA "soft Capacity" → SINR
- "Noise Rise" and UL capacity / link budget

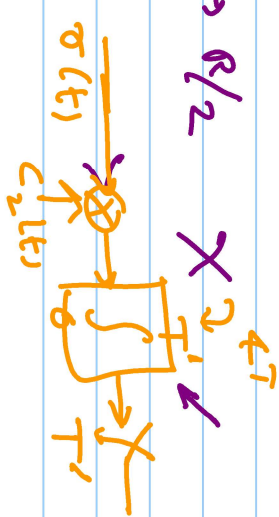
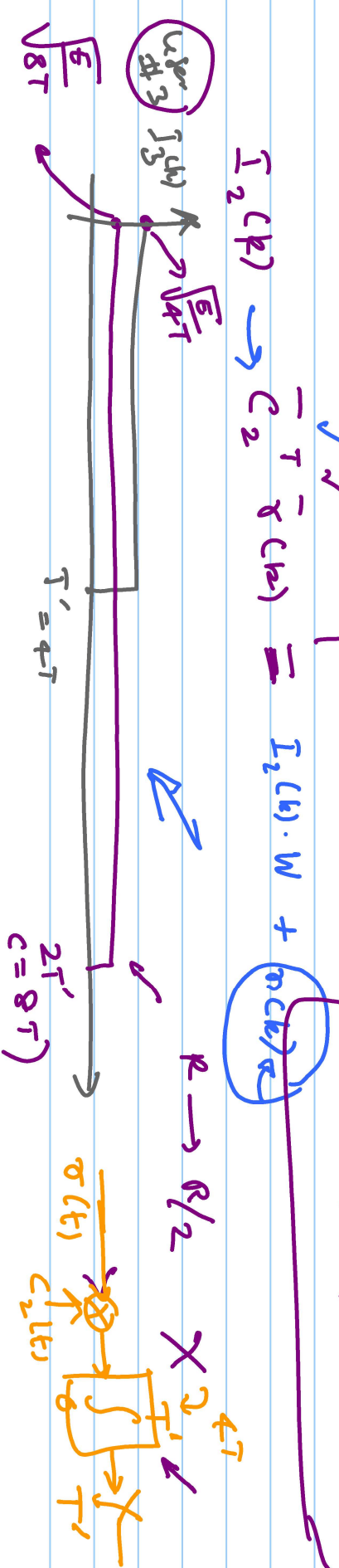




$$I_2(k) = I_1(k) \cdot c_1 + I_2(k) \cdot c_2 + I_3(k) \cdot c_3 + I_4(k) \cdot c_4 + \bar{n}_{4 \times 1}$$

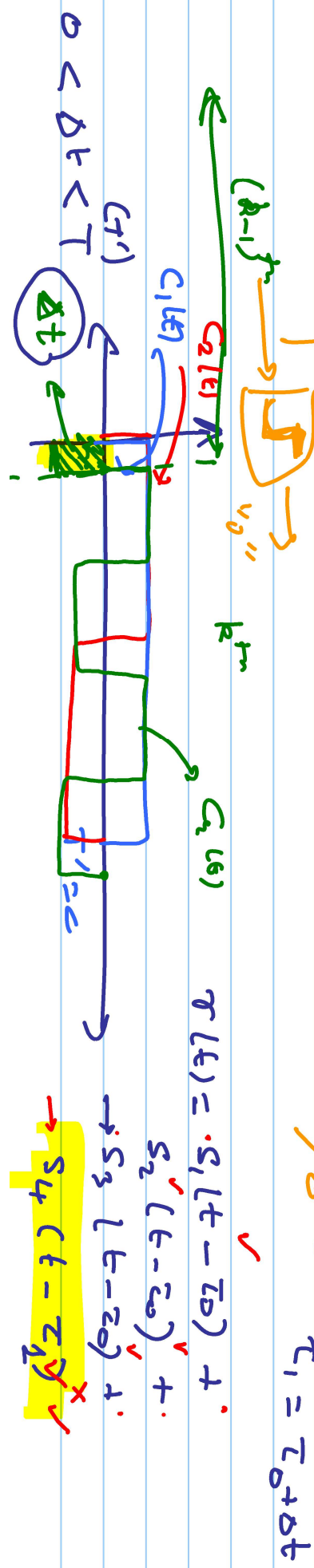
$$\bar{r}(k) = I_2(k) \cdot W + n(k)$$

$$I_2(k) \rightarrow c_2^{-T} \bar{r}(k) = I_2(k) \cdot W + n(k)$$



$$\begin{aligned}
 \text{for } \Delta t < T \\
 z_1 = c_3^{-T} \cdot \tau(k) &= I_1(k) \bar{c}_1 + I_2(k) \bar{c}_2 + I_3(k) \bar{c}_3 + I_4(k) \bar{c}_4 + \bar{n}(k) \\
 &= \sqrt{I_3(k)} \cdot 4 + n(k) \rightarrow 4 \cdot \frac{E}{\sigma^2} + \bar{n}(k) \\
 &= \sqrt{I_3(k)} \cdot 4 + n(k) \\
 z_2 = c_3^{-T} \cdot r(k) &= I_1(k) \bar{c}_1 + I_2(k) \bar{c}_2 + I_3(k) \bar{c}_3 + I_4(k) \bar{c}_4 + \bar{n}(k)
 \end{aligned}$$

$$\begin{aligned}
 z_1 \quad z_2 &= 8 \cdot \sqrt{I_3(k)} + n(k) + \bar{n}(k) \\
 &\leftarrow \text{Amplitude} \\
 &\rightarrow \frac{(8^2) \cdot \sigma^2}{2 \sigma^2} \leftarrow E \\
 &\rightarrow \frac{32E}{\sigma^2} \quad \tau_1 = \tau_0 + \Delta t
 \end{aligned}$$



"Delay spread" $h(t) \neq \delta(t) \leftarrow \int |f(\omega)|^2 d\omega$

