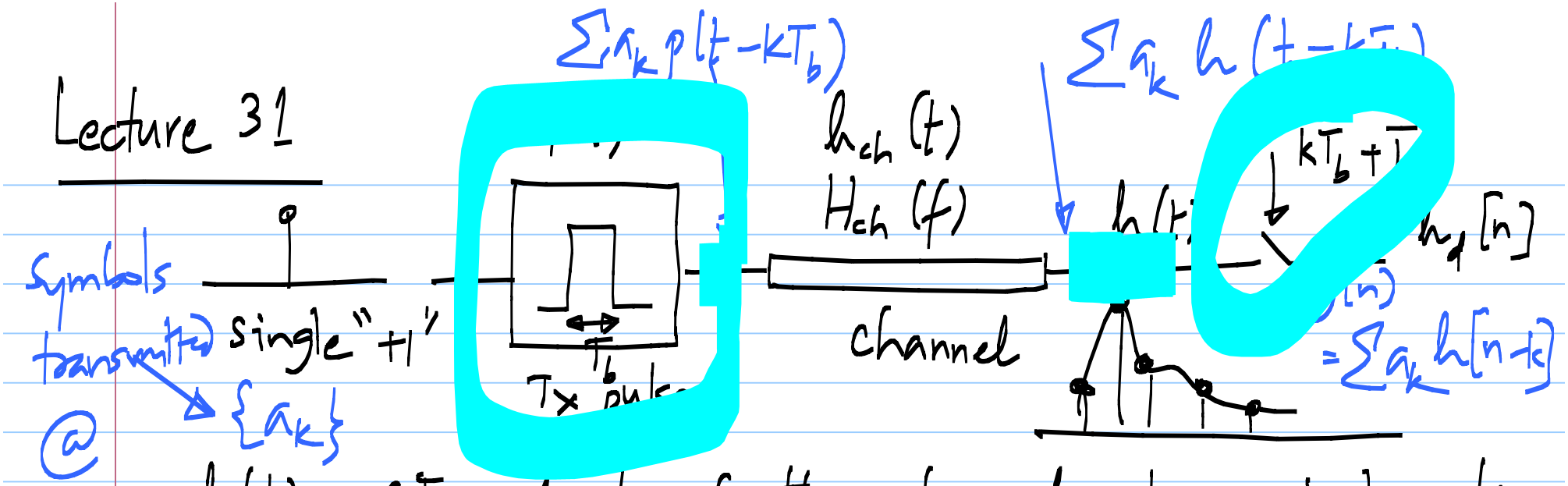
Lecture 31



@ $f_b = \frac{1}{T_b}$

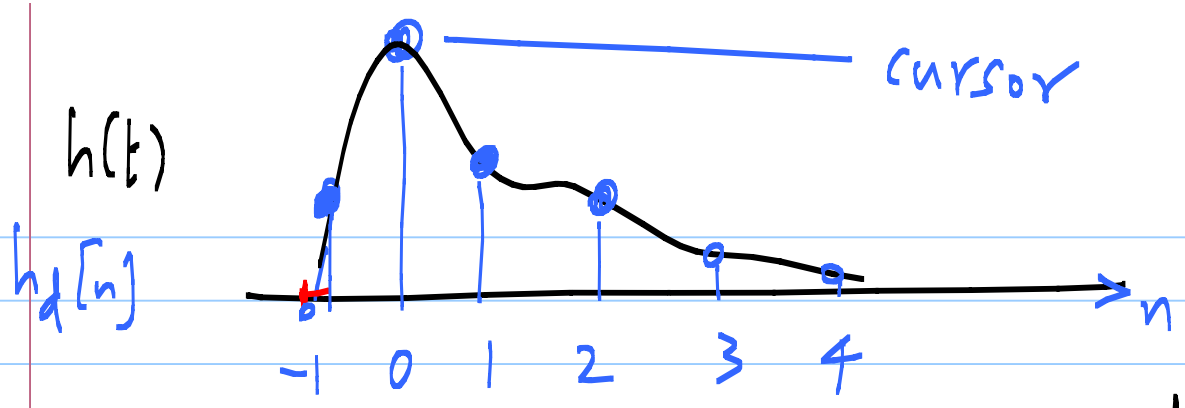
$h(t)$: CT output of the channel to a single pulse input

$h_d[n]$: DT output " "

$h(t)$: spans more than T_b $\Rightarrow$ memory

$h_d[n]$: more than 1 non-zero element

Inter symbol interference (ISI)



(ISI: everything other than the cursor)

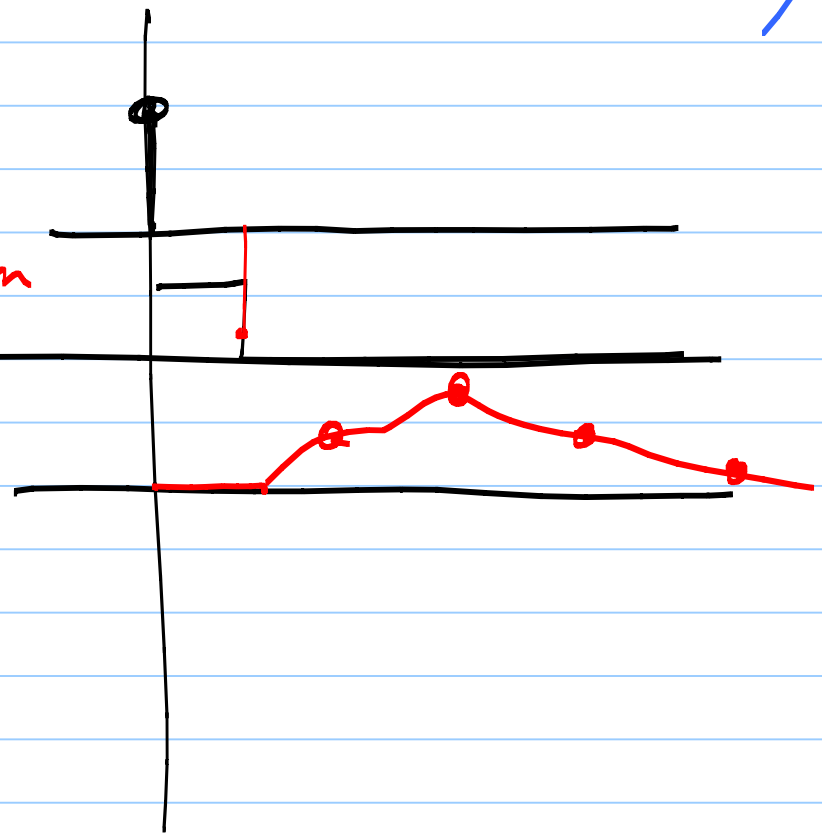
pre-cursor ISI

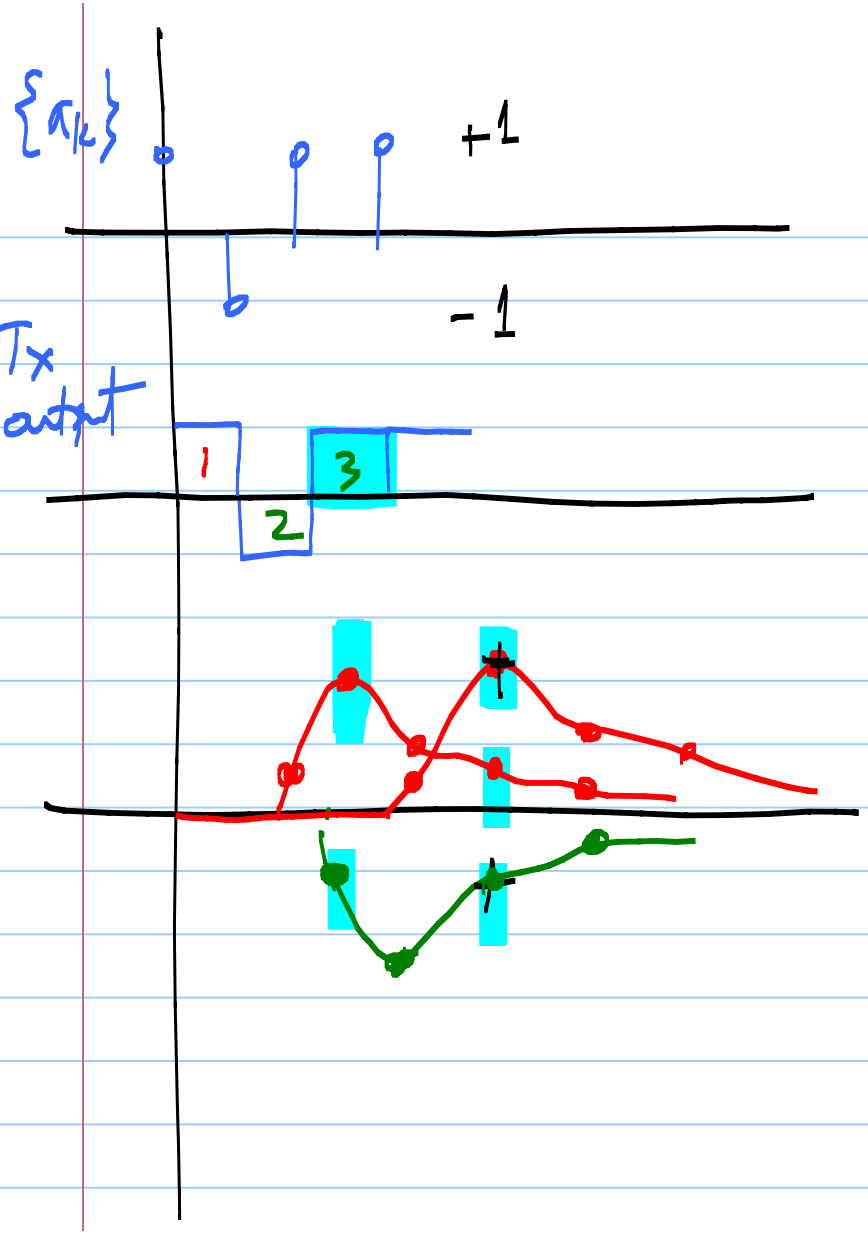
Interference from future bits

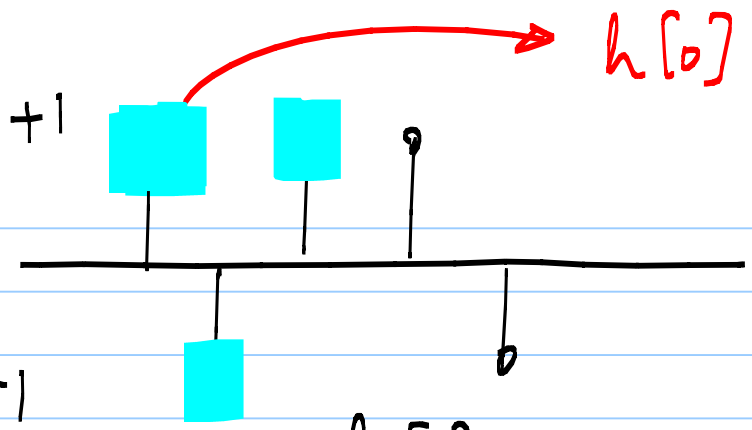
post-cursor ISI

Interference from past bits

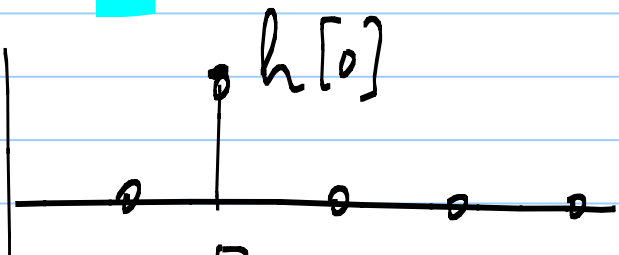
present bit



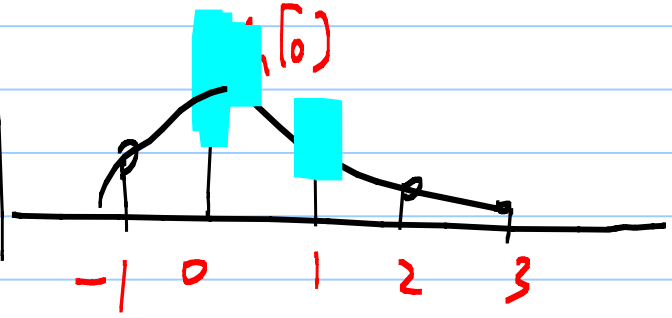




memory - less channel



channel w/ memory (ISI)



Eliminating ISI

$h_{eq}[n]$ – Equalizer

* Use a discrete-time filter, either @ Tx or @ Rx (assume that CDR is working correctly)

highpass lowpass

Linear DT equalization

$$h_{eq}[n] * \text{[redacted]} \sim \delta[n]$$

$$H_{eq}(\Omega) \cdot H_d(\Omega) \sim 1 \quad (0 \text{ to } \pi)$$

* Use a CT highpass filter @ Tx ($\sim$ changing $p(t)$) or @Rx

$$H_{eq}(f) \cdot H_{ch}(f) \sim 1$$

Input bits $\{a_k\}$

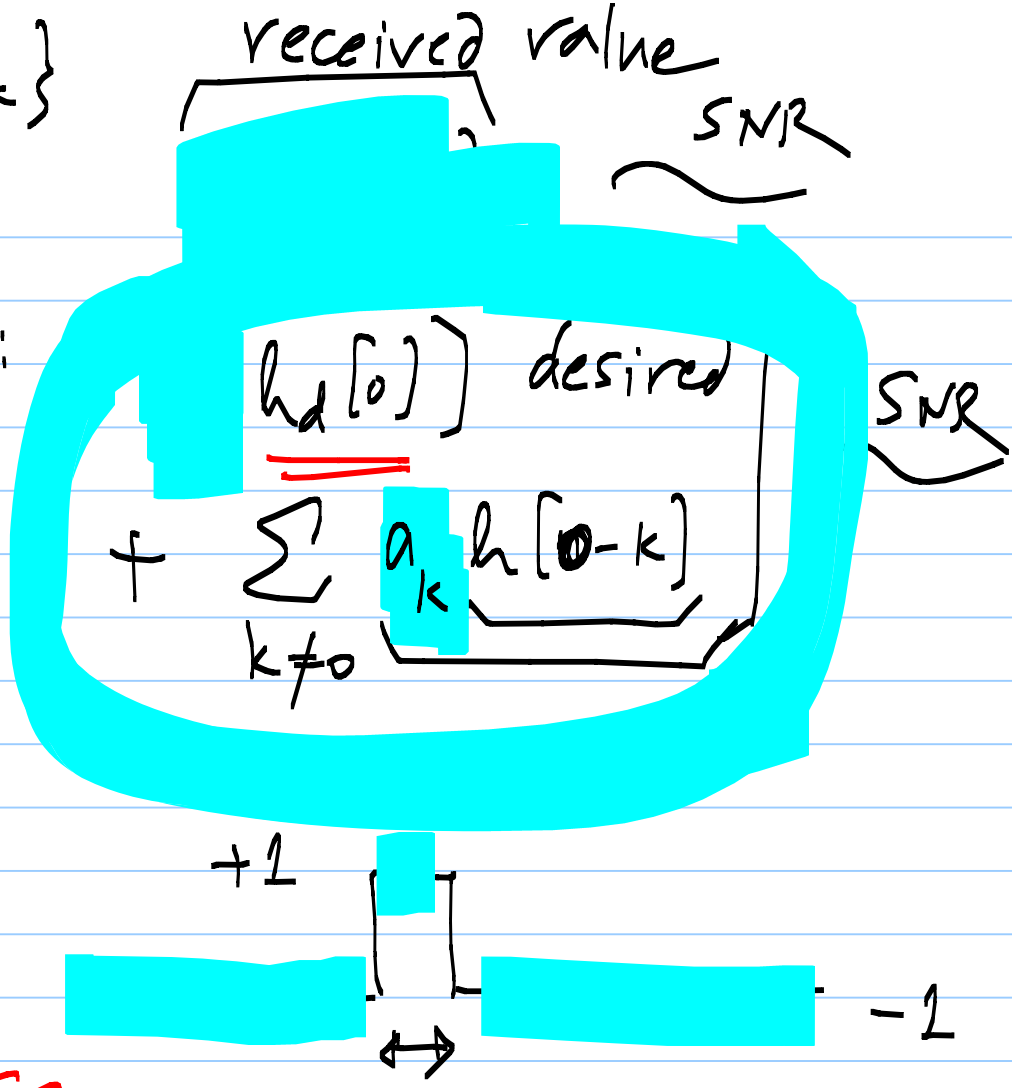
Memoryless channel:

Channel w/ ISI:

$h_d[n]$

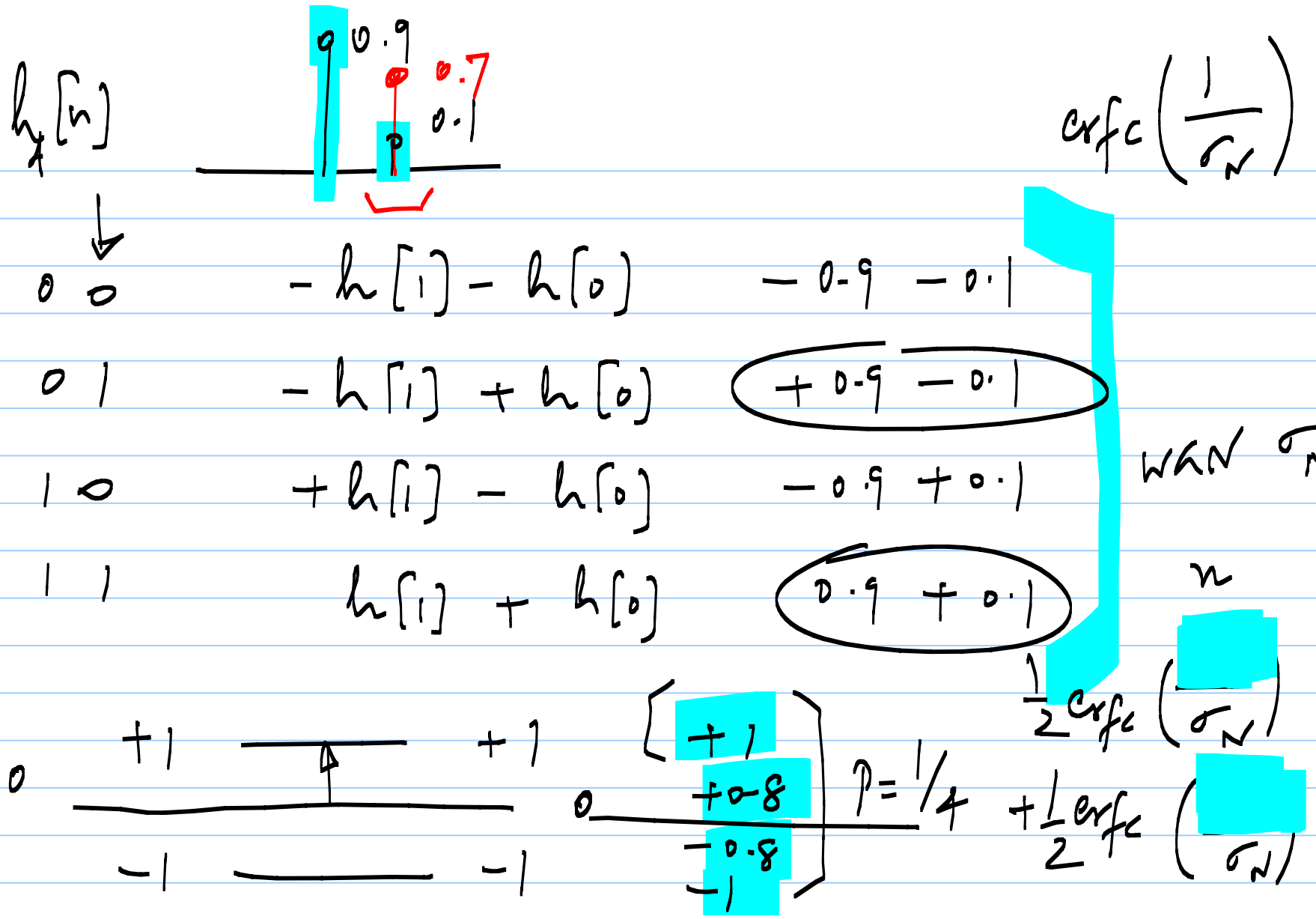
$$\sum_k a_k h[n-k]$$

$a_0 = 1$



Total ISI $= \sum_{k \neq 0} |h[-k]| \geq h[0]$

w/ =


$h_1[n]$
q 0.9
p 0.7
0.1
$\operatorname{erfc}\left(\frac{1}{\sigma_N}\right)$
0 0 $-h[1]-h[0]$ $-0.9-0.1$
0 1 $-h[1]+h[0]$ $+0.9-0.1$
1 0 $+h[1]-h[0]$ $-0.9+0.1$
1 1 $h[1]+h[0]$ $0.9+0.1$
WGN σ_N
n
$\frac{1}{2}\operatorname{erfc}\left(\frac{\quad}{\sigma_N}\right)$
$+\frac{1}{2}\operatorname{erfc}\left(\frac{\quad}{\sigma_N}\right)$
$P=1/4$
0
+1
+1
−1
−1
+1
+0.8
−0.8
−1
0