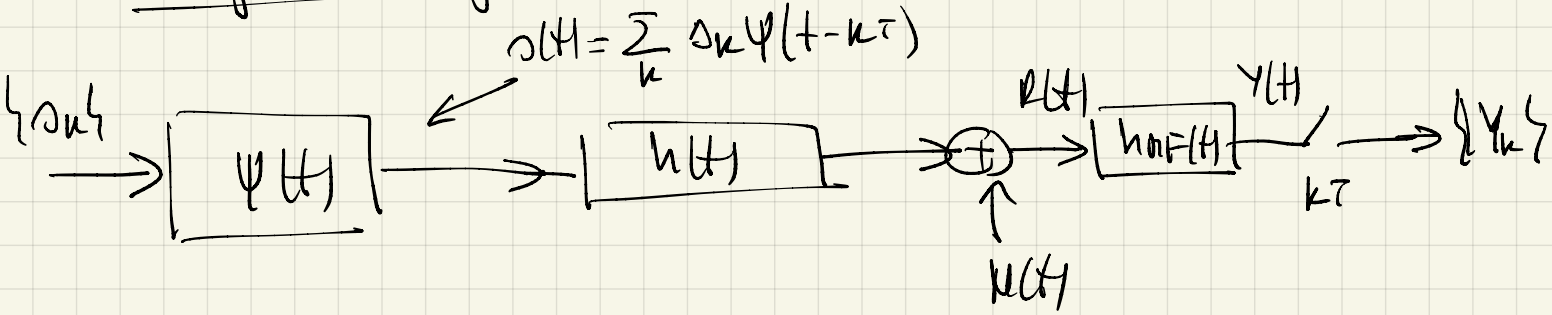
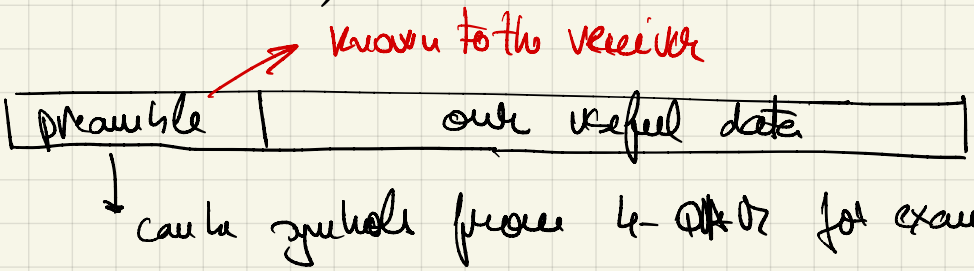
Symbol Synchronization



We need to know:

- when we sample! (kT)
- When we start sampling (or where our useful data starts).

In practice, usually we introduce a known sequence (known to the receiver) in the transmitted data



At the receiver, we correlate the received samples with the preamble, to determine its location within the stream of samples.

How do we choose the preamble?

Usually we choose it as a pseudo-random sequence. It should have good correlation properties.

Matlab xcorr function

$a = [a[1] \ldots a[n]]$

$b = [b[1] \ldots b[m]]$ $\quad m < n$

$a[1]\ a[2] \ldots a[n]$

$b[1]\ b[2] \ldots b[m]\ \boxed{\emptyset}$ Adds zeros to make these the same length

$a[1]\ a[2] \ldots a[n]$

$b_1 \ldots b_m\ \emptyset$

$a[1]\ a[2] \ldots a[n]$

$b_1\ b_2 \ldots b_m\ \emptyset \ldots \emptyset$

Length of a was 8 + 20 + 14 = 42

b was 20

The first useful entry of xcorr would be at length of a (42)

The peak of xcorr was at 50 (42 + 8).

Convolution

$a_1 \ldots a_n$

$b_1 \quad b_m$

The first useful entry where the two vectors fully overlap is at length (b) (20)

$$20 + \underbrace{\text{?}}_{\text{original data}} = 25 \text{ ?}$$

Python : convolution (Numpy or Scipy)

conv of Scipy