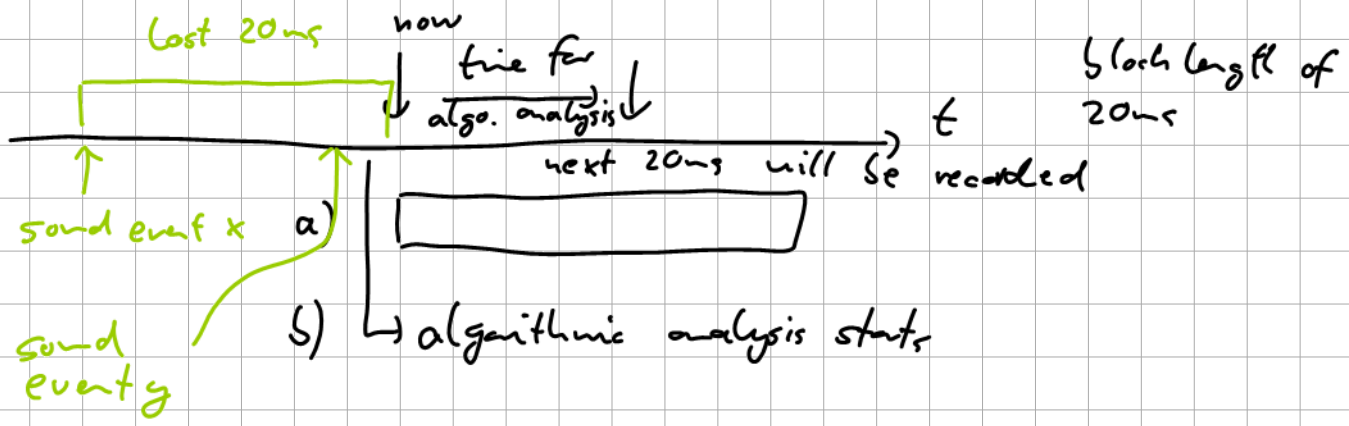
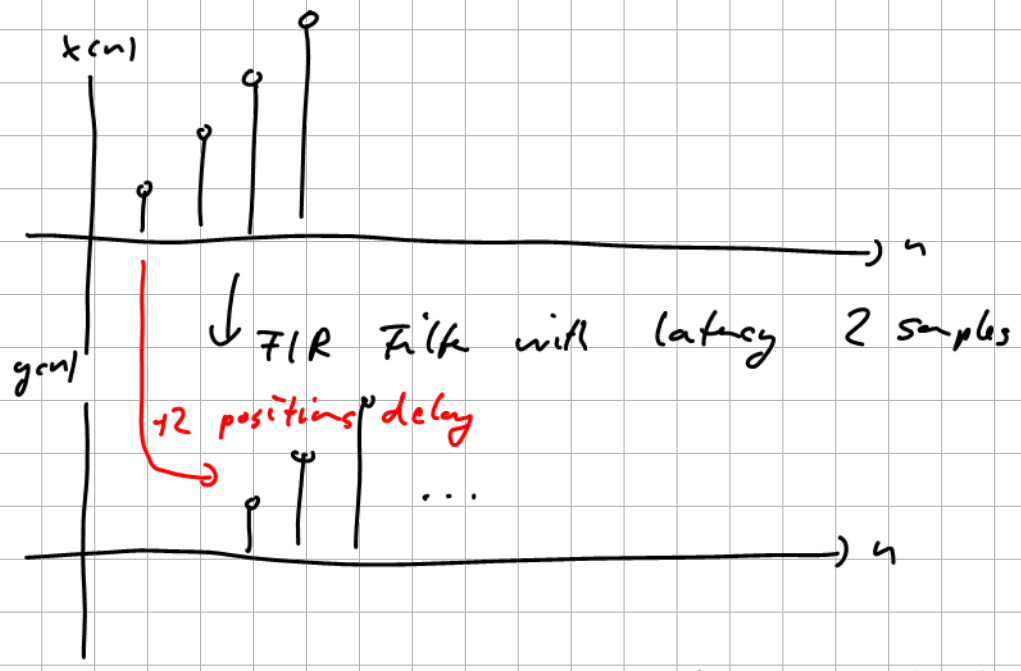
the lower the latency, the faster is the reaction of your system.

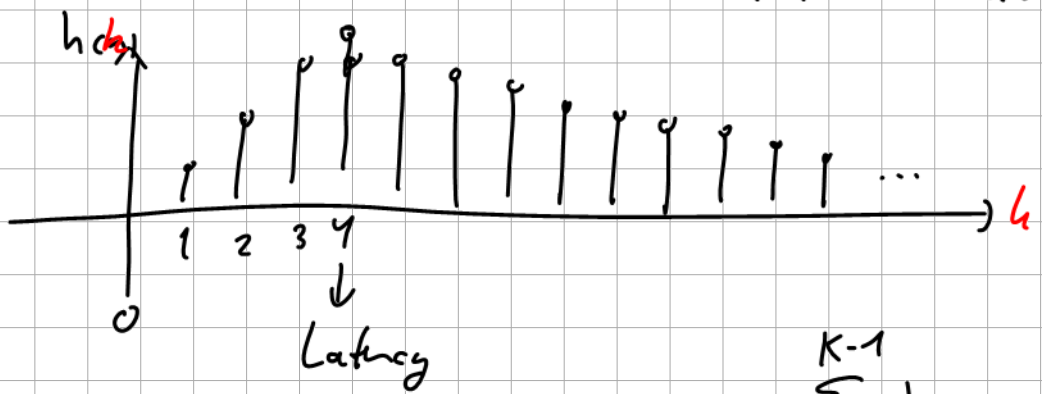
2 types of latency:

in an online scenario, block based algorithms are typical



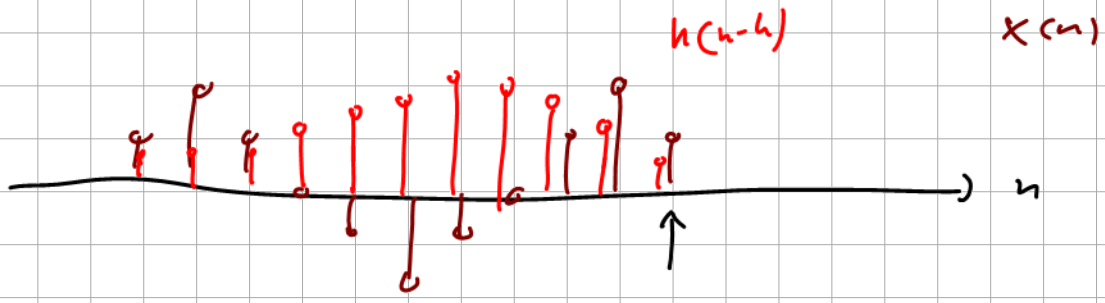


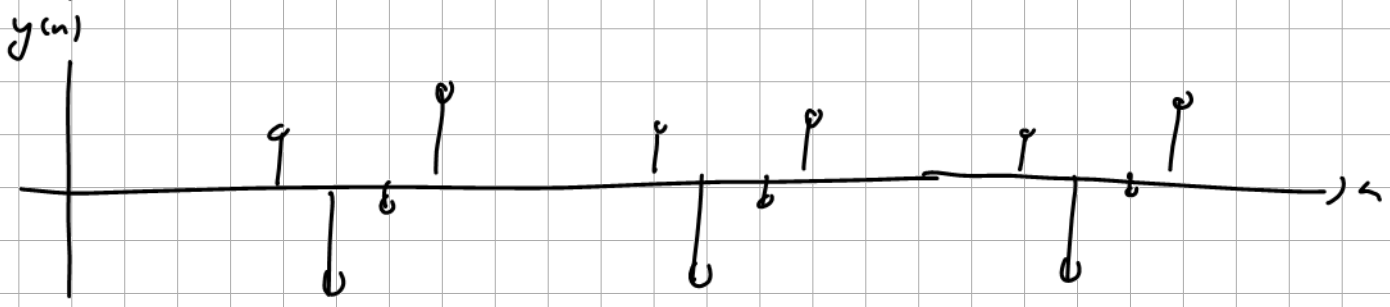
Matrix Method

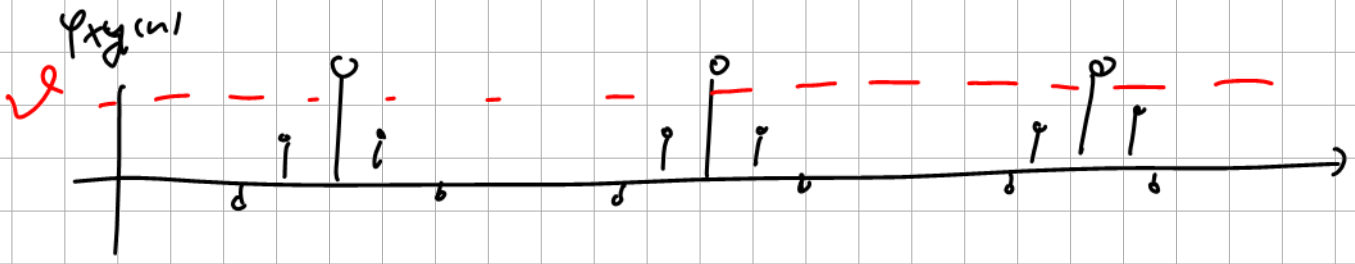


$$y(n) = \sum_{k=0}^{K-1} h(k) \cdot x(n-k)$$

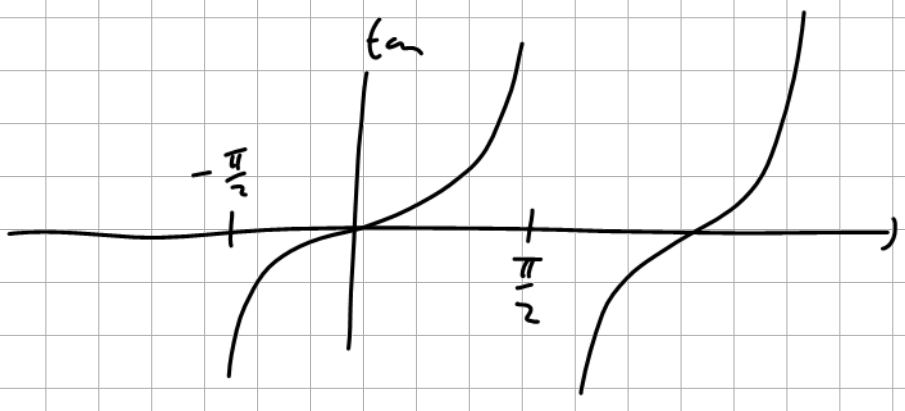
$$= \sum_{i=0}^{K-1} h(n-k) \cdot x(n)$$

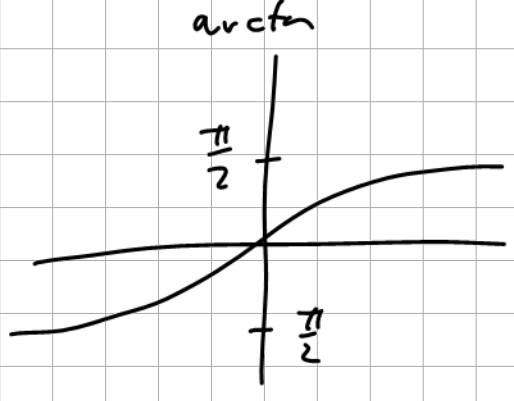


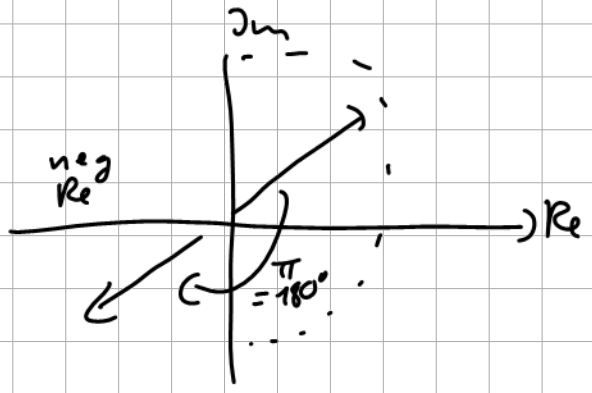




angle = phase = $\varphi(f)$







$f = [0, 1, 2, 3, \dots]$

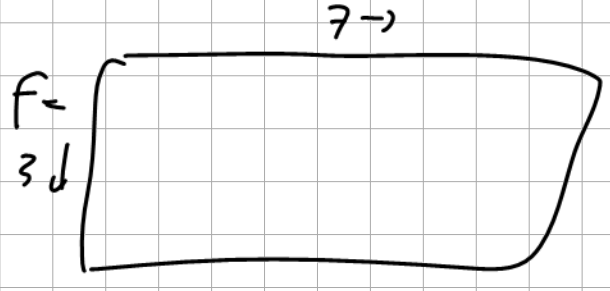
$f == 0 \quad [\text{true}, \text{false}, \text{false}, \dots]$

if $f == 0$: if [true false false ...]

$$-\frac{\varphi(f)}{2\pi f} \approx -\frac{\varphi(f)}{2\pi f + \varepsilon} \qquad \varepsilon = 10^{-16}$$

$$\approx -\frac{\varphi(f) + \varepsilon}{2\pi f + \varepsilon}$$

```
y = np.zeros ...
for n in range(..)
    if np.abs(f[n]) < ε :
        y[n] = 0
    else :
        y[n] =
```



f.shape = (3, 7)

f.shape[0] = 3

unwrapping :

angle (H) : $-\pi \dots \pi$

Delay: $-\frac{\varphi}{2\pi f}$

$\varphi(f) = \text{unwrap}(\text{angle}(H))$