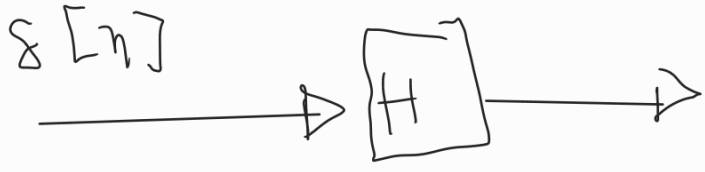
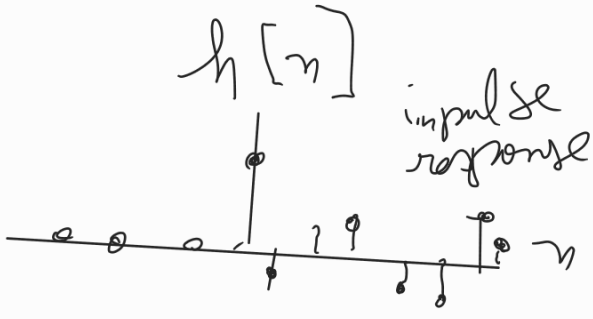
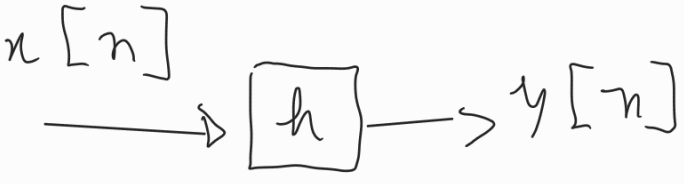
Characterizing linear, time-invariant systems using canonical inputs –

1) Write arbitrary input as a weighted sum of time-shifted canonical input

2) Output is a weighted sum of time-shifted canonical outputs







$$y[n] = \sum_{k=-\infty}^{\infty} h[k]\, x[n-k] =$$

$$h[n] * x[n]$$

$\vec{C}$ operator notation

Properties

1) Causal system

$$y[n] = \sum_{k=-\infty}^{\infty} h[k]\, x[n-k]$$

$$= \ldots + h[-2]x[n+2] + h[-1]x[n+1] + h[0]x[n] +$$

$$h[1]x[n-1] + \ldots$$

Causal $\iff$ $h[n] = 0$ for $n < 0$

2) Finite impulse response (FIR):

number of nonzero $h[n]$ is finite

Most common form $h[n] = 0$

$n < 0$, $n \geq N$

$$y[n] = \sum_{k=0}^{N-1} h[n]\, x[n-k]$$

$$= h[0]x[n] + h[1]x[n-1] + \cdots$$

$$+ h[N-1]$$