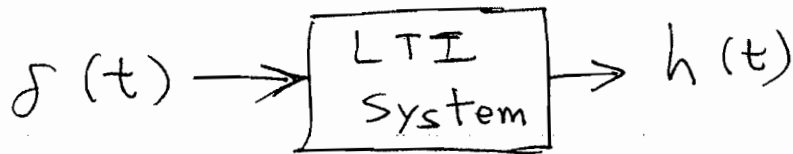
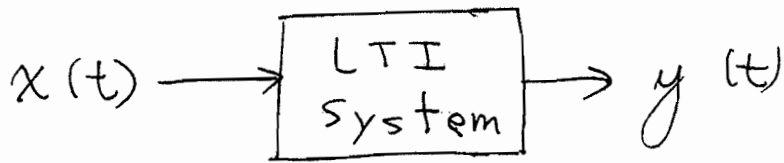


# LTI System Properties Determined from Impulse Response



$$y(t) = x(t) * h(t) \\ = \int_{-\infty}^{\infty} x(\tau) h(t-\tau) d\tau = \int_{-\infty}^{\infty} h(\tau) x(t-\tau) d\tau$$

System is causal if  $h(t) = 0$  for  $t < 0$

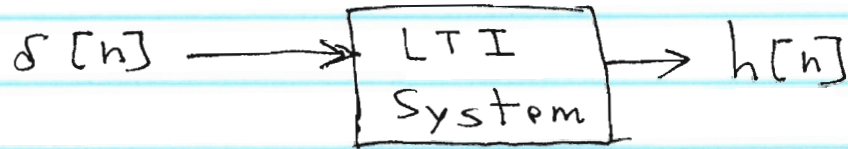
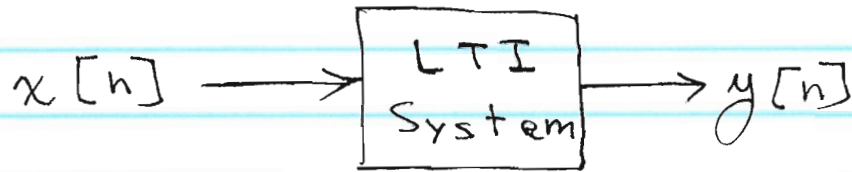
stable iff  $\int_{-\infty}^{\infty} |h(t)| dt < \infty$

memoryless iff  $h(t) = k \delta(t)$

invertible if there exists an <sup>(inverse)</sup> LTI system with impulse response  $h_I(t)$  that satisfies

$$h(t) * h_I(t) = \delta(t)$$

# Discrete-Time LTI Systems



Kronecker  
Delta  $\rightarrow$

$$y[n] = x[n] * h[n]$$

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

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

System is causal if  $h[n] = 0$  for  $n < 0$

System is stable iff  $\sum_{n=-\infty}^{\infty} |h[n]| < \infty$

memoryless iff  $h[n] = k \delta[n]$

Invertible if there exists an LTI inverse system with impulse response  $h_I[n]$  satisfying

$$h[n] * h_I[n] = \delta[n]$$