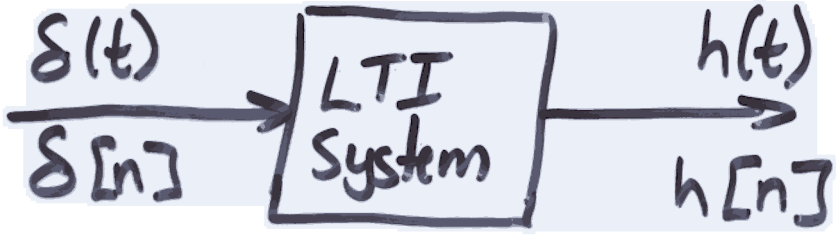
Response of LTI Systems to Special Signals

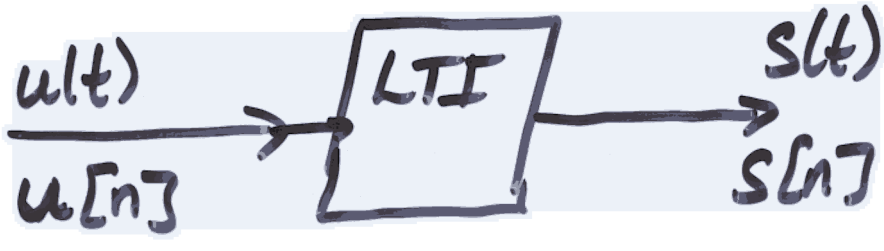
- We already know, that if we put in an impulse, what comes out is the impulse response; i.e.,



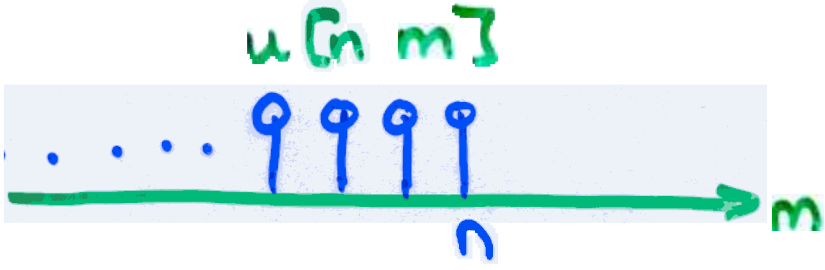
- What about other special signals

Step Response

- this characterizes the system's response to sudden changes in the input
- Especially important in control and robotics applications, because the step may be a command.
- Let $s(t)$, $s[n]$ denote the step response.



$$s[n] = \sum_m h[m]\,u[n-m]$$



So what s $w_n[m] = h[m]\,u[n-m]$?

$$\begin{cases} 0 & m > n \\ h[m] & m \le n \end{cases}$$

Therefore

$$s[n] = \sum_m w_n[m]$$

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

e a running sum of the impulse response

Similarly (prove this)

$$s(t) = \int_{-\infty}^{t} h(\tau)\,d\tau$$

e a running integral of the impulse response