Stability

- Bounded input → bounded output

Given $|x[n]| < M, \forall n$ and M finite
Then $|y[n]| < M, \forall n$ and M finite

Alternatively:
$\sum_{k=-\infty}^{\infty} |h[k]| < \infty$ ***Absolutely summable***
or $\int_{-\infty}^{\infty} |h[t]| < \infty$ ***Absolutely integrable***

Stability

- Examples:
  - $y(t) = 2^t$ Unstable
  - $y(t) = x^2(t)$ Stable
  - $y(t) = 2^t x(0)$ Unstable
  - $y(t) = 2^t x(t)$ Unstable
  - $y(t) = (1/2)^t x(t)$ Unstable, $t \rightarrow -1$ blows up,
    $y(t) = (1/2)^t u(t)$ is stable

Causality

- Output does not depend on future values of the input:

$$h[n] = 0, \text{ for } n < 0$$

$$h(t) = 0, \text{ for } t < 0$$

- Examples
  - $y(t) = x(t+1)$ Not Causal
  - $y(t) = x(t)\, e^{t+1}$ Causal
  - $y[n] = x[n] + x[n+1]$ Not Causal