System Basics

Digital Signal Processing
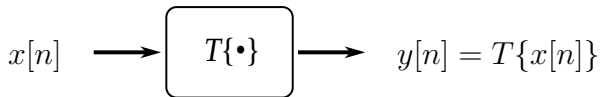
January 21, 2025

Systems
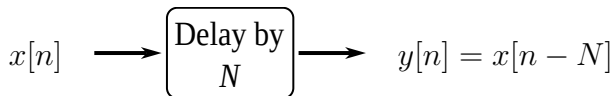
Definition

A **system** is a process that takes a signal as input and returns a signal as output.
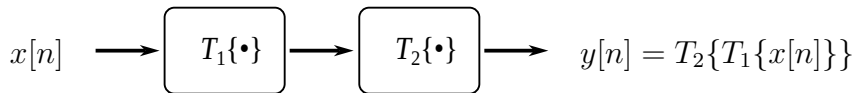
Diagram for a system:

$$x[n] \longrightarrow \boxed{T\{\bullet\}} \longrightarrow y[n] = T\{x[n]\}$$

Ideal Delay

The ideal delay system shifts the signal to the right by N samples.

$$x[n] \longrightarrow \boxed{\begin{array}{c} \text{Delay by} \\ N \end{array}} \longrightarrow y[n] = x[n - N]$$

Cascaded Systems

We can apply two systems in serial:

$$x[n] \longrightarrow \boxed{T_1\{\bullet\}} \longrightarrow \boxed{T_2\{\bullet\}} \longrightarrow \quad y[n] = T_2\{T_1\{x[n]\}\}$$

Multiplication
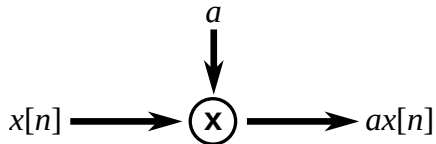
Addition

Example: Karplus-Strong