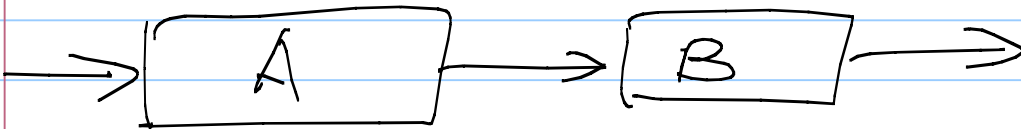For this semester, our test signals are
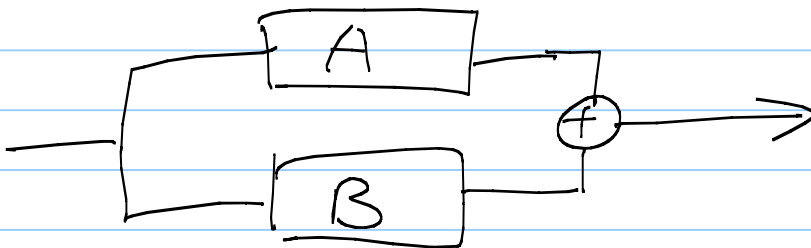either _____ or
_____

_____

Enough of signals. Let us focus on
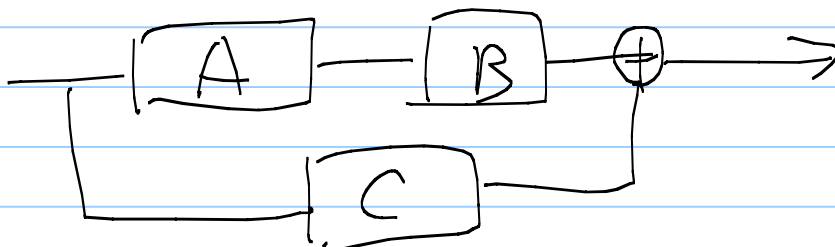the systems.

* Systems can be interconnected

Sys 1: Serial concatenation
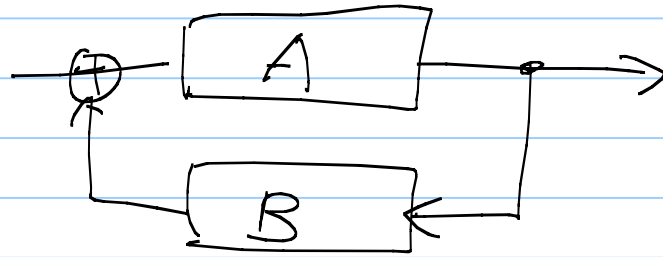

Sys 2 Parallel concatenation

Sys 3: Serial / parallel concatenation

Sys4: Feedback

* In this course, we treat all interconnections as a big system (a black box). as we are interested only in the end-to-end input/output relationship.

* How to classify a system?

Systems
①
②
③
④
✗ ⑤
✗ ⑥

Recall
Signals:
① DT vs CT
② periodic vs. aperiodic
③ ∞ ⟍⟋ energy
finite ⟋⟍ power
④ Even / odd / neither

* Watch online video 1.6.345

① With memory vs. memoryless

− A system is "_____" if $y(t)$ at time t depends only on the instantaneous value of $x(t)$ at time t, not $x(s): s < t$, nor $x(s): s > t$.

− A system that is not memoryless is called "with memory"

Example: Classify

$$y(t) = [2x(t)]^{2/3}$$

$$y(t) = x(t+1)$$

$$y(t) = \int_{-\infty}^{t} x(s) ds$$
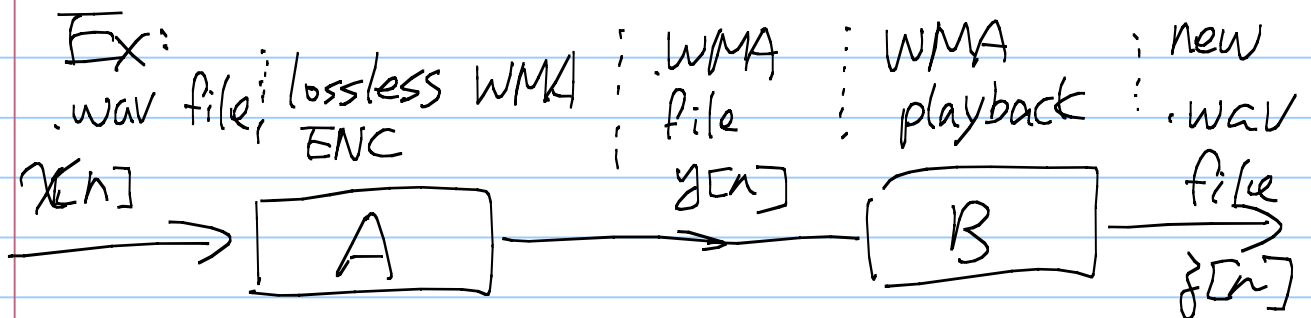
$$y(t) = x(2t)$$

$$y[n] = x[n] - x[n-1]$$

② Invertible vs. Non-invertible

A system is _____ if given the output $y(t)$, the input $x(t)$ can be deduced.

* Invertible vs. Non-invertible

Namely, an inverse system can be created

Ex:

.wav file; lossless WMA | .WMA | WMA | new
$x[n]$ ¦ ENC ¦ file $y[n]$ ¦ playback ¦ .wav file $z[n]$

$$x[n] \longrightarrow \boxed{A} \longrightarrow y[n] \longrightarrow \boxed{B} \longrightarrow z[n]$$

Ex: Classify

$$y(t) = 2x(t)$$

$$y(t) = \sin(x(t))$$

Question for the teams

Consider a <u>sliding window</u> averaging system

$$y[n] = \begin{cases} \dfrac{1}{\min(5,n)+1} \displaystyle\sum_{k=\max(0,n-5)}^{n} x[k] & \text{if } n > 0 \\ x[n] & n \leq 0. \end{cases}$$

Note Title

That is

$y[-1] =$

$y[0] =$

$y[1] = .$

$y[2] =$

$\vdots$

$y[5] =$

$y[6] =$

$y[n] =$

Q: Construct the corresponding inverse system

$x[n] \longrightarrow \boxed{} \xrightarrow{y[n]} \boxed{Inverse} \xrightarrow{x[n]}$
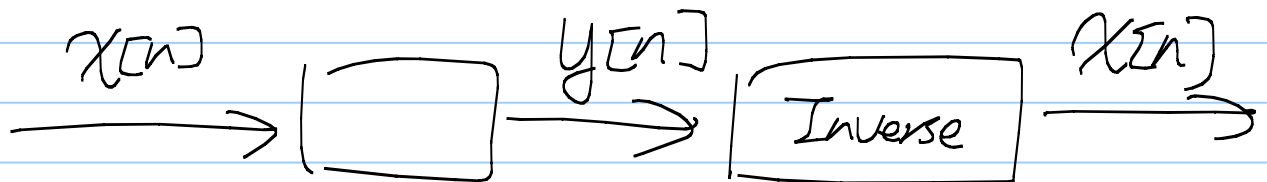
Hint: You may want to use "feedback" in your system.