Signal Processing Fall/2019

http://piazza.com
↳ istanbul university
↳ BIMU3009
↳ Kod : signal123

- Midterm Exam %50
- Final " %50

Textbook: "Signals and Systems", Simon Haykin and Barry Van Veen, Wiley, 2nd Ed.

Türkçe Kitaplar: 1) Oppenheim, "Sinyaller ve Sistemler",
2) Schaum's outlines "

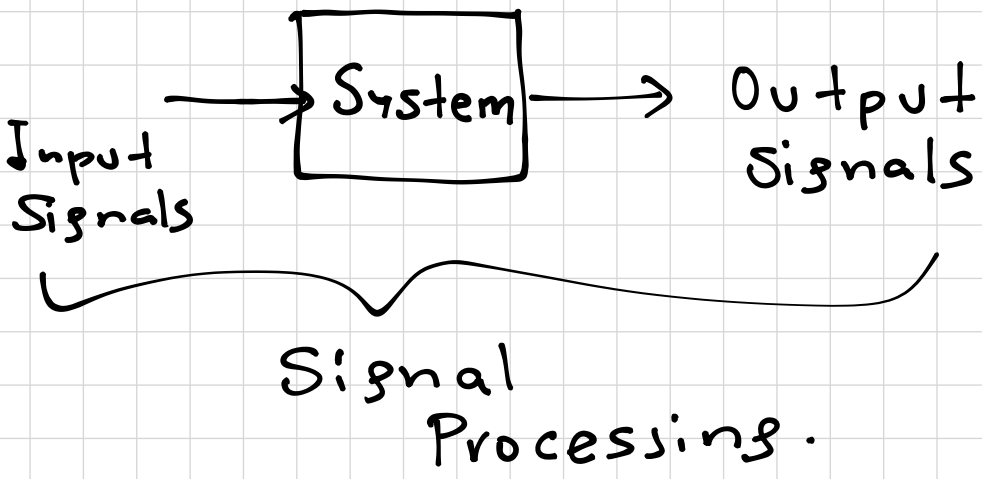
What is a signal?

- Speech Signals.
- Emails
- Heartbeats
- Radio waves
- Fluctuations in the prices of stocks

Formally: "A signal is formally defined as a function of one or more variables that conveys information on the nature of a physical phenomenon"

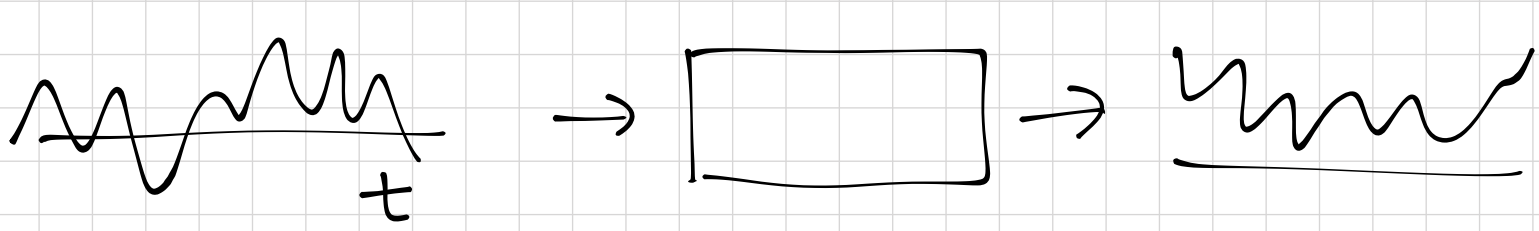
What is a system?

A system is an entity that manipulates one or more signals to accomplish a function, thereby yielding new signals.

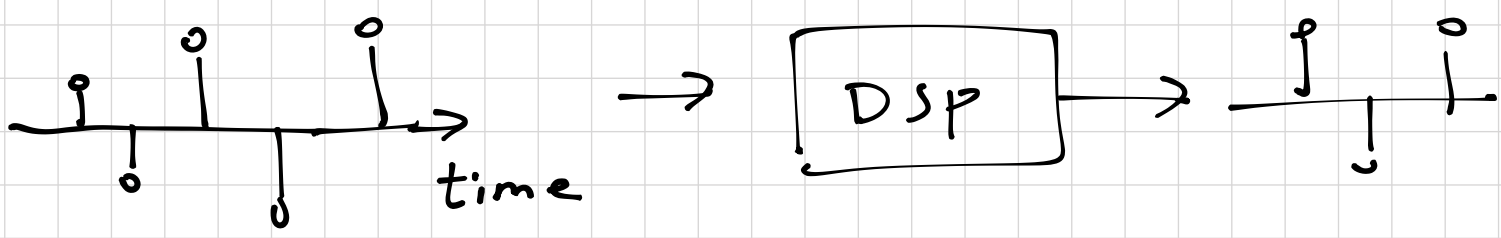


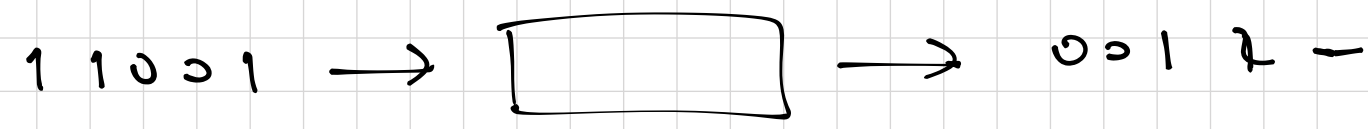
Analog vs Digital Signal Processing

- Analog signal processing involves continuous signals.



- D.S.P → involves "discrete" signals.





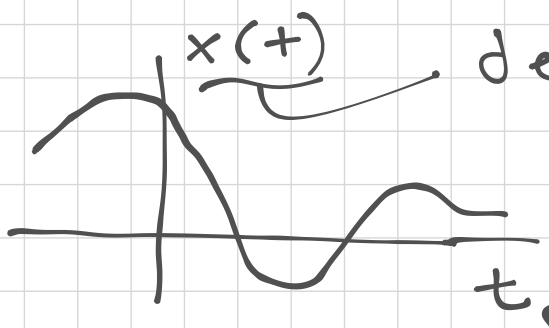
Classification of Signals

→ In this class we will focus on one dimensional single valued signals.

→ We will represent the signals as a function of time

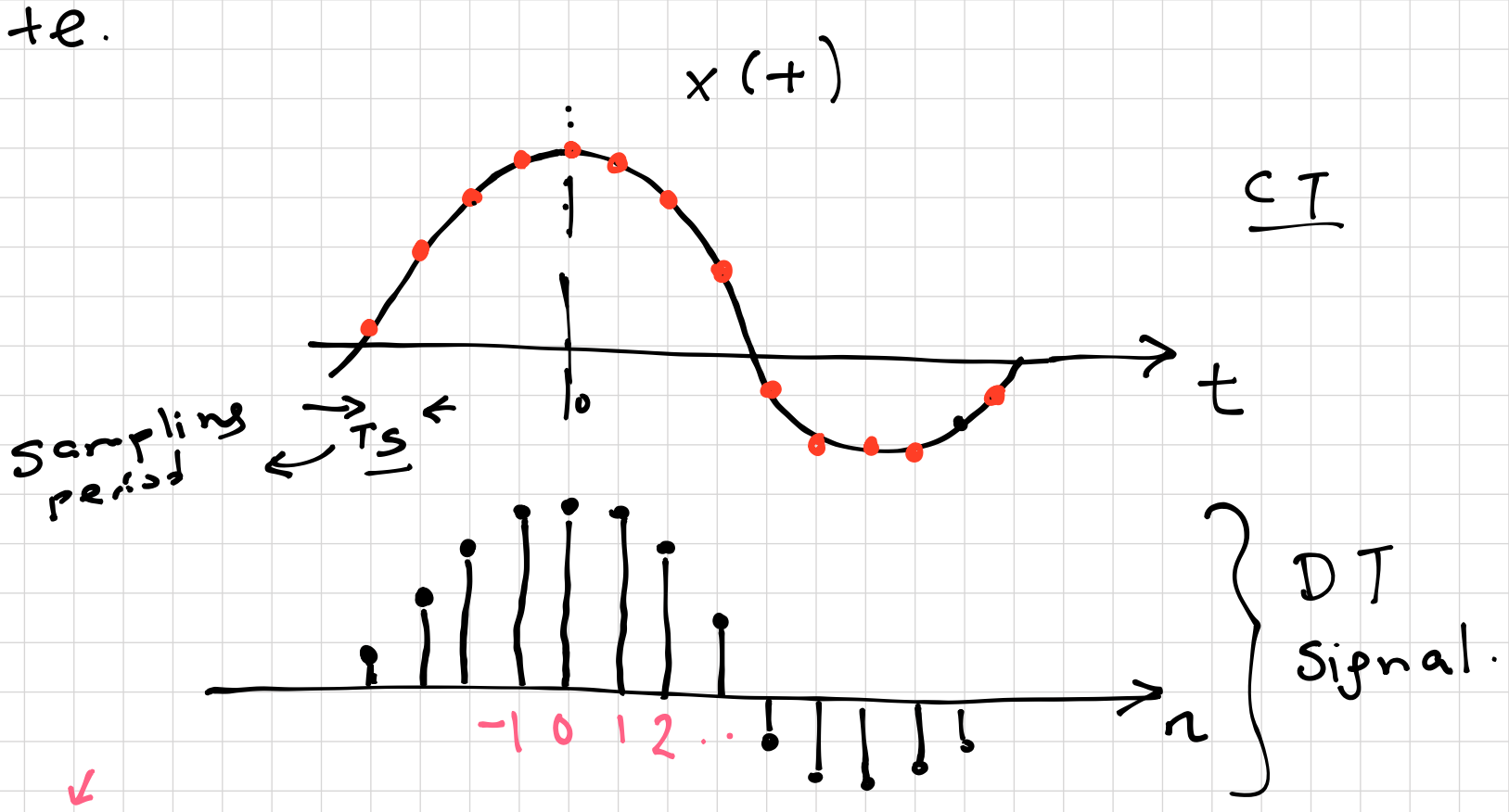
① Continuous-Time vs Discrete-Time

CT Signals



→ A CT signal, x(t), is defined for all time, t, second

- A DT signal is defined only at discrete instants of time.
- A DT signal is derived from a CT signal by <u>sampling</u> (örnekleme) it at a uniform rate.



$x[n] = x(nT_s)$, $n = 0, \mp 1, \mp 2, \cdots$

$x[n]$: independent variable.

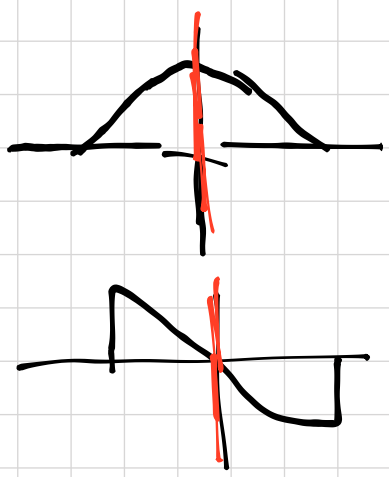
② Even and Odd Signals

A CT signal, $x(t)$, is said to be an **even** signal if

$$x(-t) = x(t) \quad \text{for all } t$$

A CT signal, $x(t)$, is said to be an **odd** signal if

$$x(-t) = -x(t) \quad \text{for all } t$$

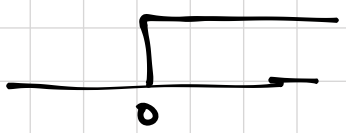


even

odd

(Same applies to DT signals)

Even signals are symmetrical about the vertical axis, odd signals are anti-symmetric about the vertical axis



→ neither even nor odd.

Ex

$$x(t) = \begin{cases} \sin(\pi t/T), & -T \le t \le T \\ 0, & \text{otherwise} \end{cases}$$

odd ? even ?

even $x(t) = x(-t)$

odd $x(t) = -x(-t)$

$+T \ge t \ge -T$

$-T \le -t \le T$

$$x(-t) = \begin{cases} \sin\left(-\frac{\pi t}{T}\right), & -T \le -t \le T \\ 0, & \text{otherwise} \end{cases}$$

$$= \begin{cases} -\sin(\pi t/T), & -T \le t \le T \\ 0, & \text{otherwise} \end{cases}$$

$x(-t) = -x(t)$ $\therefore$ $x(t)$ is ODD