- Chaque port x(B, C ou D) est contrôlé par 3 registre.
  - DDRX : Le registre de direction ((sens de transfert)) du port
  Ces port sont bi-directionnels leur configuration se fait par des registre spécifique((DDRX)): par example DDRD contrôle le Port D
    DDRD = 0 => PORTD = entré
    DDRD = 1 => PORTD = sortie
  - Port X : Le registre de donné du port ((registre de sortie))
    - Pour les broches en sortie : permet de commander ces broches ((écrire))
    - Pour " " " entré : l'état 1 perme d'active la résistance pull-up, si 0 => pull up désactiver
  - PINX : le registre de lecture du port
    perme de lire les états des broches : 0 pour bas, 1 pour haut

I_{max} 40 mA / PIN , 200 mA / Port , 400 mA / μC

2 - 10 - 2024 Cours

SAP // TAS

- Digital signal ((discrete))

Def: A signal is broadly defined as a carrier of information

. Continuous ((analog)) is noted $x(t)$

. Discrete ((digital)) " " $x(n.T_s)$ where T_s - sampling periode or ((step)) and n is an integer $((n \in \mathbb{Z}))$

Shanon ~~[illegible]~~ theorem : $\frac{1}{T_s} \geq 2 f_{max}$

To avoid loosing information contained in the analog signal The Shanon Condition must be satisfied

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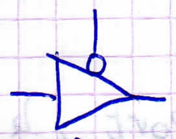
8 - 10 - 2024 Cours

FPGA

CLP:

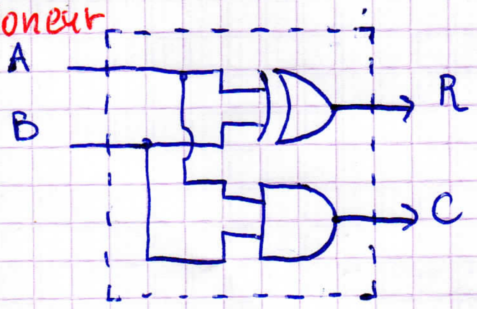


Buffer

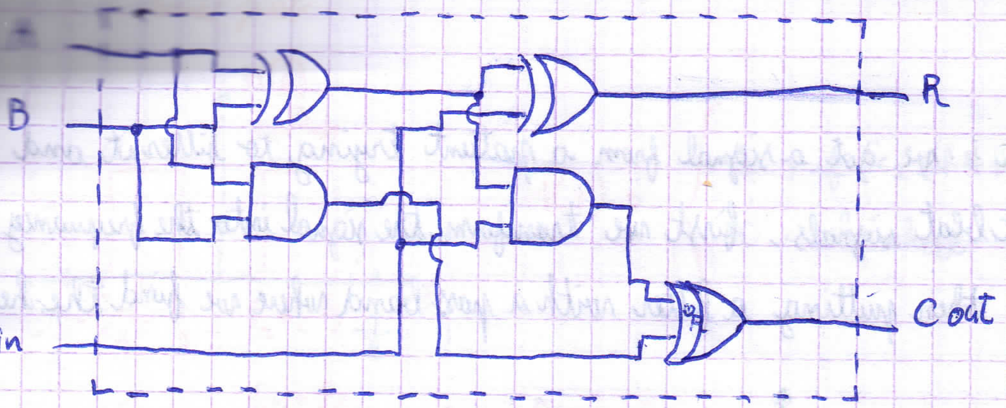
In	Out
0	0
1	1
Z	Z

	0
	1
	Z
Unbuffer	U
High	H
Low	L
	X

Semi - Additioneur



Half - adder



Full-Adder

9 - 10 - 2024

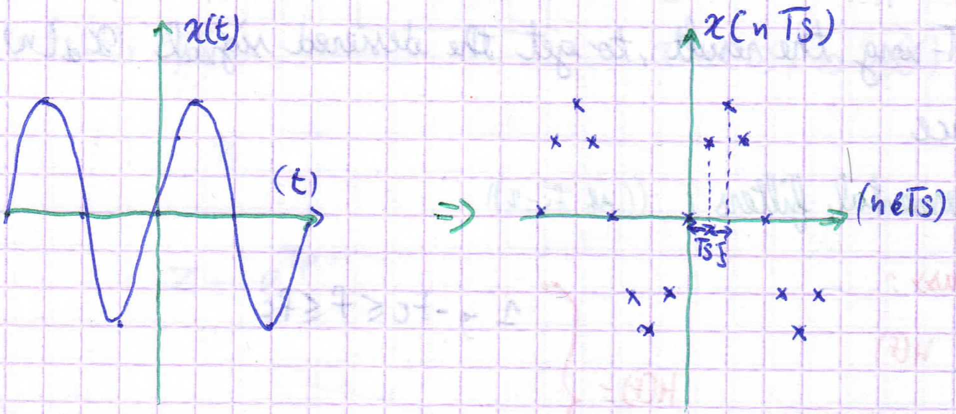
cours

TAS // SAP

→ FT of digital signal

. $x(t)$ is an analog signal

. $x(n, Ts)$ digital signal



T_S = sampling periode "periode d'échantionage"

$n \in \mathbb{Z}$ $\{ \dots, -3, -2, -1, 0, 1, 2, 3, \dots \}$

. $X(f) = \sum_{n=-\infty}^{+\infty} x(nT_S) e^{-2\pi j f n T_S} = X(f + \frac{1}{T_S})$

sampling

FT is periodic of period equals to $f_S = \frac{1}{T_S}$ wich is the frequancy periode

if $T_S = 1$ then $f_S = 1$

. So ITF is $x(n) = \int_{-\frac{f_S}{2}}^{\frac{f_S}{2}} X(f) e^{2\pi f j n T_S} df$

• Filters:

• Example: we got a signal from a patient trying to filter it and show just heart beat signals. first we transform the signal into the frequancy space with FT, then putting a filter with a pass band where we find the heart beat

• Procedures

→ $x(n)$ is in time space

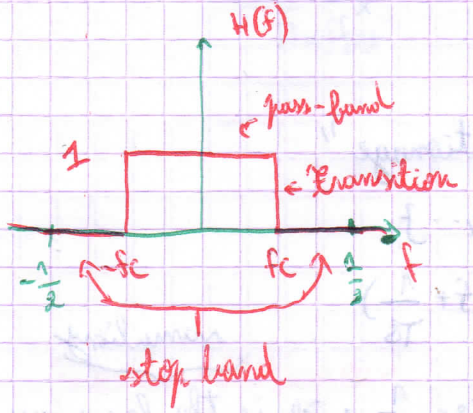
→ FT-ing $x(t)$ making $X(f)$ to observe the desired frequances

→ Selecting the right filter corresponding to these fréquances and applying it.

→ IFT-ing the result, to get the desired signal $x_d(n)$ in the time-space

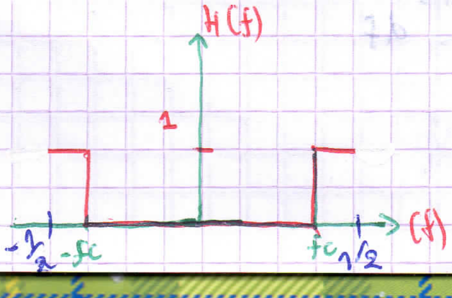
• The fondamental filters: ((if $f_s = 2$))

• Low pass:



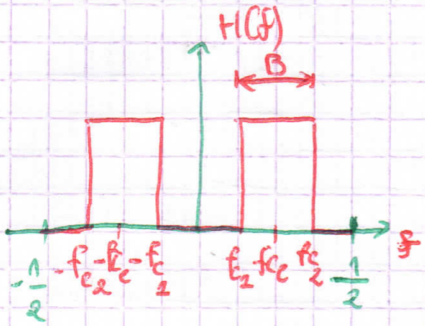
$$H(f) = \begin{cases} 1 \;, & -f_c \leq f \leq f_c \\ 0 \;, & \text{elsewhere} \end{cases}$$

. High-pass



$$H(f) = \begin{cases} 1 \;\; \frac{1}{2}f_s \geq f \geq f_c \text{ or } f \leq -f_c \leq -\frac{1}{2}f_s \\ 0, \;\; \text{elsewhere} \end{cases}$$

• band-pass



$$H(f) = \begin{cases} 1 \ , \text{if } f_{c_1} \leq f \leq f_{c_2} \quad \text{or } -f_{c_2} \leq f \leq -f_{c_1} \\ 0 \ , \text{elsewhere} \end{cases}$$

$$f_{ce} = \frac{f_{c_1} + f_{c_2}}{2} \ , \ B = f_{c_2} - f_{c_1}$$

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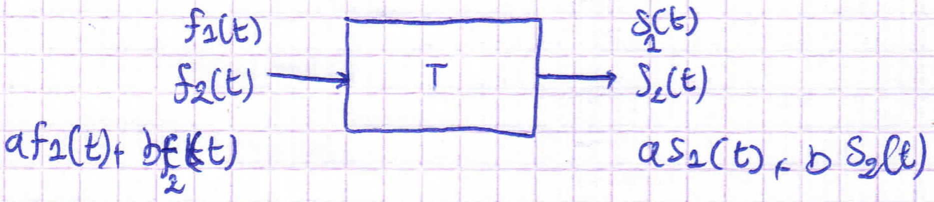
10 - 10 - 2024

SAN

* Spectre d'un signal = module de transformé de Fourier



*

$$Z = e^{Tp}$$