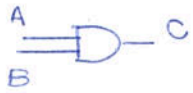
COMPUERTAS LÓGICAS (TP 6)

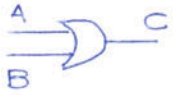
AND



$C = A.B$

A	B	C
0	0	0
0	1	0
1	0	0
1	1	1

OR



$C = A + B$

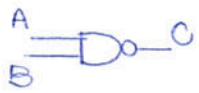
A	B	C
0	0	0
0	1	1
1	0	1
1	1	1

NOT

$B = \overline{A}$

A	B
0	1
1	0

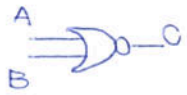
NAND



$C = \overline{AB}$

A	B	C
0	0	1
0	1	1
1	0	1
1	1	0

NOR



$C = \overline{A + B}$

A	B	C
0	0	1
0	1	0
1	0	0
1	1	0

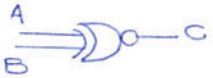
OR EXCLUSIVA

$C = A \oplus B$

$C = (A+B)(\overline{AB})$

A	B	C
0	0	0
0	1	1
1	0	1
1	1	0

NOR EXCLUSIVA



$C = \overline{A \oplus B}$

A	B	C
0	0	1
0	1	0
1	0	0
1	1	1

DISTRIBUTIVA

$A(B+C) = AB + AC$

$A + BC = (A+B)(B+C)$ (A)

ASOCIATIVA

$A(B.C) = (AB)C$

$A+(B+C) = (A+B)+C$

ABSORCIÓN

$A + AB = A$

$A(A+B) = A$

MORGAN

$\overline{A+B} = \overline{A}.\overline{B}$

$\overline{A.B} = \overline{A}+\overline{B}$

OTRAS

$A + \overline{A}B = A+B$

$A(\overline{A}+B) = AB$

$A + \overline{A} = 1$

$A.\overline{A} = 0$

$A.A = A$

CIRCUITOS (TP 9)

CERROJO SET-RESET (LATCH S-R)

S	R	Qn	
0	0	Qn-1	Memoria
0	1	0	Reset
1	0	1	Set
1	1	0	No se usa → indeterminado ambiguo

E = 0 → Todo 0
E = 1 → Depende de S y R

$\overline{S}$	$\overline{R}$	Qn	
0	0	0	Est. ambiguo
0	1	1	Set
1	0	0	Reset
1	1	Qn-1	Memoria

FLIP FLOP J-K

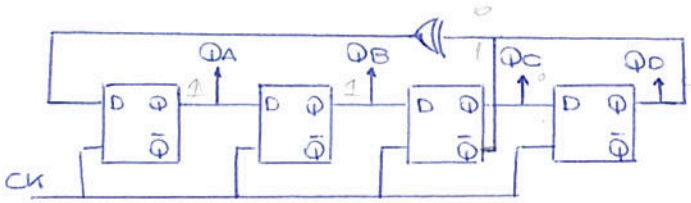
J	K	Qn	
0	0	Qn-1	
0	1	0	
1	0	1	
1	1	$\overline{Qn-1}$	→ Resuelve el prob de indet.

FLIP FLOP D

D	Qn	
0	0	Reset
1	1	Set

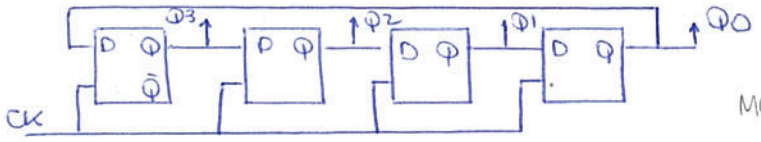
MAESTRO/ESCLAVO → flanco descendiente

CONTADORES (TP 10)



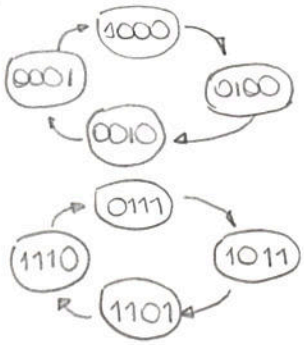
QA	QB	QC	QD	
0	0	0	0	→ Estado inicial
1	0	0	0	
1	1	0	0	
1	1	1	0	
1	0	1	1	

CONTADOR DE ANILLO CON 4 flipflops TIPO D

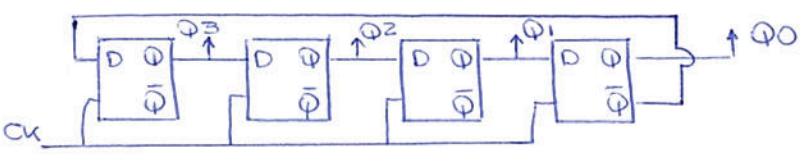


Q3	Q2	Q1	Q0
1	0	0	0
0	1	0	0
0	0	1	0
0	0	0	1

Módulo 4



CONTADOR DE JOHNSON O DE MOEBIUS

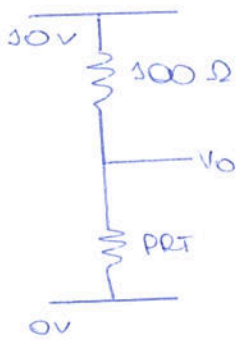


Q3	Q2	Q1	Q0
0	0	0	0
1	0	0	0
1	1	0	0
1	1	1	0
1	1	1	1
0	1	1	1
0	0	1	1
0	0	0	1

Módulo 8.

TP 2 : SENSORES Y ACTUADORES

③



$\Delta V = (0 - V_o) + (V_o - 10)$

$V_o = R_{PRT} \cdot i$

$V_o = 100\,\Omega\, i + 10$

$V_o = 100 - 100\, i$

$R_{PRT} \cdot i = 10 - 100\, i$

$i = \frac{10}{(100 + R_{PRT})} \Rightarrow$ No lineal

$R_{PRT} = 100 + 0{,}285\, t \rightarrow$ del eje 2.

④

TP 3 : AMPLIFICACIÓN

②

$a = 20 = A_V$ (ideal) $= V_o / V_i$

$R_e = 10\,k\Omega$

$R_S = 75\,k\Omega$

$V = 1\,V$

$R_{SV} = 200\,\Omega$

$R_{OCA} = 1\,k\Omega$

cascada → ampl. en serie

$V_i = \frac{V \cdot R_e}{R_e + R_v} = 0{,}98\ V$

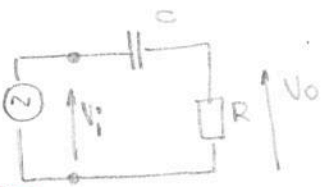
$A_v \cdot V_i \cdot \frac{R_c}{R_S + R_C} = V_o = 0{,}25\ V$

⑦

$$W_L = \frac{1}{C\,(R_o + R_S)}$$

C. EN SERIE (de acopl) → PASAN f altas ; corte inferior

C EN PARALELO → PASAN f bajas ; corte sup.

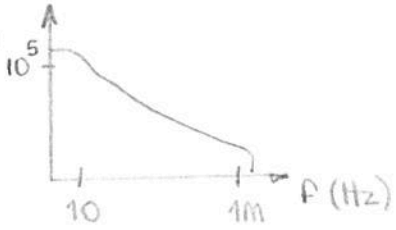


$$G_V(dB) = 20 \log_{10} \frac{V_o}{V_i}$$

$$G_P(dB) = 10 \log_{10} \frac{V_o}{V_i}$$

Amp 741

- $G_T = 106\ dB$
- $R_e = 2\,M\Omega$
- $R_S = 75\,\Omega$
- $i = 20\,mA$



FRECUENCIA

OCTAVA = $2^{\wedge} f$

DÉCIMA = $10^{\wedge} f$

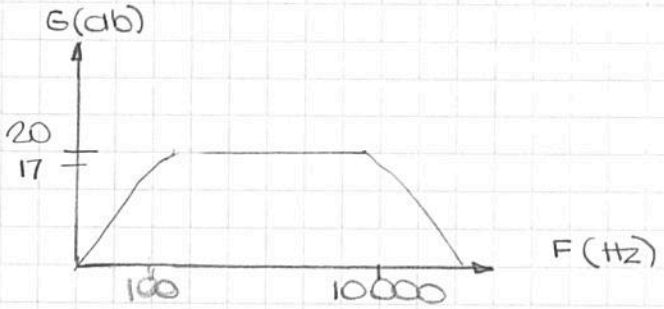
EJ. 1 OCTAVA POR ENCIMA DE 10 HZ

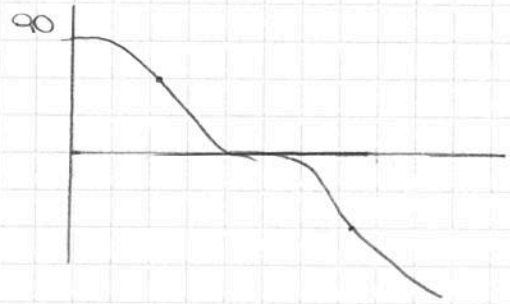
$= 2^{1} \cdot 10 = 20\ Hz$

TP 3 : AMPLIFICACIÓN

(5) G_V frec med $= 10 = 20 \log_{10}(10) = 20$ dB

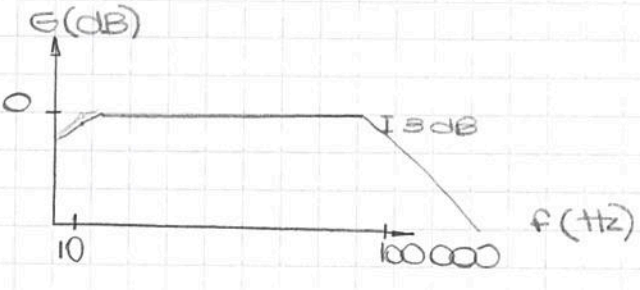
F. inf = 100 Hz
F. sup = 10000 Hz

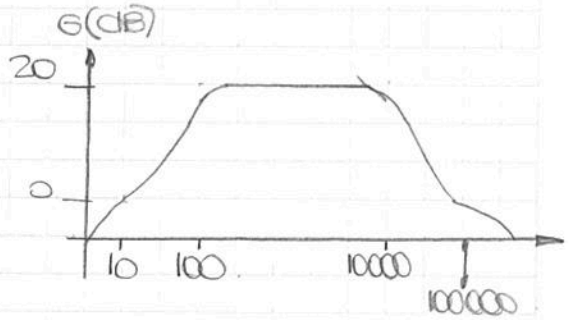


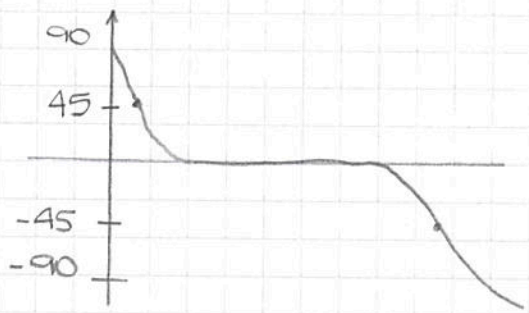


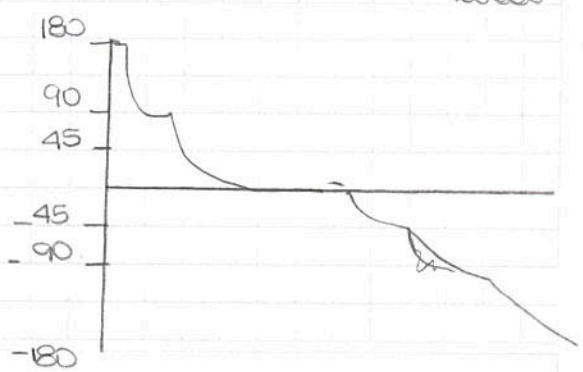
(6) $G_V = 1 = 20 \log_{10}(1) = 0$

f inf = 10
f sup = 100000









TP 4: AMPLIFICADORES OPERACIONALES

2,4

IDEALES: HIPÓTESIS
✓ $G = \infty$
✓ $R_i = \infty$
✓ $R_o = 0$.

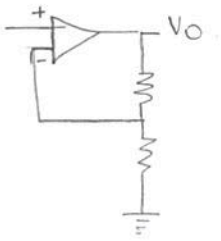
(1) A) No inversor

$$G = \frac{V_o}{V_1} = \frac{R_1 + R_2}{R_2} = \frac{470 + 2,2}{2,2} = 214,63$$

B) Inversor

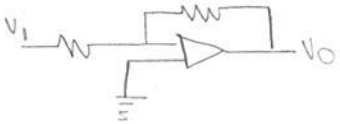
$$G = \frac{V_o}{V_i} = -\frac{R_1}{R_2} = \frac{-330}{10} = -33$$

(2)



$$G = 100 = \frac{V_o}{V_i} = \frac{R_1 + R_2}{R_2}$$

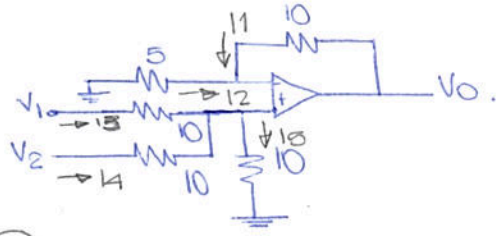
(3)



$G = -50$.

(4) Repetición señales
Buffer?

(5)



(V-)

$I_1 = -I_2$

$(0 - V_-) = I_2 \cdot 5 \rightarrow I_2 = -V_-/5$

$(V_o - V_-) = I_1 \cdot 10 = -I_2 \cdot 10 \rightarrow I_2 = \frac{V_- - V_o}{10}$

$$\begin{cases} -\frac{V_-}{5} = \frac{V_- - V_o}{10} \end{cases}$$

$$\frac{V_-}{10} + \frac{V_-}{5} = \frac{V_o}{10}$$

$$\frac{3V_-}{10} = \frac{V_o}{10} \Rightarrow \boxed{V_- = \frac{V_o}{3}}$$

$I_3 + I_4 = I_5$

(V+) $(V_1 - V_+) = I_3 \cdot 10 \rightarrow I_3 = (V_1 - V_+)/10$

$(V_2 - V_+) = I_4 \cdot 10 \rightarrow I_4 = (V_2 - V_+)/10$.

$(V_+ - \cancel{0}) = I_5 \cdot 10 = (I_3 + I_4)\,10$

$$V_+ = \left[\frac{(V_1 - V_+)}{\cancel{10}} + \frac{(V_2 - V_+)}{\cancel{10}}\right] \times \cancel{10} = V_1 - V_+ + V_2 - V_+ = V_1 + V_2 - 2V_+$$

$3V_+ = V_1 + V_2$

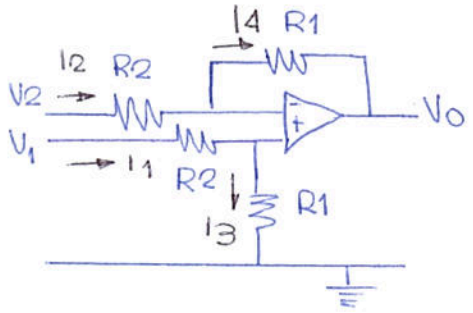
$$\boxed{V_+ = \frac{V_1 + V_2}{3}}$$

$V_+ = V_-$

$V_o = 3V_- = 3V_+ = \cancel{3}\frac{(V_1 + V_2)}{\cancel{3}} = V_1 + V_2$

$V_o = 3V_-$

(6) RESTADOR



$V_o = 10\,(V_1 - V_2)$

(1) $(V_1 - V_+) = I_1 R_2$

(2) $(V_2 - V_-) = I_2 R_2$

(3) $V_+ = I_3 R_1$

(4) $(V_- - V_o) = I_4 R_1$

- $I_1 = I_3$

$$\frac{V_1 - V_+}{R_2} = \frac{V_+}{R_1}$$

$$\frac{V_1}{R_2} - \frac{V_+}{R_2} = \frac{V_+}{R_1}$$

$$\frac{1}{R_2}(V_1 - V_+) = \frac{V_+}{R_1}$$

$$V_1 - V_+ = V_+ \cdot \frac{R_2}{R_1}$$

$$V_+\left(1 + \frac{R_2}{R_1}\right) = V_1$$

$$V_+ = V_1 \cdot \frac{R_1}{R_1 + R_2}$$

- $I_2 = I_4$

$$\frac{V_2 - V_-}{R_2} = \frac{V_- - V_o}{R_1}$$

$$V_2 - V_- = \frac{R_2}{R_1}(V_- - V_o)$$

$$\frac{R_2}{R_1} V_o = \frac{R_2}{R_1} V_- - V_2 + V_-$$

$$\frac{R_2}{R_1} V_o = \left(\frac{R_2}{R_1} + 1\right) V_- - V_2$$

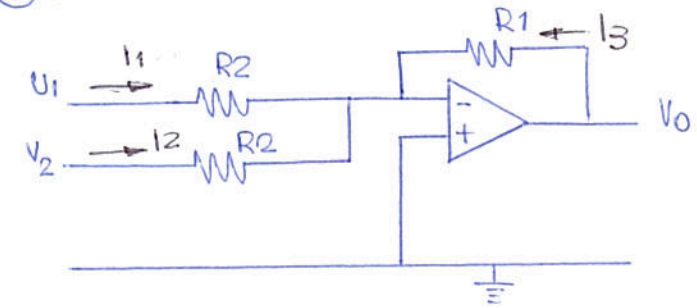
$$\frac{R_2}{R_1} V_o = \frac{R_2 + R_1}{R_1} V_- - V_2$$

$$V_o = \frac{R_1}{R_2}\left(\frac{R_2 + R_1}{R_1}\right) V_- - V_2 \frac{R_1}{R_2}$$

$$\Rightarrow V_o = \frac{R_2 + R_1}{R_2} \cdot \frac{R_1}{R_1 + R_2} \cdot V_1 - V_2 \frac{R_1}{R_2} = \boxed{(V_1 - V_2)\frac{R_1}{R_2}}$$

$$\frac{R_1}{R_2} = 10 \begin{cases} R_1 = 10\,k\Omega \\ R_2 = 1\,k\Omega \end{cases}$$

(7) SUMADOR INVERSOR



(1) $I_1 + I_2 = -I_3$

(2) $V_1 = I_1 R_2$

(3) $V_2 = I_2 R_2$

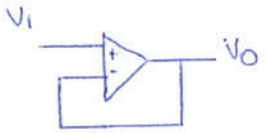
(4) $V_o = I_3 R_1 = (-I_1 - I_2) R_1$

$$V_o = \left(-\frac{V_1}{R_2} - \frac{V_2}{R_2} \right) R_1$$

$$\boxed{V_o = -(V_1 + V_2)\frac{R_1}{R_2}}$$

$R_1 = R_2$

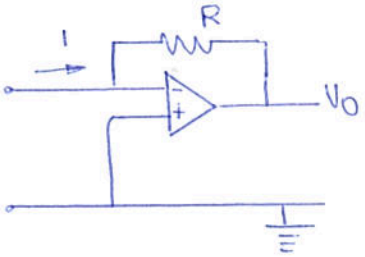
BUFFER DE GANANCIA UNITARIA



$$G = \frac{R_1 + R_2}{R_2} = \frac{R_1}{R_2} + 1 = \frac{0}{\infty} + 1 = 1$$

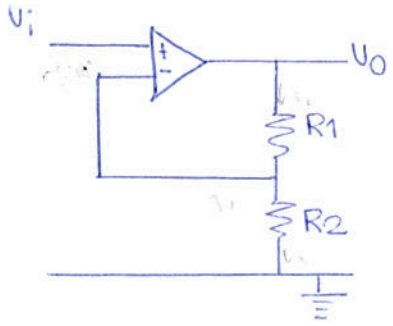
$R_1 = 0$, $R_2 = \infty$

CONVERTIDOR CORRIENTE - TENSIÓN



$V_o = -I_R$

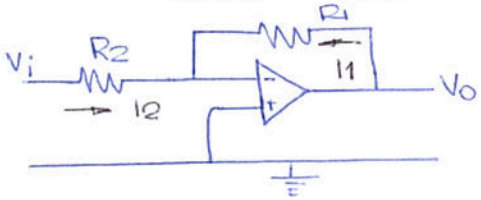
AMPLIFICADOR NO-INVERSOR (entra por el +)



$$V_i = V_+ = V_-$$

$$V_- = V_o \cdot \frac{R2}{R1+R2} = V_i \qquad G = \frac{V_o}{V_i} = \frac{R1+R2}{R2}$$

AMPLIFICADOR INVERSOR (entra por el −)



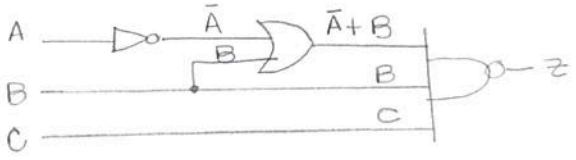
$$V_- = V_+ = 0$$

$$I_1 = -I_2$$

$$I_1 = \frac{V_o}{R1} \qquad I_2 = \frac{V_i}{R2} \Rightarrow \frac{V_o}{R1} = -\frac{V_i}{R2} \Rightarrow G = \frac{V_o}{V_i} = -\frac{R1}{R2}$$

TP 6 : ÁLGEBRA DE BOOLE

(1) A)



$$Z = \overline{(\bar{A}+\bar{B})\,B\,C}$$

$$= \overline{(\bar{A}+\bar{B})} + \bar{B} + \bar{C}$$

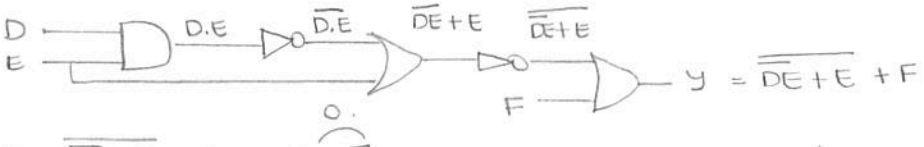
$$= A\,\bar{B} + \bar{B} + \bar{C} = \bar{B} + \bar{C}$$

($A\,\bar{B} + \bar{B} = \bar{B}$)

TABLA DE VERDAD

A	B	C	Z
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

B)



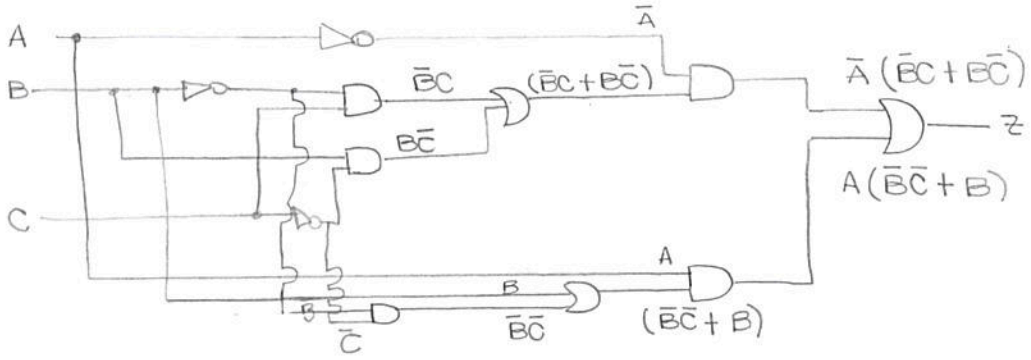
$$y = \overline{\overline{DE}+E} + F = D\bar{E}\cdot\bar{E} + F = F$$

D	E	F	Y
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	1

(2) A) $Z = \bar{A}\bar{B}C + \bar{A}B\bar{C} + A\bar{B}\bar{C} + AB\bar{C} + ABC$

$$= \bar{A}(\bar{B}C + B\bar{C}) + A(\bar{B}\bar{C} + B\bar{C} + BC)$$

$$= \bar{A}(\bar{B}C + B\bar{C}) + A(\bar{B}\bar{C} + B(\bar{C}+C)) = \bar{A}(\bar{B}C + B\bar{C}) + A(\bar{B}\bar{C} + B)$$



B) $y = \bar{A}\bar{B}C\bar{D} + \bar{A}BCD + A\bar{B}\bar{C}\bar{D} + A\bar{B}\bar{C}D + AB\bar{C}\bar{D} + AB\bar{C}D + ABCD$

(6) $W = \bar{A}\bar{B} + AB(C+\bar{D})$

$\bar{W} = \overline{\bar{A}\bar{B} + AB(C+\bar{D})} = AB.\overline{(AB(C+\bar{D})} = AB.\left(\bar{A}+\bar{B} + \overline{(\bar{C}+\bar{D})}\right)$

$= AB\left(\bar{A}+\bar{B} + (\bar{C}.D)\right)$

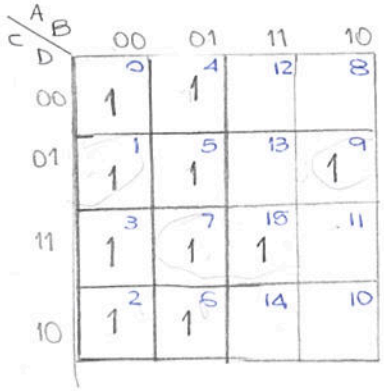
(7) A) $Y = \overline{\overline{\bar{A}BC}.\overline{D\bar{B}}.\overline{AC\bar{D}}} = \bar{A}BC + DB + AC\bar{D} = C(\bar{A}B + A\bar{D}) + DB$

B)

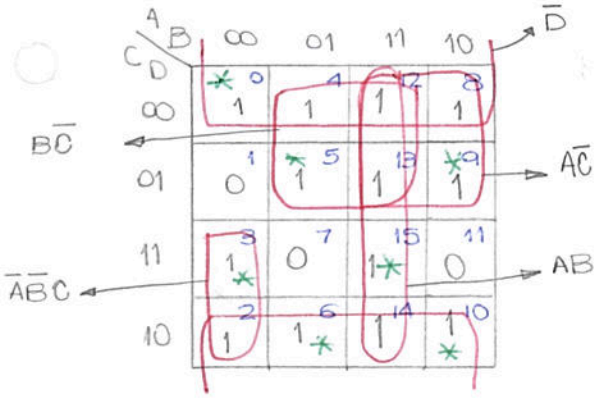
TP 7: SIMPLIFICACIÓN DE F. BOOLEANAS

A)

(1) $Z = \bar{A}B + \bar{A}\bar{C} + \bar{A} + AD(\bar{B}\bar{C} + BC) = \bar{A} + AD\bar{B}\bar{C} + ABCD$

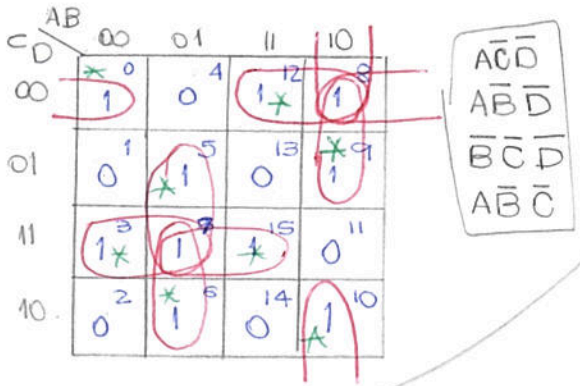


B) $Y = \Sigma_m(0,2,3,4,5,6,8,9,10,12,13,14,15)$



$Y = \bar{D} + A\bar{C} + AB + B\bar{C} + \bar{A}\bar{B}C$

(2)



$\bar{A}C\bar{D}$
$A\bar{B}\bar{D}$
$\bar{B}\bar{C}\bar{D}$
$A\bar{B}\bar{C}$

$Y = \quad + \quad$ Minitérminos

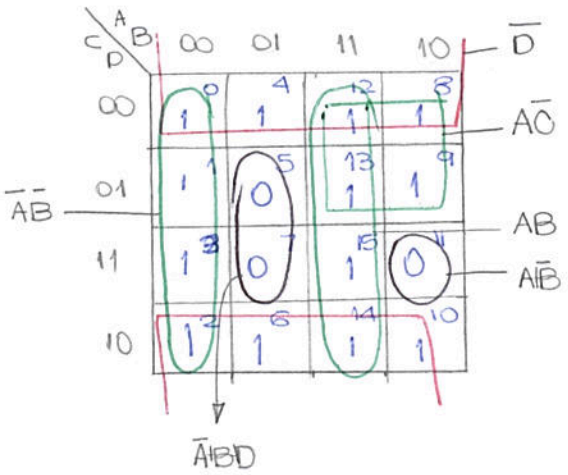
$\bar{A}CD$
$\bar{A}BD$
$\bar{B}CD$
$\bar{A}\bar{B}C$

$1 = \bar{A} + \bar{B} + \bar{C} + D$
$4 = \bar{A} + B + \bar{C} + \bar{D}$
$2 = \bar{A} + \bar{B} + C + \bar{D}$
$13 = A + B + \bar{C} + D$
$14 = A + B + C + \bar{D}$
$11 = A + \bar{B} + C + D$

$Y = \Pi(\quad)$

Al revés!
los negados
no van negados

B)



$Y = \bar{D} + A\bar{C} + AB + \bar{A}\bar{B}$ Mini

$Y = (A+\bar{B})(\bar{A}+B+D)$ Maxi

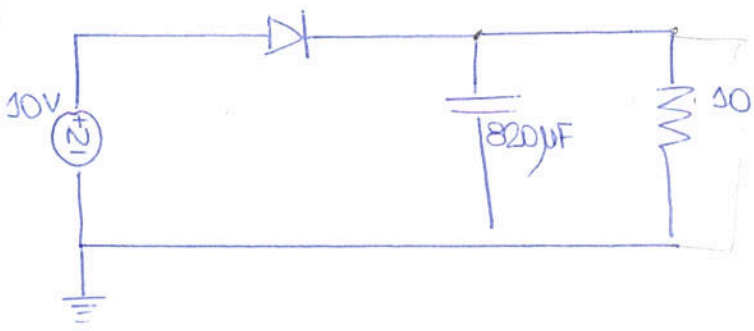
↓

Al revés!

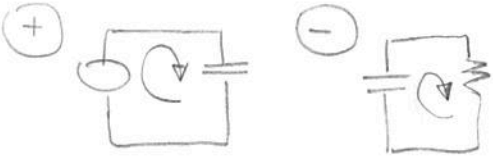
$Y = (A+\bar{B}+\bar{D})(A+\bar{B}+\bar{C}+\bar{D})$

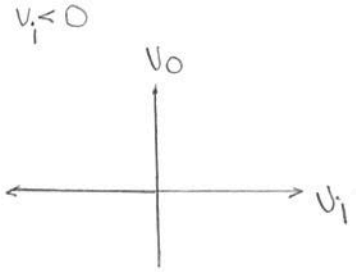
TP 5

(1) B)

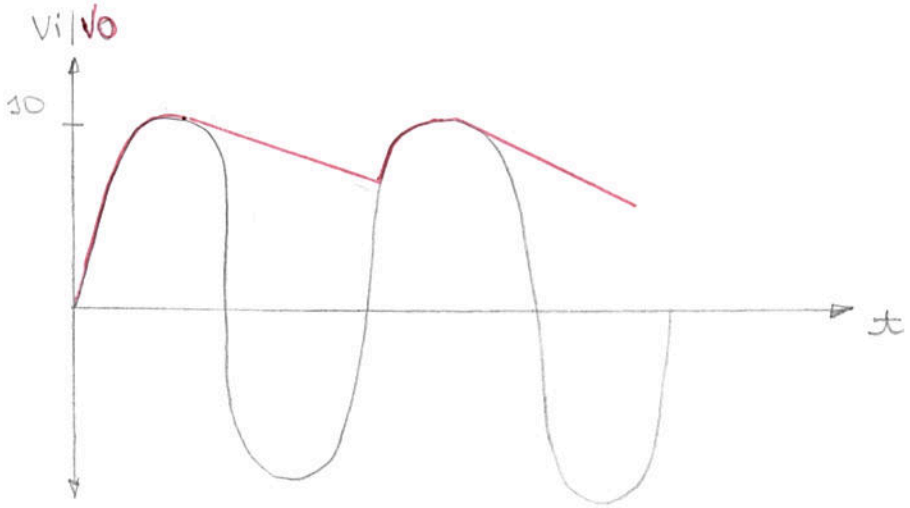


Cuando $V_i > 0$ la corriente pasa por el capacitor

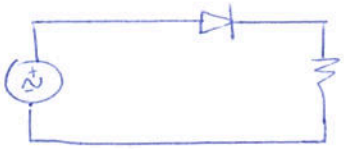




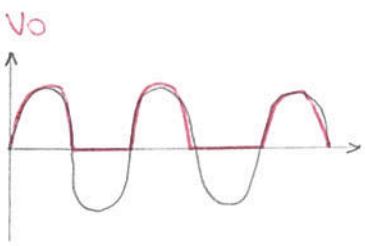
Cuando V de la fuente (V_i) es:
- > al Vcap. → cap. se carga
- < al Vcap → cap se descarga

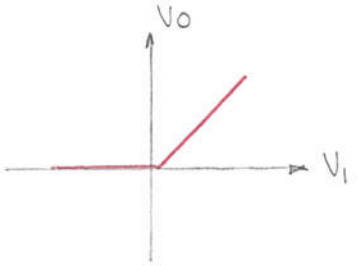


A)

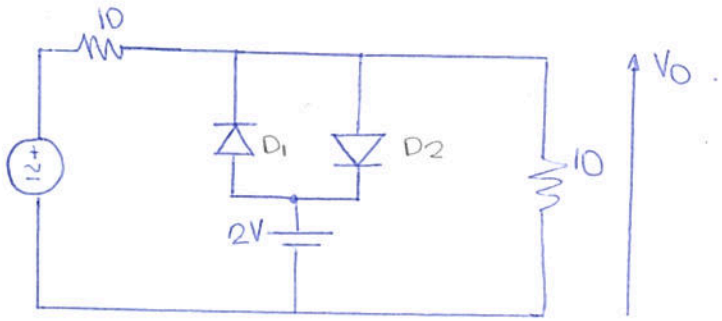


$V_i > 0$ $V_o = V_i$
$V_i < 0$ $V_o = 0$





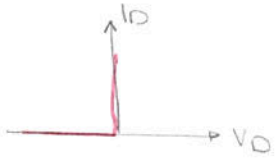
e) i)



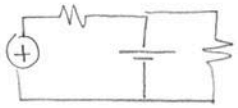
4 casos:

1) D1 inv.
D2 dir

$V_o = 2V$



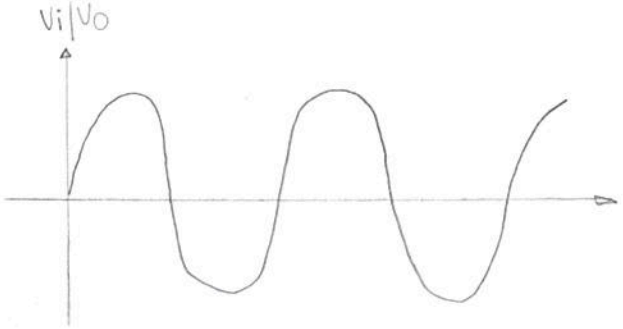
2) D1 dir
D2 inv



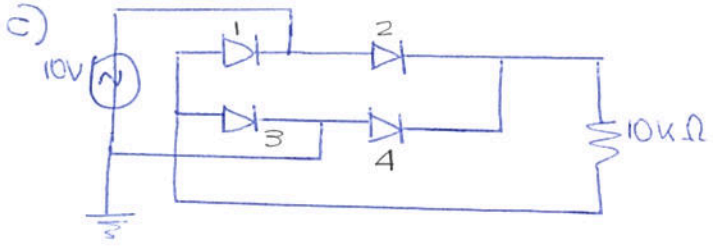
$V_o = 2V$

3) D1 inv
D2 inv

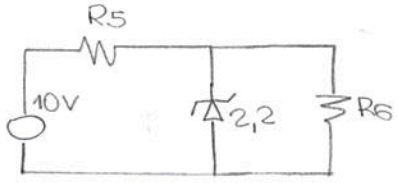
$V_o = \frac{V_i}{2}$ (10 sobre Vi) =



c)

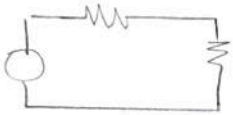


f)



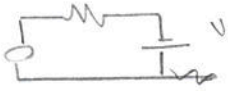
corriente (+) → $V_i > 2,2$ (Z fuente)
→ $V_i < 2,2$ (Z no pasa I)

I(+)



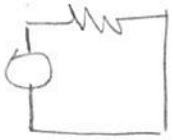
$V_o = \frac{V_i}{2}$

I(+)

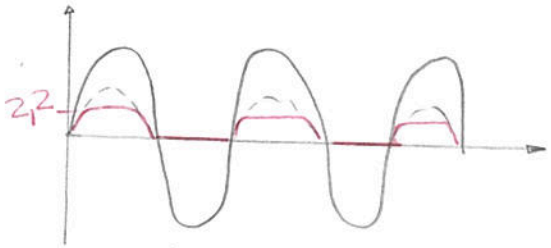


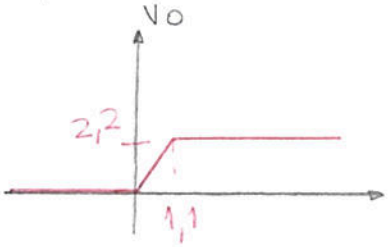
$V_o = 2,2$

I(−)

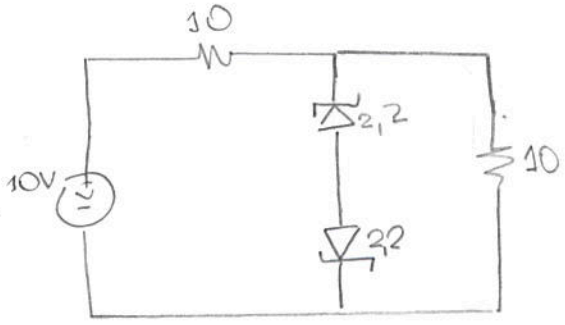


$V_o = 0$

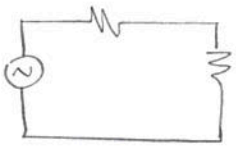




g)

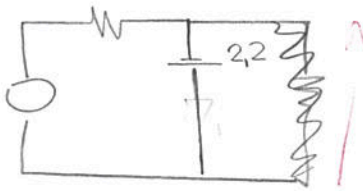


I⊕

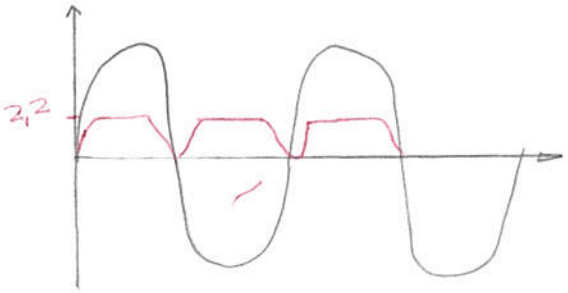


$V_o = \frac{V_i}{2}$ $(V_o < 2{,}2)$

I⊕

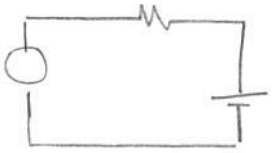


$V_o \doteq 2{,}2$



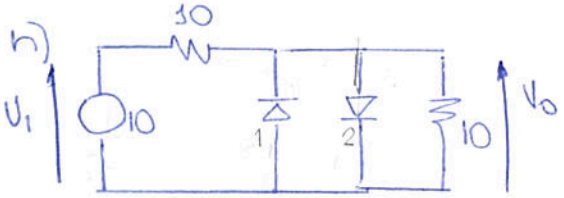
I⊖

$V_o = \frac{V_i}{2}$

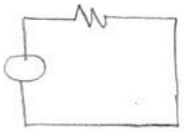


$V_o = +2{,}2$

h)



I⊕

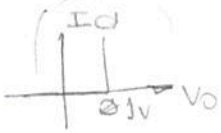


$V_o = 0$

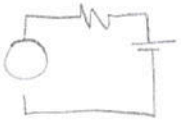
I⊖

$V_o = 0$

Modelo:



D1 inv.
D2 dir



$V_o = -1$

Di dir
D2 inv

$V_o = -1$

DiyD2inv

$V_o = \frac{V_i}{2}$