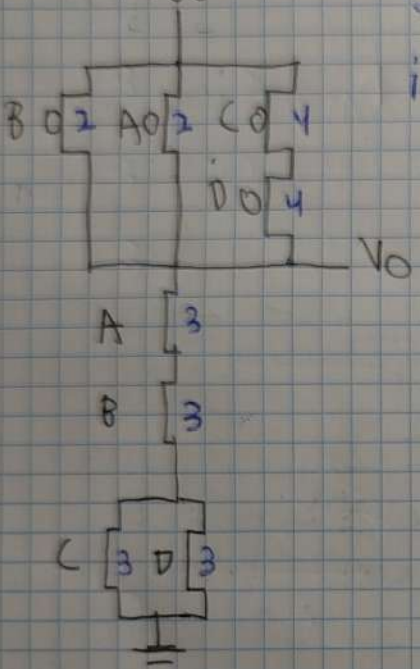
Junio 2010

2.

$P \neq n_i \rightarrow$ EXTRÍNSECO

$$n = \frac{n_i^2}{P} = \frac{10^{20}}{10^6} = 10^{14}\ e/cm^3$$

3.



i) $V_O = \overline{AB(C+D)}$

ii) PUN:

Peor camino PUN: $AB\bar{C}\bar{D}$

$$R_C + R_D = R$$

$$\frac{2R}{S} + \frac{2R}{S} = R$$

$$S_{C,D} = 4$$

$$R_A = R_B \leq R$$

$$\frac{2R}{S} \leq R$$

$$S_{A,B} = 2$$

PDN:

Peores caminos: $AB\bar{C}\bar{D}$ $\quad ABC\bar{D}$

$$R_A + R_B + R_D = R$$

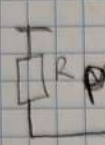
$$\frac{R}{S} + \frac{R}{S} + \frac{R}{S} = R$$

$$S_{A,B,C,D} = 3$$

iii) 101

4.

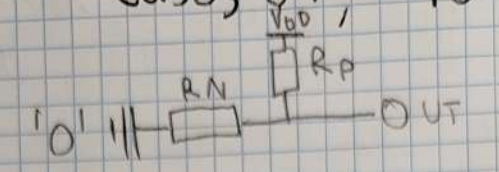
Caso '00':



$V_{OUT} = V_{DD}$

OUT = '1'

Casos '01', '10':



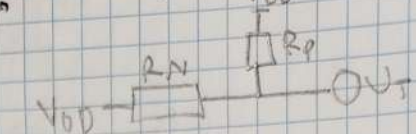
$V_{OUT} = ?$

Depende dos valores de R_n e R_p.

Se $R_p \gg R_n$, OUT = '0'

esto teríamque dalo no enunciado (ver o 5 do 2021)

Caso '11':



$V_{OUT} = V_{DD}$

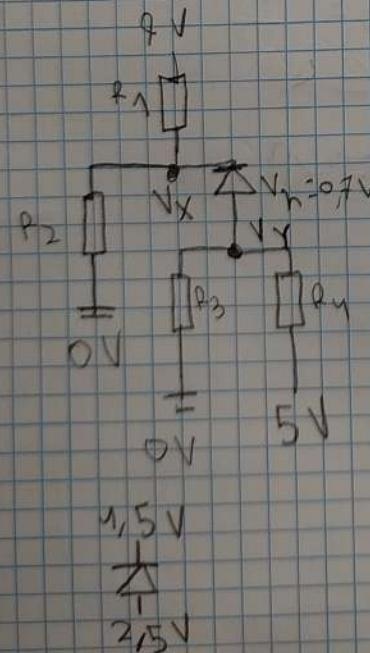
OUT = '1'

A	B	OUT
0	0	↑
0	↑	↑
↑	0	↑
↑	↑	↑

Mayo 2012 → will would referencia!?

1. Sin saber as R é imposible creo

Asumindo TODAS de 1KΩ: (e diodo de $V_\gamma = 0{,}7V$)



Diodo en OFF: $I_d = 0$

$V_{R1} = 4{,}5\ V \rightarrow V_x = 4{,}5V$

$I_d = 0 \rightarrow I_{R3} + I_{R4} = 0$

$$\frac{V_Y - 0}{1} + \frac{V_Y - 5}{1} = 0$$

$V_Y = 2{,}5V$

$\Delta V_D = 2{,}5 - 4{,}5 = -2V$

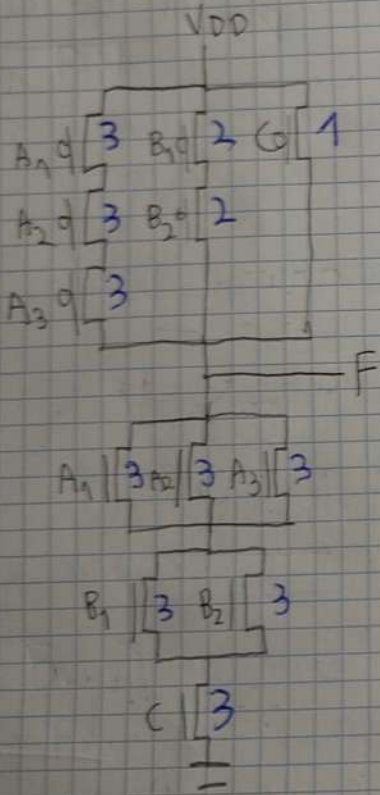
$V_D < V_\gamma \rightarrow$ Diodo en OFF ✓

2.

$P_D = V_{DD}^2 \cdot f_0 \cdot C_L \rightarrow \uparrow C_L, \uparrow P_D$

A mayor C_L, menor potencia de cortocircuito (menos conexión $V_{DD} - GND$)

3.i) $F = \overline{(A_1 + A_2 + A_3)(B_1 + B_2)C}$



PUN:

Peor camino PUN: $\overline{A_1}\ \overline{A_2}\ \overline{A_3}\ (B_1+B_2)C$

$R_{A_1} + R_{A_2} + R_{A_3} = R$

$\frac{3R}{5} = R$

$S_{A_1, A_2, A_3} = 3$

$R_{B_1} + R_{B_2} \leq R$

$S_{B_1, B_2} = 2$

$R_C \leq R$

$S_C = 1$

PDN: Todos los caminos son iguales (ignorando paralelos)

$R_A + R_B + R_C \geq R$

$\frac{3R}{5} \geq R$

$S = 3$

NOTA: Asumiendo que $R_N = R_P$ (Si $R_P = 2R_N$, es lo mismo pero todos los PMOS con doble)

Mayo 2015

1.

Datos: $\mu_n = 1350 \, cm^2/Vs$

n_i (Si @300K) $= 10^{10} \, cm^{-3}$

$$\frac{1}{0,045} = \mu_n \cdot n \cdot q$$

$$n = 1,1 \cdot 10^{17} \, cm^{-3}$$

$$p = \frac{n_i^2}{n} = 907,2 \, cm^{-3}$$

2.

Poniendo a porta e o óxido?? no sé

3.

$V_i < 0,7 \rightarrow V_{D_1} < 0,7 \rightarrow D_1$ en OFF

$\rightarrow I_D = 0 \rightarrow I_R = 0 \Rightarrow V_R = 0$

$V_i = 1 \rightarrow V_{D_2} < 0,7 \rightarrow D_2$ en OFF

$V_i = 3 \rightarrow V_R = 3 - 0,7 - 0,7 = 1,6 V$

$I_R = \frac{V_R}{R} = 1,6 mA$

V_i	V_R	I_R
-3	0	0
-1	0	0
0	0	0
1	0	0
3	1,6	1,6

4.

D_1 em ON, D_2 em OFF:

$V_B = -0,7\,V$

$V_{D_2} = 10,7\,V > 0,7$ (Incongruente)

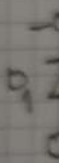
D_1 em OFF, D_2 em ON:

$I_{D_1} = 0 \quad V_{D_2} = 0,7\,V$

$I_T = \frac{20-0,7}{1+1} = 9,65$

$V_X = 10 - V_{R1} = 10 - 9,65 = 0,35\,V$

$V_B = 0,35 - V_{D_2} = -0,35\,V$



$V_{D_1} = 0,35\,V < 0,7 \rightarrow D_1$ em OFF ✓

$I_{D_1} = 0$

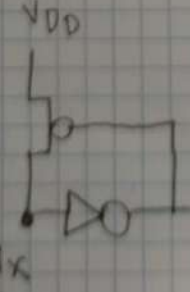
5. O mesmo que o 3 do 2012 pero todos os PMOS 3 veces más grandes

7.

*se $R_P >> R_N$

A	B	OUT
0	0	OUT
0	1	1*
1	0	OUT
1	1	0

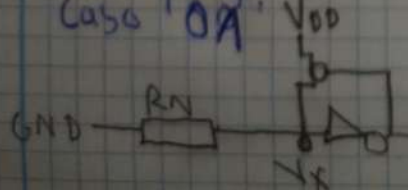
caso '00', '10':



OUT = '0' -> PMOS em ON
-> $V_X = V_{DD}$ -> OUT = 0

OUT = '1' -> PMOS em OFF
-> OUT = '1'

Caso '01':



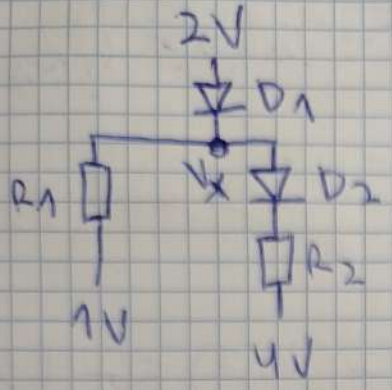
OUT = '0' -> PMOS em ON -> depende das R

OUT = '1' -> PMOS em OFF
-> $V_X = 0$ -> OUT = '1'

Mayo 2016

2.

$R_1 = 2K\Omega$ $R_2 = 4K\Omega$



D_1 en ON, D_2 en OFF: $V_{D1} = 0,7V$

$V_x = 2 - V_{D_1} = 1,3\,V$

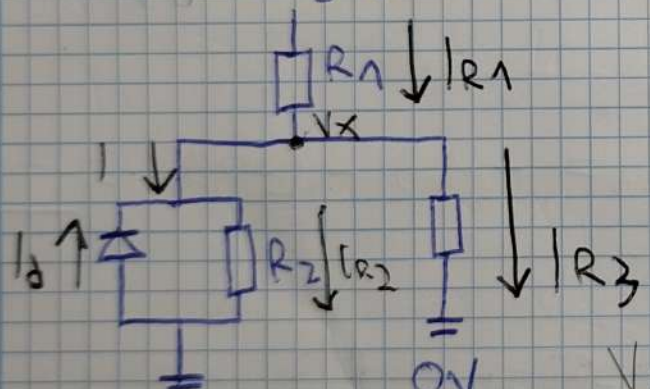
$V_{D_2} = 1,3 - 4 = -2,7V$ (D_2 en OFF ✓)

$I_{D_2} = 0$

$I_{D_1} = I_{R_1} = \frac{0,7}{2} = 0,35\,mA$

Julio 2017

1. V = 5V



Diodo en OFF:

R_2 y R_3 en paralelo

$R_{23} = \frac{1}{\frac{1}{2}+\frac{1}{2}} = 1K\Omega$

$I_{R1} = I_{R23} = \frac{5}{1+1} = 2,5mA$

$V_{R1} = 2,5 \cdot 1 = 2,5\,V$

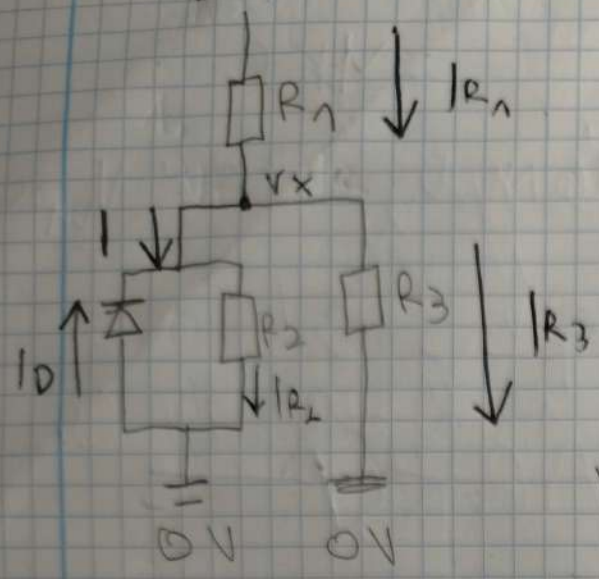
$V_X = 5 - 2,5 = 2,5\,V$

$V_D = 0 - 2,5 = -2,5$

D en OFF ✓

$I = 1,25\,mA$, $I_D = 0$

$(I = I_{R2} = \frac{I_{R23}}{2})$



Diodo en ON: $V_D = 0,7V$

$0 - V_D = V_X$

$V_X = -0,7V = V_{R2}$

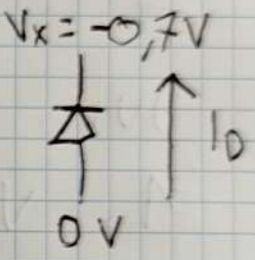
$I_{R2} = \frac{-0,7}{2} = -0,35\,mA$

$V_{R1} = -5 - (-0,7) = -4,3V$

$I_{R1} = \frac{-4,3}{1} = -4,3\,mA$

$V_{R3} = -0,7 - 0 = -0,7V$

$I_{R3} = \frac{-0,7}{2} = -0,35\,mA$



$I + I_{R3} = I_{R1}$

$I = I_{R1} - I_{R3} = -4,3 - (-0,35) = -3,95\,mA$

$I = I_{R2} - I_D$

$I_D = I_{R2} - I = -0,35 - (-3,95) = 3,6\,mA$

$I_D > 0$, $V_D = 0,7V$ -> Diodo en ON ✓

$V_{OH} = V_{DD} - V_{TN} - V_{TN} = 3V$

$V_{OL} = 0 + V_{TP} = 1V$

4.

Assumindo $R_P = \frac{70}{5}$ e $R_N = \frac{35}{5}$

$$R_{eq} \cdot C_L \cdot \ln 2 < 5\,ns$$

$$R_{eq} < 7{,}213\ K\Omega$$

PUN:

Pior caminho: $A\bar{D}\bar{E}(\bar{B}+\bar{C})$

$R_D + R_E + R_B < 7{,}213$

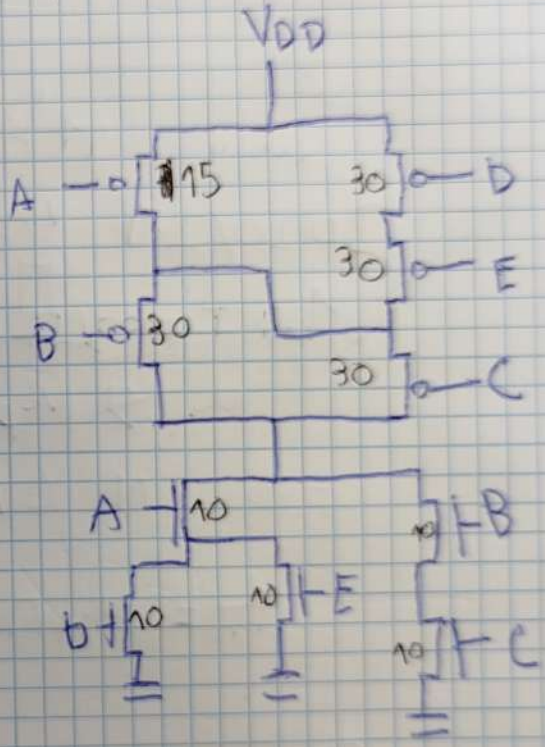
$$\frac{3 \cdot 70}{S} < 7{,}213$$

$$S > \frac{210}{7{,}213} \rightarrow S_{B,C,D,E} = 30$$

$R_A + R_B < 7{,}213$

$$\frac{70}{S_A} + \frac{70}{30} < 7{,}213$$

$$S_A > \frac{70}{4{,}88} \rightarrow S_A = 15$$



PDN: Todos os caminhos são de dois R

$$\frac{2 \cdot 35}{S} < 7{,}23$$

$$S > \frac{70}{7{,}23} \rightarrow S = 10$$

Maio 2018

1.

V_i	V_R
-1	0
0	0
1	0
2	0,6V

3. Falta un cacho do circuito

2020/21

1. Tipo N.

$\mu_n > \mu_p \rightarrow$ los semiconductores de tipo N ($N >> P$) son más conductivos.

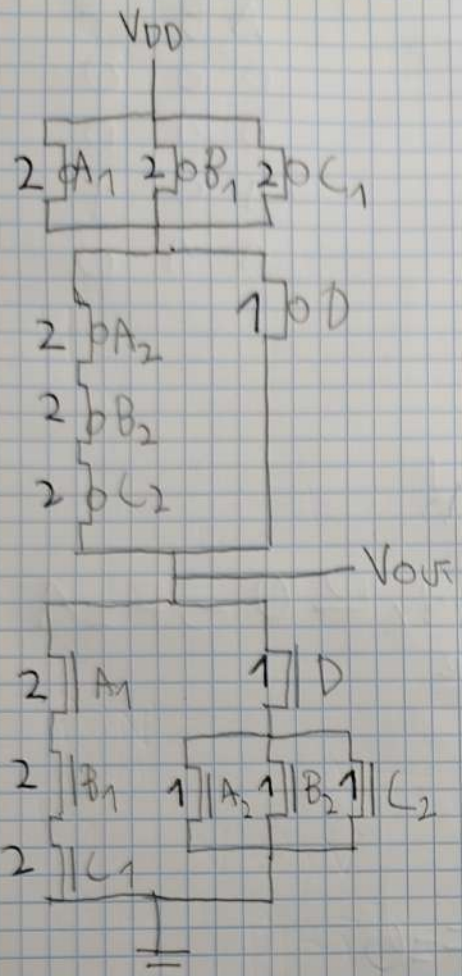
$\sigma_n = \mu_n \cap q \qquad \sigma_p = \mu_p \; p \; q$

2.

Sí. Es producida por fenómenos de generación térmica próximos a la zona de vaciamiento.

3. É o mismo que o 1 do 2017 pero con R distinta (Creo que non fai diferencia nos diodos)

4. Cen (CMOS) $R_P = R_N = \frac{10^4}{5}\ \Omega$?



$\ln 2 \cdot R_{eq} \cdot C_L \leq 1\,ns$

$R_{eq} \leq 20609\ \Omega$

PUN:

Peor caso: $\bar{A}\bar{B}\bar{C}D$

$R_{A2} + R_{B2} + R_C + R_{A1B1C1} \leq 20609$

$\frac{3 \cdot 10^4}{S} + \frac{10^4}{3S} \leq 20609$

$9 + 1 \leq 6,48275$

$S \geq 1,617 \rightarrow S = 2$

Peor caso con $\bar{D}$: $\bar{A}B\bar{C}\bar{D}$, $A\bar{B}C\bar{D}$, $AB\bar{C}\bar{D}$

$R_{A1} + R_D \leq 20609$

$\frac{10^4}{2} + \frac{10^4}{S_D} \leq 20609$

$S_D \geq 0,64 \rightarrow S_D = 1$

PDN:

Peor caso: $AB\bar{C}\bar{D}$

$3 \cdot \frac{10^4}{S} \leq 20609$

$S_{A1,B1,C1} \geq 1,46 \rightarrow S = 2$

Peor caso con D: $\bar{A}\bar{B}\bar{C}D$, $\bar{A}B\bar{C}D$, $A\bar{B}\bar{C}D$

$R_A + R_D \leq 20609$

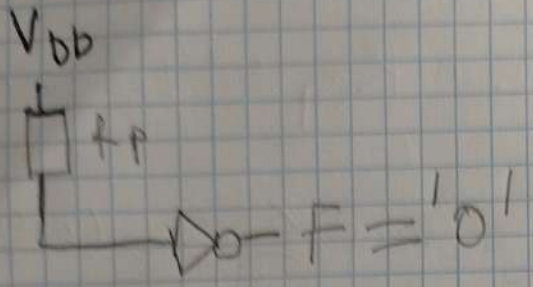
$\frac{10^4}{2} + \frac{10^4}{S_D} \leq 20609$

$S_D = 1$

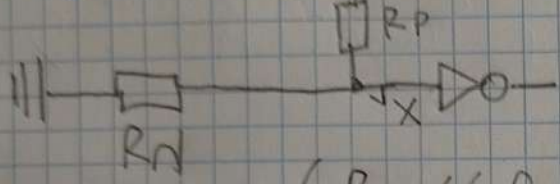
5.

A	B	F
0	0	0
0	1	0
1	0	1
1	1	0

Casos '00' e '01': T_2 em OFF

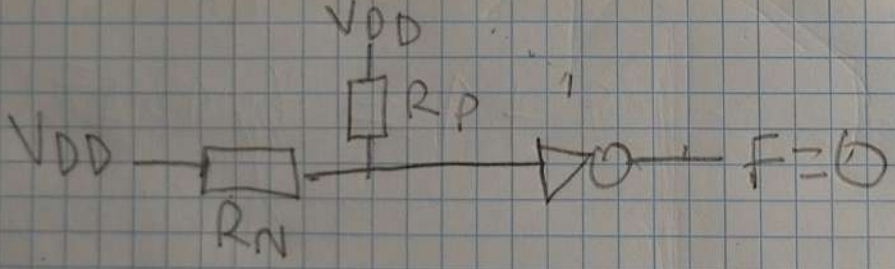


Caso '10': V_{DD}

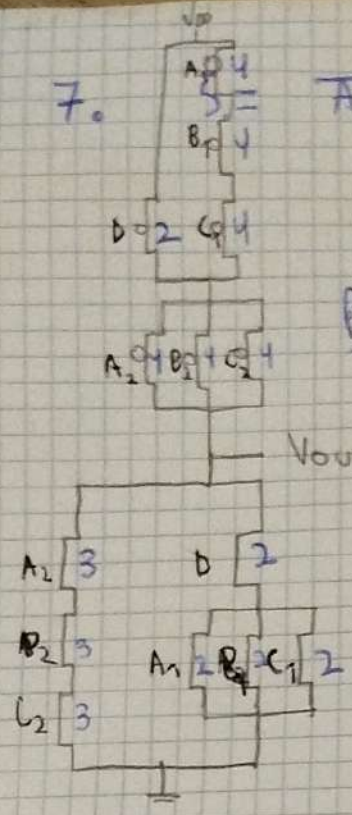


$(R_N << R_P) \rightarrow V_X \cong 0 \rightarrow F = 1$

Caso '11':



7. $\overline{ABC + (A+B+C)D}$



NOTA: (A_1, B_1, C_1) tener as mismas [illegible]
(A_2, B_2, C_2)

PUN

Peor caso PUN: $\overline{A}\,B\,\overline{C}\,D$

$$R_{A_1} + R_{B_1} + R_{C_1} + R_{A_2 B_2 C_2} = R$$

$$\frac{3R}{S} + \frac{1}{\frac{1}{\frac{R}{S}} + \frac{1}{\frac{R}{S}} + \frac{1}{\frac{R}{S}}} = R$$

$$\frac{3R}{S} + \frac{1}{\frac{3S}{R}} = R$$

$$\frac{3R}{S} + \frac{R}{3S} = R$$

$$3 + \frac{1}{3} = S$$

$$S = \frac{10}{3} \rightarrow S = 4$$

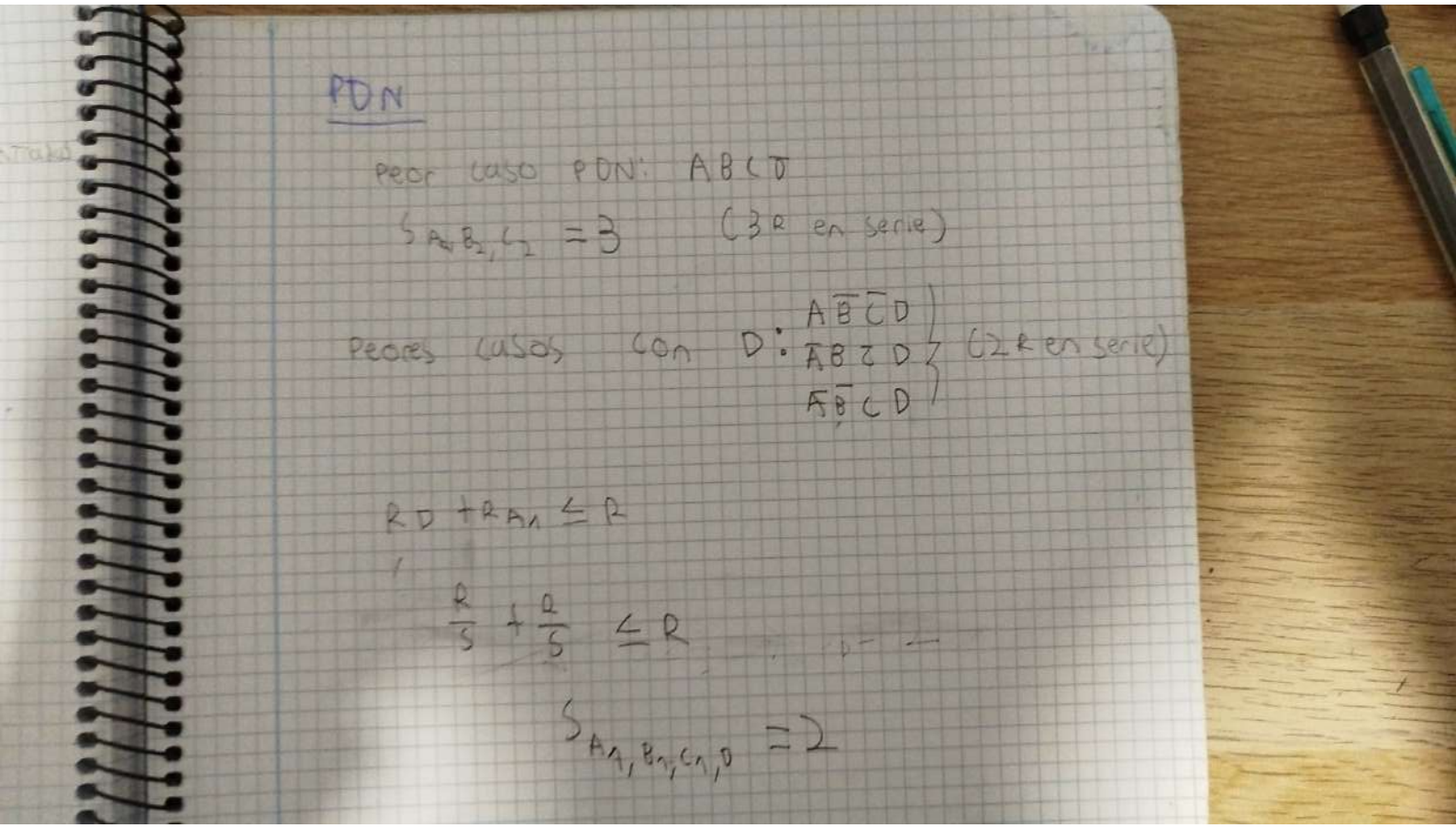
$(A_1, B_1, C_1, A_2, B_2, C_2)$

Peores casos con $\overline{D}$: $\overline{A}BC\overline{D}$, $A\overline{B}C\overline{D}$, $AB\overline{C}\overline{D}$

$$R_D + R_A \leq R$$

$$\frac{R}{S} + \frac{R}{4} \leq R$$

$$S \geq \frac{4}{3} \rightarrow S_D = 2$$


PDN
Peor caso PDN: $A\bar{B}C\bar{D}$
$S_{A_2,B_2,C_2} = 3$ (3R en serie)
Peores casos con D: $A\bar{B}\bar{C}D$, $\bar{A}BCD$, $\bar{A}\bar{B}CD$ (2R en serie)
$R_D + R_{A_1} \leq R$
$\frac{R}{5} + \frac{R}{5} \leq R$
$S_{A_1,B_1,C_1,D} = 2$