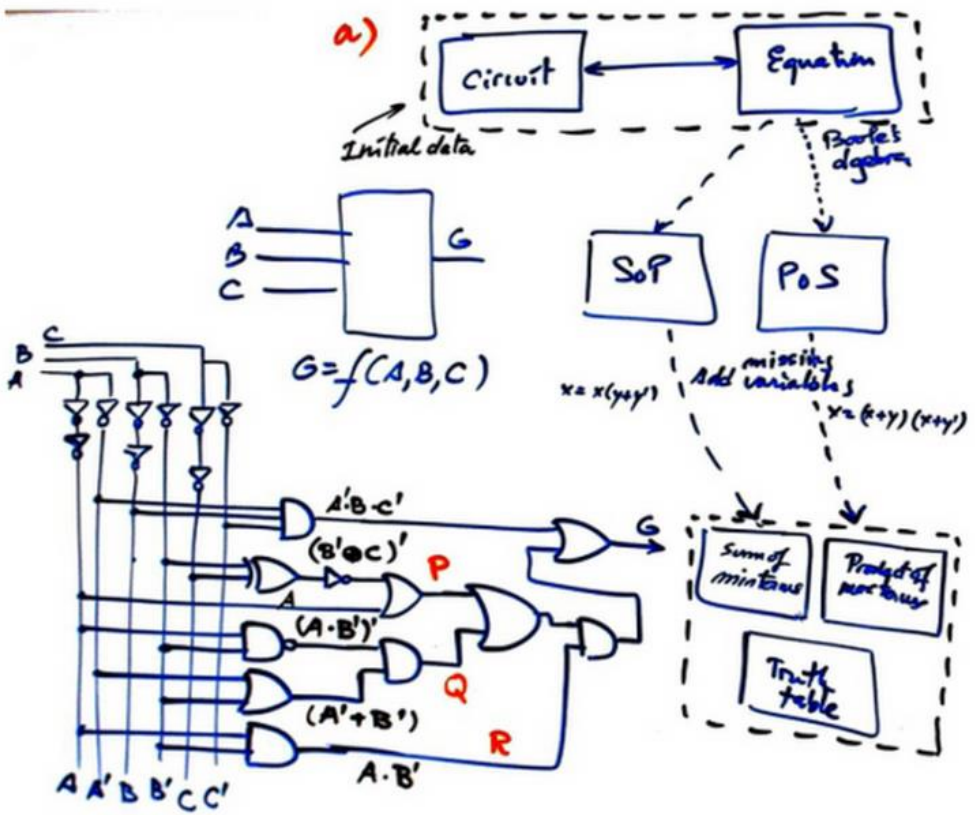
Problem 2) as in MUX_8 using plan C2 in digsys at: https://digsys.upc.edu/csd/P03/MUX_8/MUX_8_C2.html

Problem 3) solution very similar to Problem 4) in 2021Q1 EXA1 at: https://digsys.upc.edu/csd/exams/EX1/2021Q1_CSD_EXAM1_solution.pdf

Problem 1)



b) Equation → $G = A' \cdot B \cdot C' + (P+Q) \cdot R$

$P = (B' \oplus C)' + A$

$Q = (A \cdot B')' \cdot (A'+B')$

$R = A \cdot B'$

c) $(B' \cdot C' + B'' \cdot C)' = (\underbrace{B'C' + BC}_{NXOR})' = \underbrace{BC' + B'C}_{XOR}$

$P = BC' + B'C + A$

$Q = (A'+B'')(A'+B') = \underbrace{(A'+B) \cdot (A'+B')}_{x=(x+y)(x+y')} \rightarrow A'$

$G = A'BC' + (BC' + B'C + \underbrace{A + A'}_{x+x'=1}) \cdot AB'$

$1 + x = 1$

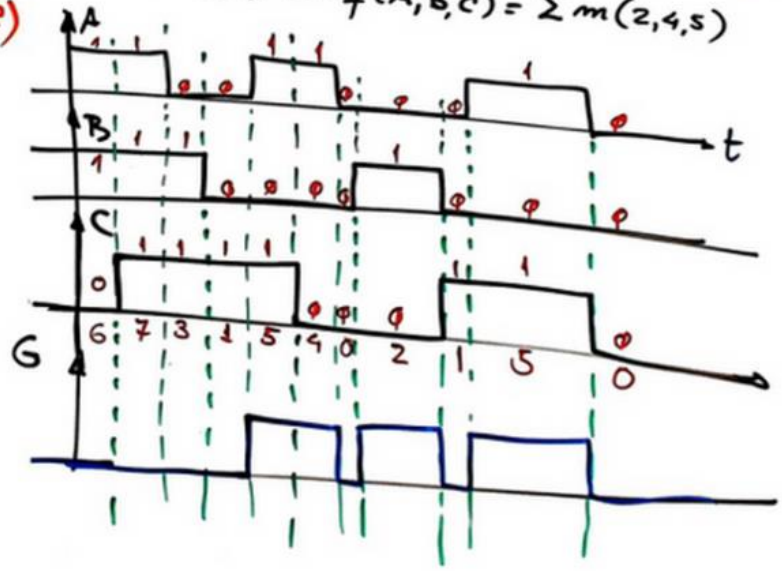
$G = \underbrace{A'BC' + AB'}_{SoP}$

d) $A'BC' = m_{010} = m_2$

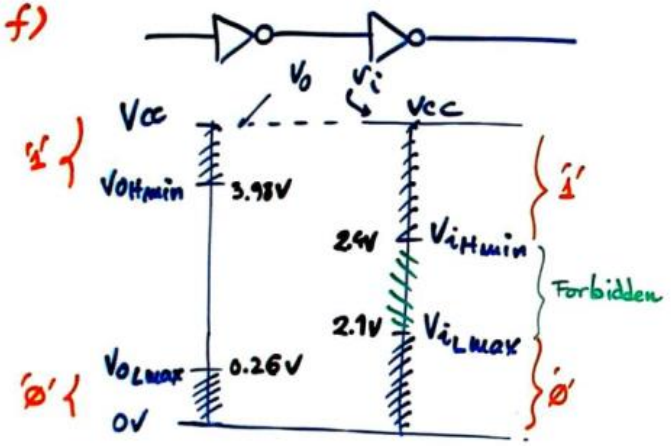
$AB' = AB'C + AB'C' = m_{A01} + m_{A00} = m_5 + m_4$

Truth table ⇒ $G = f(A,B,C) = \Sigma m(2,4,5)$

e)



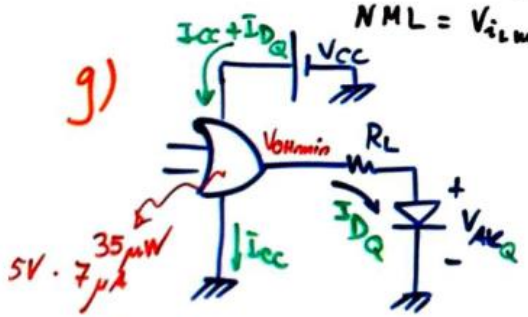
f)



$NMH = V_{OHmin} - V_{iHmin} = 1.58V$

$NML = V_{iLmax} - V_{OLmax} = 1.84V$

g)



19 gates → $35_{\mu W} \cdot 19 = 665_{\mu W}$

1 gate → $5V(7\mu A + 5.5mA) = 27{,}535mW$

$P_D = 28.2\ mW$

$R_L = \dfrac{V_{OHmin} - V_{AKQ}}{I_{DQ}} = \dfrac{3.98V - 1.85V}{5.5mA} = 387\Omega$

h) 8 - levels of gates

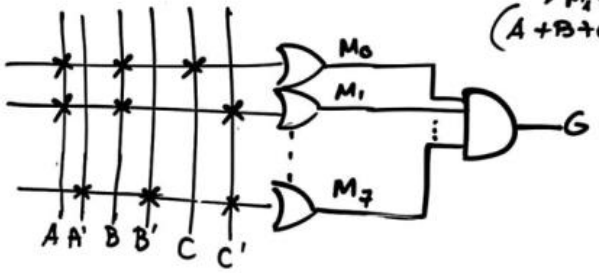
$t_{p_{1\,gate}} = 2.7ns$

This circuit can calculate its truth table 46.3 million times per second

$t_p = 27ns \cdot 8 = 21.6ns$ $\quad f_{max} \leq 46.3MHz$

i) Circuit based on maxterms $G = f(A,B,C) = \Pi M(0,1,3,6,7)$

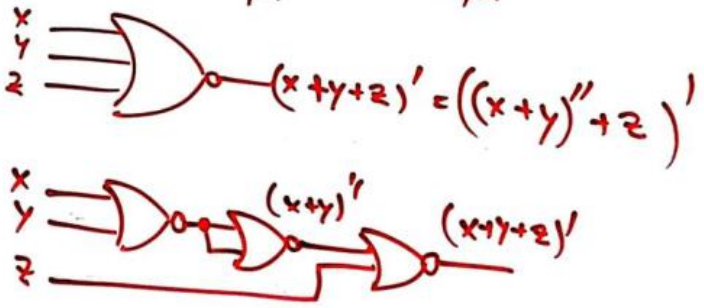
$M_0 = M_{000}$ $(A+B+C')$ $\quad M_7 = M_{111}$ $(A'+B'+C')$



j) For example, from c) → $G = A'BC' + AB = \left((A' \cdot B \cdot C')'' + (A \cdot B)''\right)''$

$= \left(\left((A+B'+C)' + (A'+B')'\right)'\right)'$

NOR 3-input $\quad$ NOR 2-input



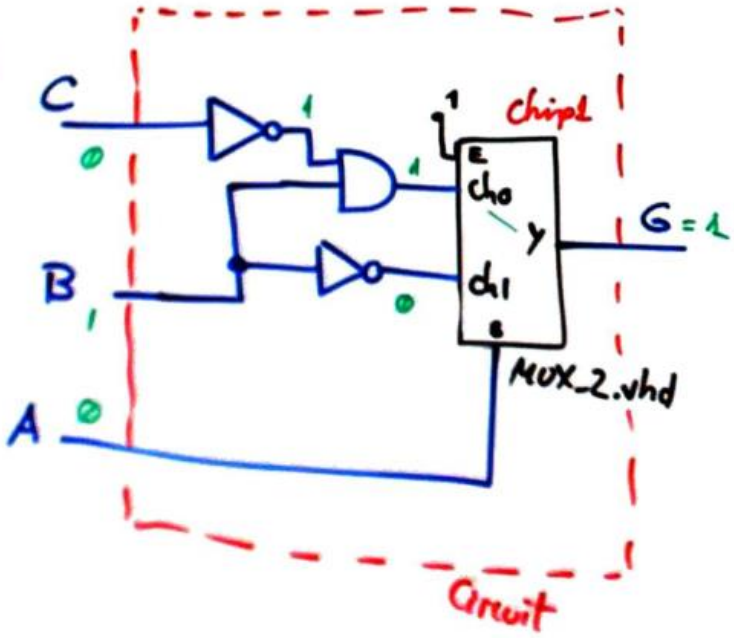
K) MoM using a MUX_2

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

Ch0 → B·C'

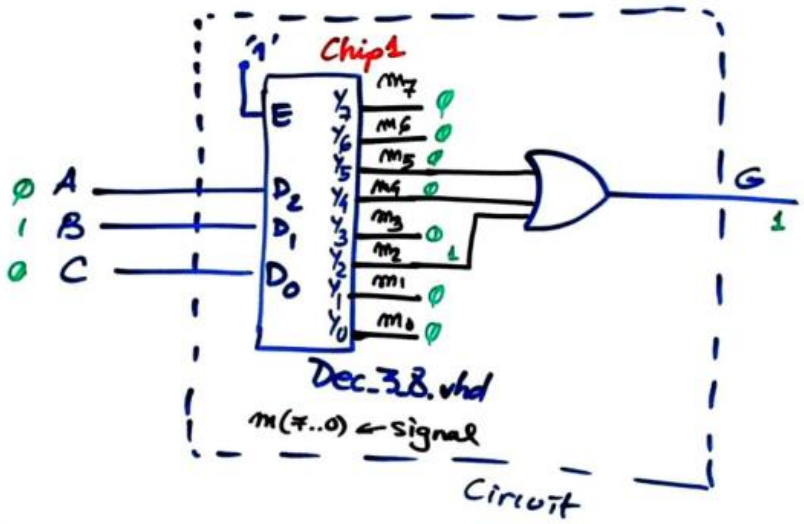
Ch1 → B'

This is Channel Selector



l) MoD

$$G = \sum m(2,4,5) = m_2 + m_4 + m_5$$



j)

Another way to solve j is using canonical output

$$G = \Pi M(0,1,3,6,7) = (M_0 \cdot M_1 \cdot M_3 \cdot M_6 \cdot M_7)''$$

$$= (M_0' + M_1' + M_3' + M_6' + M_7')'$$