Ejemplo ①: Tener la siguiente expresión algebraica logica

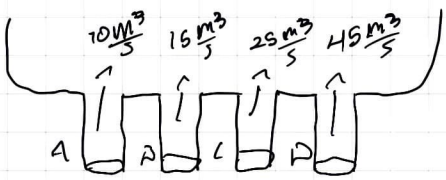
$$M = A\bar{B} + C\bar{D} + \bar{A}D + \bar{C}B$$

a) Expandir en la forma de productos de suma la expresión M

b) Simplificar usando solamente algebra de Boole

c) Dibujar los circuitos logicos obtenidos en el item ⓐ y ⓑ

Ej: ② Se tiene 4 electro Valvulas para controlar los flujos de agua de un sistema de tuberias. Los flujos a traves de los electro valvulas son 10, 15, 25, 45. Respectivamente ($\frac{m^3}{s}$)



1 abierto
0 cerrado

a) Obtener la tabla de la Verdad para ofrecer a la salida del sistema Hidraulico $10\frac{m^3}{s}$, $40\frac{m^3}{s}$, $85\frac{m^3}{s}$, $60\frac{m^3}{s}$, $35\frac{m^3}{s}$, $70\frac{m^3}{s}$

b) Determine la expresión logica de salida en su forma estandar de productos de suma

c) Obtener la expresión algebraica logica minima usando MK

d) Dibujar la expresión algebraica logica obtenida en el item ⓒ

Ejemplo ① Solución

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

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

$M = AB\bar{C}\bar{D} + AB\bar{C}D + AB\,C\bar{D} + AB\,CD + \bar{A}\bar{B}\,C\bar{D} + \bar{A}B\,C\bar{D} + A\bar{B}\,C\bar{D}$

$+ \bar{A}\bar{B}\bar{C}D + \bar{A}\bar{B}\,CD + \bar{A}B\bar{C}D + \bar{A}B\,CD + A\bar{B}\,\bar{C}\bar{D}$

A	B	C	D	M
0	0	0	0	0
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	1
0	1	0	1	1
0	1	1	0	1
0	1	1	1	1
1	0	0	0	0
1	0	0	1	0
1	0	1	0	1
1	0	1	1	0
1	1	0	0	1
1	1	0	1	1
1	1	1	0	1
1	1	1	1	1

a)

$M = \prod_{ps} (A+B+C+D)(\bar{A}+B+C+D)(\bar{A}+B+C+\bar{D})(\bar{A}+B+\bar{C}+\bar{D})$

b) $(A\bar{A} + AB + AC + AD + B\bar{A} + B\bar{B} + BC + BD + C\bar{A} + C\bar{B} + C\bar{C} + CD + D\bar{A} + D\bar{B} + DC + D\bar{D})$

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

$= B(A+\bar{A}) + C(A+\bar{A}) + D(A+\bar{A}) + C(B+\bar{B}) + B(D+\bar{D}) + C(D+\bar{D}) + B + C + D$ ①

$(\bar{A}(B+\bar{B}) + \bar{A}(\bar{C}+C) + \bar{A}(D+\bar{D}) + B(\bar{C}+C) + \bar{D}(B+\bar{B}) + \bar{D}(C+\bar{C}) + \bar{A} + B + \bar{D})$ ②

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

$(B + B\bar{D} + C + C\bar{B} + D + C\bar{D} + B + C + D)$

$(B + C + D + B + C + D) = (B + B + C + C + D + D) = (B + C + D)$ ①

$(\bar{A}\bar{B} + \bar{A} + \bar{A}\bar{D} + \bar{B} + \bar{D}\bar{B} + \bar{D} + \bar{A} + \bar{B} + \bar{D})$

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

$(\bar{A} + B + B + \bar{D} + \bar{A}\bar{D}) = (\bar{A} + B + \bar{D})$ ②

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

$= B\bar{A} + BB + B\bar{D} + C\bar{A} + CB + C\bar{D} + D\bar{A} + D\bar{B} + D\bar{D}$

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

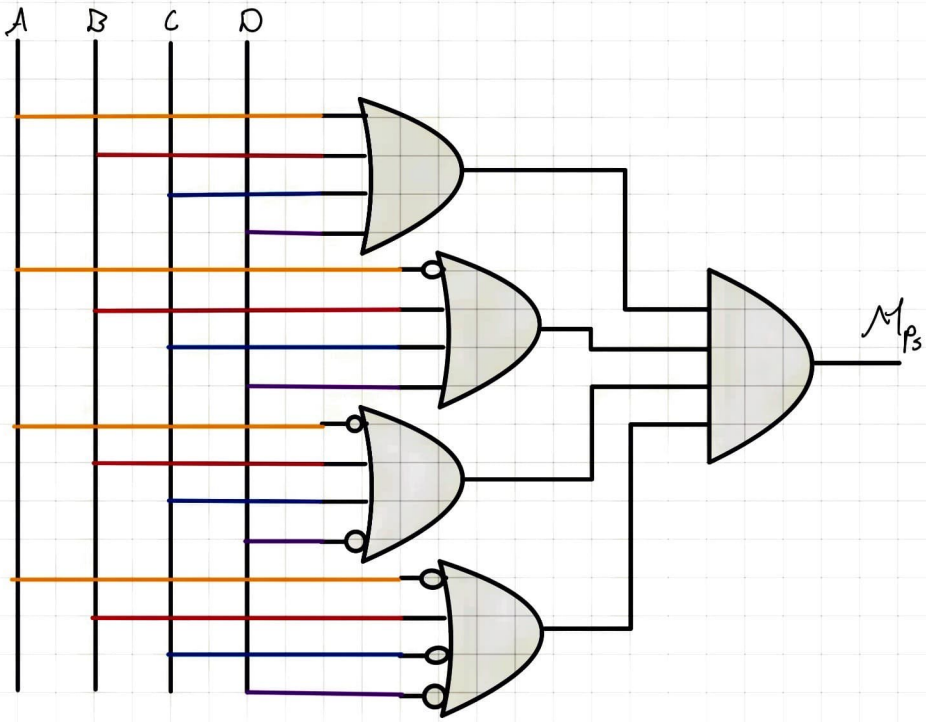
$= (B + \bar{A}B + CB + C\bar{A} + C\bar{D} + D\bar{A})$

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

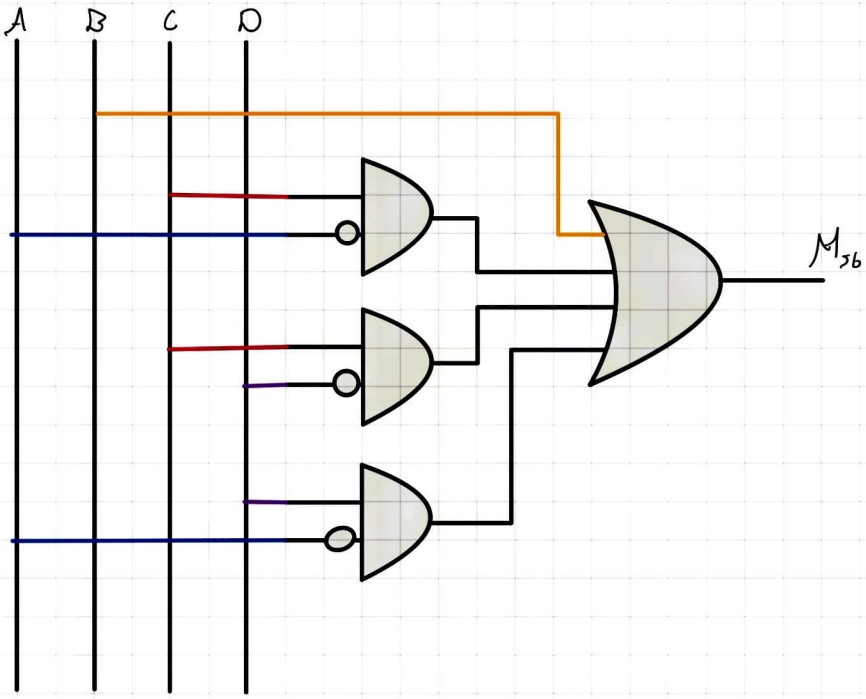
$R// = M_{pb} = B + C\bar{A} + C\bar{D} + D\bar{A} = B + C(A+D) + D\bar{A}$

C)

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



$$M_{sb} = B + C\bar{A} + C\bar{D} + D\bar{A}$$



Ejemplo ②

a)

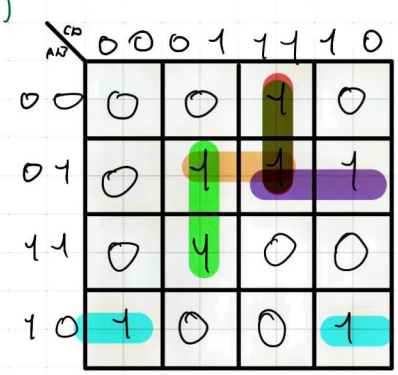
A	B	C	D	S	
0	0	0	0	0	✓
0	0	0	1	0	✓
0	0	1	0	0	✓
0	0	1	1	1	✓
0	1	0	0	0	✓
0	1	0	1	1	✓
0	1	1	0	1	✓
0	1	1	1	1	✓
1	0	0	0	1	✓
1	0	0	1	0	✓
1	0	1	0	1	✓
1	0	1	1	0	✓
1	1	0	0	0	
1	1	0	1	1	
1	1	1	0	0	
1	1	1	1	0	

b) $S_{PS} = (A+B+C+D)(A+B+C+\bar{D})(A+B+\bar{C}+D)(A+\bar{B}+C+D)$

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

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

c)



$G_1 = A\bar{B}\bar{C}\bar{D} + A\bar{B}C\bar{D} = A\bar{B}\bar{D}$

$G_2 = AB\bar{C}D + A\bar{B}\bar{C}D = B\bar{C}D$

$G_3 = \bar{A}B\bar{C}D + \bar{A}BCD = \bar{A}BD$

$G_4 = \bar{A}\bar{B}CD + \bar{A}BCD = \bar{A}CD$

$G_5 = \bar{A}BC\bar{D} + \bar{A}BCD = \bar{A}BC$

$S = A\bar{B}\bar{D} + B\bar{C}D + \bar{A}BD + \bar{A}CD + \bar{A}BC$

D)