DISEÑO DIGITAL - IST 7072 - UNIVERSIDAD DEL NORTE - EVALUACIÓN

Felipe Jose Benítez Avilez
Fernando Mateo Valencia Gómez
Kenny Dong Jie Zhu Ye

Marzo 8 de 2023

Punto 1

0.1. Represente los números decimales en binario usando 16 bits y realice las operaciones en complemento a 2:

- $7365 - 4192$ (7365 menos 4192)
  - Iniciamos haciendo la conversión del sistema decimal a binario de 7365

Número	Divisor	Restante	Residuo
7365	2	3682	1
3682	2	1841	0
1841	2	920	1
920	2	460	0
460	2	230	0
230	2	115	0
115	2	57	1
57	2	28	1
28	2	14	0
14	2	7	0
7	2	3	1
3	2	1	1
1	2	0	1

Número	Divisor	Restante	Residuo
4192	2	2096	0
2096	2	1048	0
1048	2	524	0
524	2	262	0
262	2	131	0
131	2	65	1
65	2	32	1
32	2	16	0
16	2	8	0
8	2	4	0
4	2	2	0
2	2	1	1
1	2	0	0

  - Ahora, llevamos a 16 bits cada número

Número	Representación binaria en 16 bits
7365	0001110011000101
4192	0001000001100000

- El resultado en sistema decimal es: 3173. Ahora debemos de tomar el segundo número (4192) para llevarlo a complemento 2

4192	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0
complemento	1	1	1	0	1	1	1	1	1	0	0	1	1	1	1	1

- Ahora le sumamos +1

Complemento	1	1	1	0	1	1	1	1	1	0	0	1	1	1	1	1
suma																+1
Resultado	1	1	1	0	1	1	1	1	1	0	1	0	0	0	0	0

- A Resultado lo vamos a sumar con 7365

7365	0	0	0	1	1	1	0	0	1	1	0	0	0	1	0	1
Resultado	1	1	1	0	1	1	1	1	1	0	1	0	0	0	0	0
Suma	0	0	0	0	1	1	0	0	0	1	1	0	0	1	0	1

- El resultado binario debe concordar con 3173 en decimal

$$3173 = 0000110001100101$$

- $9274 - 5888$ (9274 menos 5888)
  - Iniciamos haciendo la conversión a binario de ambos números

Número	Divisor	Restante	Residuo
9274	2	4637	0
4637	2	2318	1
2318	2	1159	0
1159	2	579	1
579	2	289	1
289	2	144	1
144	2	72	0
72	2	36	0
36	2	18	0
18	2	9	0
9	2	4	1
4	2	2	0
2	2	1	0
1	2	0	1

Número	Divisor	Restante	Residuo
5888	2	2944	0
2944	2	1472	0
1472	2	736	0
736	2	368	0
368	2	184	0
184	2	92	0
92	2	46	0
46	2	23	0
23	2	11	1
11	2	5	1
5	2	2	1
2	2	1	0
1	2	0	1

Cuadro 1: Caption

  - Ahora, llevamos a 16 bits cada número

Número	Representación binaria en 16 bits
9274	0010010000111010
5888	0001011100000000

- El resultado en decimal es de 3386. Ahora procedemos a hallar el complemento de 5888

5888	0	0	0	1	0	1	1	1	0	0	0	0	0	0	0	0
Complemento	1	1	1	0	1	0	0	0	1	1	1	1	1	1	1	1

- Ahora le sumamos un +1

Complemento	1	1	1	0	1	0	0	0	1	1	1	1	1	1	1	1
suma																+1
Resultado	1	1	1	0	1	0	0	1	0	0	0	0	0	0	0	0

- A Resultado lo vamos a sumar con 9274

9274	0	0	1	0	0	1	0	0	0	0	1	1	1	0	1	0
+																
Resultado	1	1	1	0	1	0	0	1	0	0	0	0	0	0	0	0
Suma	0	0	0	0	1	1	0	1	0	0	1	1	1	0	1	0

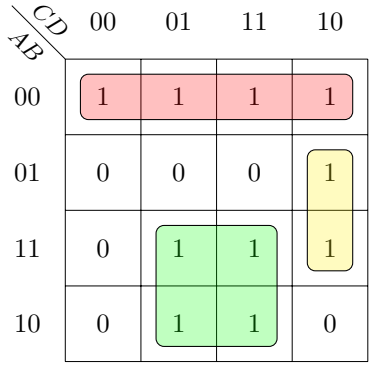
- el resultado tiene que ser acorde a 3386 en binario

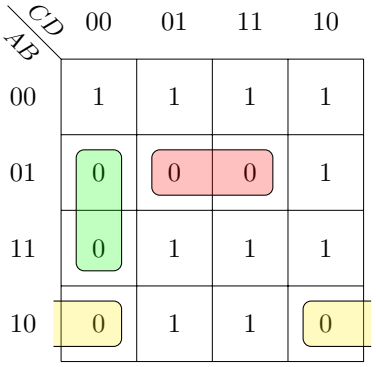
$$3386 = 0000110100111010$$

Punto 2

F(A,B,C,D) $= \sum m(0,1,2,3,6,9,11,13,14,15) = \prod M(4,5,7,8,10,12)$

	A	B	C	D	Y
0	0	0	0	0	1
1	0	0	0	1	1
2	0	0	1	0	1
3	0	0	1	1	1
4	0	1	0	0	0
5	0	1	0	1	0
6	0	1	1	0	1
7	0	1	1	1	0
8	1	0	0	0	0
9	1	0	0	1	1
10	1	0	1	0	0
11	1	0	1	1	1
12	1	1	0	0	0
13	1	1	0	1	1
14	1	1	1	0	1
15	1	1	1	1	1





Suma de productos
F(A,B,C,D)= $\overline{A}\overline{B} + BC\overline{D} + AD$

Producto de sumas
F(A,B,C,D)=$(\overline{B} + C + D)(A + \overline{B} + \overline{D})(\overline{A} + B + \overline{D})$

$$\rightarrow \underbrace{\overline{A}\overline{B}}_{①} + \underbrace{BC\overline{D}}_{②} + \underbrace{AD}_{③} = \underbrace{(\overline{B} + C + D)}_{④}\underbrace{(A + \overline{B} + \overline{D})}_{⑤}\underbrace{(\overline{A} + B + D)}_{⑥}$$

②Y③ : $BC\overline{D} + AD$

$= \underline{(B + A)}(B + D)\underline{(C + A)}(C + D)(\overline{D} + A)(\cancel{D + \overline{D}})$

$=\underbrace{(B + D)(C + D)(\overline{D} + A)}_{⑦}$ Por consenso y $\overline{X} + X = 1$

$\textcircled{1} Y \textcircled{7} : (\overline{AB}) + (B+D)(C+D)(\overline{D}+A)$

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

$=(\overline{A}+B+D)(\overline{B}+C+D)(A+\overline{B}+\overline{D})(\overline{A}+C+D)$ Por $\overline{X}+X=1$

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

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

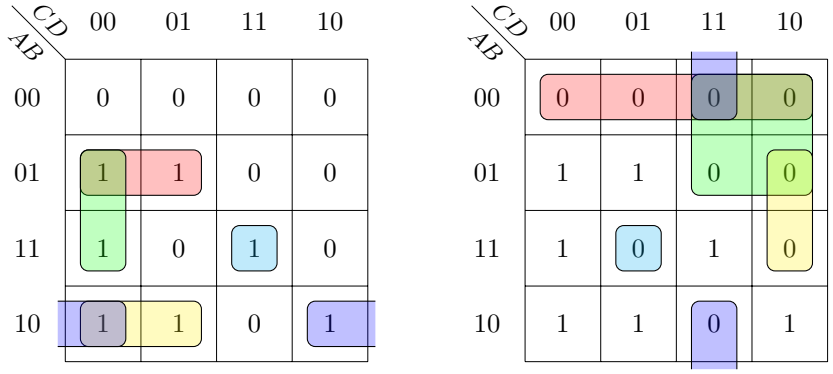
Por consenso $(x+y)(\overline{x}+z)(y+z) = (x+y)(\overline{x}+z)$

$= \underbrace{(\overline{B}+C+D)}_{\textcircled{4}}\underbrace{(A+\overline{B}+\overline{D})}_{\textcircled{5}}\underbrace{(\overline{A}+B+D)}_{\textcircled{6}}$

1. Punto 3

F(A,B,C,D) $= \prod M(0,1,2,3,6,7,11,13,14) = \sum m(4,5,8,9,10,12,15)$

	A	B	C	D	Y
0	0	0	0	0	0
1	0	0	0	1	0
2	0	0	1	0	0
3	0	0	1	1	0
4	0	1	0	0	1
5	0	1	0	1	1
6	0	1	1	0	0
7	0	1	1	1	0
8	1	0	0	0	1
9	1	0	0	1	1
10	1	0	1	0	1
11	1	0	1	1	0
12	1	1	0	0	1
13	1	1	0	1	0
14	1	1	1	0	0
15	1	1	1	1	1



Producto de sumas
$F = (A+B)(A+\overline{C})(\overline{B}+\overline{C}+D)(B+\overline{C}+\overline{D})(\overline{A}+\overline{B}+C+\overline{D})$

Suma de productos
$F = \overline{A}B\overline{C} + ABCD + B\overline{C}D + A\overline{B}\overline{C} + A\overline{B}D$

$$\rightarrow \underbrace{(A+B)}_{①}\underbrace{(A+\overline{C})}_{②}\underbrace{(\overline{B}+\overline{C}+D)}_{③}\underbrace{(B+\overline{C}+\overline{D})}_{④}\underbrace{(\overline{A}+\overline{B}+C+\overline{D})}_{⑤} = \underbrace{(\overline{A}B\overline{C})}_{⑥}\underbrace{(ABCD)}_{⑦}\underbrace{(B\overline{C}D)}_{⑧}\underbrace{(A\overline{B}\overline{C})}_{⑨}\underbrace{(A\overline{B}D)}_{⑩}$$

① Y ②: $(A+B)(A+\overline{C})$

$= AA + \underline{A\overline{C}} + \underline{BA} + B\overline{C}$
$= A + B\overline{C} \rightarrow$ ⑪ por absorción.

③ y ④: $(\overline{B}+\overline{C}+D)(B+\overline{C}+\overline{D})$

$= \cancel{\overline{B}\overline{B}} + \underline{\overline{B}\overline{C}} + \overline{B}\overline{D} + \underline{\overline{C}B} + \overline{C}\overline{C} + \underline{\overline{C}\overline{D}} + DB + \underline{D\overline{C}} + \cancel{D\overline{D}}$
$= \overline{B}\overline{D} + \overline{C} + DB$ ⑫ por $X \cdot \overline{X} = 0$ y absorción.

$\rightarrow \underbrace{(A+B\overline{C})}_{⑪}\underbrace{(\overline{B}\overline{D}+\overline{C}+DB)}_{⑫}\underbrace{(\overline{A}+\overline{B}+C+\overline{D})}_{⑤}$

⑪ y ⑤: $(A+B\overline{C})(\overline{A}+\overline{B}+C+\overline{D})$

$= \cancel{A\overline{A}} + A\overline{B} + AC + A\overline{D} + B\overline{C}\overline{A} + \cancel{B\overline{C}\overline{B}} + \cancel{B\overline{C}C} + B\overline{C}\overline{D}$
$= A\overline{B} + AC + A\overline{D} + B\overline{C}\overline{A} + B\overline{C}\overline{D}$ ⑬

⑬ Y ⑫: $(\overline{B}\overline{D}+\overline{C}+DB)(A\overline{B}+AC+A\overline{D}+B\overline{C}\overline{A}+B\overline{C}\overline{D})$

$= A\overline{B}\overline{B}\overline{D} + A\overline{B}\overline{C} + \cancel{A\overline{B}D\overline{B}} + AC\overline{B}\overline{D} + \cancel{AC\overline{C}} + ACDB + A\overline{D}\overline{B}\overline{D} + A\overline{D}\overline{C} + \cancel{A\overline{D}D\overline{B}} + \cancel{B\overline{C}AB\overline{D}} + B\overline{C}A\overline{C} + B\overline{C}\overline{A}DB + \cancel{B\overline{C}DB\overline{D}} + B\overline{C}D\overline{C} + \cancel{B\overline{C}D\overline{D}B}$

Por la ley $X \cdot \overline{X} = 0$ y $X \cdot X = X$

$= A\overline{B}\overline{D} + A\overline{B}\overline{C} + \underline{AC\overline{B}\overline{D}} + ACDB + \underline{A\overline{D}B} + \underline{A\overline{D}\overline{C}} + \overline{A}B\overline{C} + \underline{\overline{A}B\overline{C}D} + B\overline{C}\overline{D}$

Aplicando ley de absorción tenemos que:
$= A\overline{B}\overline{D} + A\overline{B}\overline{C} + ABCD + \underline{A\overline{C}\overline{D}} + \overline{A}B\overline{C} + B\overline{C}\overline{D}$

Reorganizando el siguiente termino:
$= A\overline{B}\overline{D} + A\overline{B}\overline{C} + ABCD + \underline{A\overline{C}D\overline{D}} + \overline{A}B\overline{C} + B\overline{C}\overline{D}$

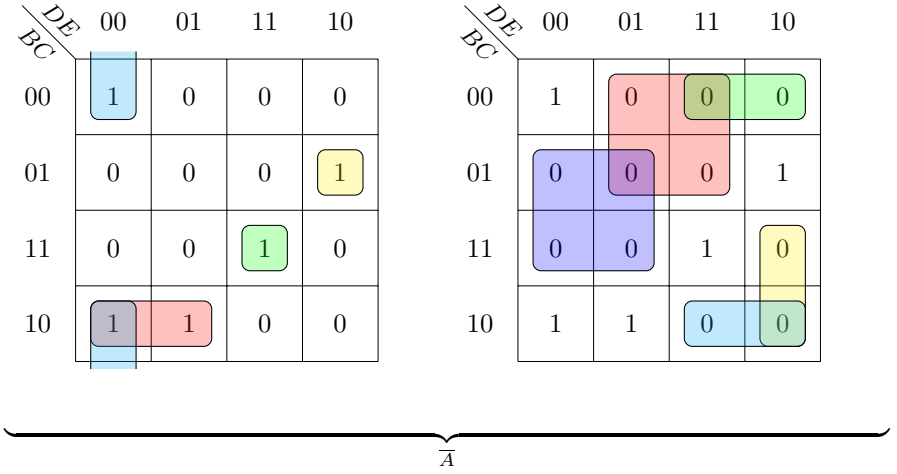
Por ley del consenso y $X \cdot X = X$: $B\overline{C}\overline{D} + A\overline{B}\overline{D} + A\overline{C}D\overline{D} = B\overline{C}\overline{D} + A\overline{B}\overline{D}$

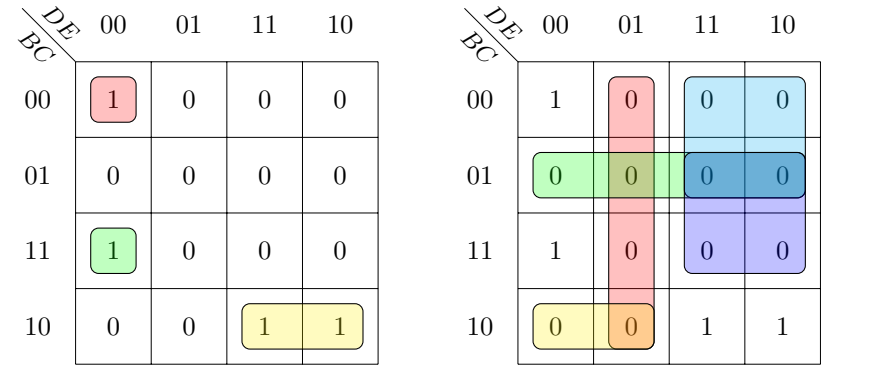
Obtenemos al final:
$= A\overline{B}\overline{D} + A\overline{B}\overline{C} + \overline{A}B\overline{C} + ABCD + B\overline{C}\overline{D}$

Punto 4

F(A,B,C,D,E) $= \sum m(0, 6, 8, 9, 15, 16, 26, 27, 28)$
$= \prod M(1, 2, 3, 4, 5, 7, 10, 11, 12, 13, 14, 17, 18, 19, 20, 21, 22, 23, 24, 25, 29, 30, 31)$

	A	B	C	D	E	Y
0	0	0	0	0	0	1
1	0	0	0	0	1	0
2	0	0	0	1	0	0
3	0	0	0	1	1	0
5	0	0	1	0	1	0
6	0	0	1	1	0	1
7	0	0	1	1	1	0
8	0	1	0	0	0	1
9	0	1	0	0	1	1
10	0	1	0	1	0	0
11	0	1	0	1	1	0
12	0	1	1	0	0	0
13	0	1	1	0	1	0
14	0	1	1	1	0	0
15	0	1	1	1	1	1
16	1	0	0	0	0	1
17	1	0	0	0	1	0
18	1	0	0	1	0	0
19	1	0	0	1	1	0
20	1	0	1	0	0	0
21	1	0	1	0	1	0
22	1	0	1	1	0	0
23	1	0	1	1	1	0
24	1	1	0	0	0	0
25	1	1	0	0	1	0
26	1	1	0	1	0	1
27	1	1	0	1	1	1
28	1	1	1	0	0	1
29	1	1	1	0	1	0
30	1	1	1	1	0	0
31	1	1	1	1	1	0





$$\underbrace{\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad}_{A}$$

Suma de productos

$$\text{F(A,B,C,D,E)}= \underbrace{\overline{A}}_{\overline{X}}\underbrace{(\overline{C}\overline{D}E+\overline{B}CD\overline{E}+BCDE+B\overline{C}\overline{D})}_{Z}+\underbrace{A}_{X}\underbrace{(\overline{B}CDE+BC\overline{D}E+B\overline{C}D)}_{Y}$$

Producto de sumas

$$\text{F(A,B,C,D,E)}=$$

$$(\underbrace{A}_{X}+\underbrace{(C+\overline{D})(B+\overline{B})(\overline{C}+D)(\overline{B}+\overline{D}+E))}_{V}(\underbrace{\overline{A}}_{\overline{X}}+\underbrace{(D+\overline{E})(B+\overline{C})(\overline{B}+C+D)(B+\overline{D})+\overline{C}+\overline{D}))}_{W}$$

$$XY+\overline{X}Z=(X+V)(\overline{X}+W)\rightarrow(X+Z)(\overline{X}+Y)=(X+V)(\overline{X}+W)$$

$$Z=V\rightarrow\overline{Z}V=0, Y=W$$

$$\underbrace{(\overline{C}\overline{D}E+\overline{B}CD\overline{E}+BCDE+B\overline{C}\overline{D})}_{Z}=\underbrace{(C+\overline{D})(B+\overline{B})(\overline{C}+D)(\overline{B}+\overline{D}+E))}_{V}$$

Ley de Morgan en Z

$$\overline{Z}=\overline{(\overline{C}\overline{D}E+\overline{B}CD\overline{E}+BCDE+B\overline{C}\overline{D})}=(C+D+E)(B+\overline{C}+\overline{D}+E)(\overline{B}CDE)(\overline{B}+C+D)$$

$$\overline{Z}V=(\underbrace{(C+D+E)}_{①}\underbrace{(B+\overline{C}+\overline{D}+E)}_{②}\underbrace{(\overline{B}+\overline{C}+\overline{D}+\overline{E})}_{③}\underbrace{(\overline{B}+C+D)}_{④}\underbrace{(C+\overline{D})}_{⑤}\underbrace{(B+\overline{E})}_{⑥}\underbrace{(\overline{C}+D)}_{⑦}\underbrace{(\overline{B}+\overline{D}+E)}_{⑧}$$

$①Y④:(C+D+E)(\overline{B}+C+D)$

$$=\underline{C\overline{B}}+CC+\underline{CD}+\underline{D\overline{B}}+\underline{DC}+DD+E\overline{B}+\underline{EC}+\underline{ED}$$

$$=\underbrace{C+D+E\overline{B}}_{⑨}\text{ Por absorcion}$$

$②Y③:(B+\overline{C}+\overline{D}+E)(\overline{B}+\overline{C}+\overline{D}+\overline{E})$

$$=\cancel{B\overline{B}}+\underline{B\overline{C}}+\underline{B\overline{D}}+B\overline{E}+\underline{\overline{C}B}+\overline{C}\overline{C}+\underline{\overline{C}D}+\underline{\overline{C}E}+\underline{\overline{D}B}+\underline{\overline{D}C}+\overline{D}\overline{D}+\underline{\overline{D}E}+E\overline{B}+\underline{E\overline{C}}+\underline{E\overline{D}}+\cancel{E\overline{E}}$$

$$=\underbrace{B\overline{E}+\overline{C}+\overline{D}+E\overline{B}}_{⑩}\,PorX\overline{X}=0\text{ y absorcion}$$

⑤Y⑦ : $(C+\overline{D})(\overline{C}+D)$

$=\cancel{C\overline{C}}+CD+\overline{C}\overline{D}+=\cancel{D\overline{D}}$

$=\underbrace{CD+\overline{C}\overline{D}}_{⑪}$ Por $X\overline{X}=0$

⑥Y⑧ : $(B+\overline{E})(\overline{B}+\overline{D}+E)$

$=\cancel{B\overline{B}}+B\overline{D}+BE+\overline{E}\overline{B}+\overline{E}\overline{D}+\cancel{E\overline{E}}$

$=\underline{B\overline{D}}+BE+\overline{E}\overline{B}+\overline{E}\overline{D}$ Por $X\overline{X}=0$

$=\underbrace{BE+\overline{B}\overline{E}+\overline{D}\overline{E}}_{⑫}$ Por consenso

$\rightarrow (C+D+E\overline{B})(B\overline{E}+\overline{C}+\overline{D}+E\overline{B})(CD+\overline{C}\overline{D})(BE+\overline{B}\overline{E}+\overline{D}\overline{E})$

⑨Y⑪ : $(C+D+E\overline{B})(CD+\overline{C}\overline{D})$

$=CCD+\cancel{C\overline{C}\overline{D}}+\underline{DCD}+\cancel{D\overline{D}\overline{C}}+\underline{E\overline{B}CF}+E\overline{B}CD$

$=\underbrace{CD+E\overline{B}CD}_{⑬}$ Por $X\overline{X}=0$, Por absorcion y $XX=X$

⑩Y⑫ : $(B\overline{E}+\overline{C}+\overline{D}+E\overline{B})(BE+\overline{B}\overline{E}+\overline{D}\overline{E})$

$=\cancel{B\overline{B}\overline{E}\overline{E}}+\cancel{B\overline{E}\overline{E}\overline{B}}+\underline{B\overline{E}\overline{E}\overline{D}}+\overline{C}BE+\overline{B}\overline{C}E+\underline{\overline{C}\overline{E}\overline{D}}+\overline{D}BE+\underline{\overline{B}\overline{D}\overline{E}}+\cancel{E\overline{B}\overline{B}\overline{E}}+\cancel{E\overline{B}\overline{E}\overline{B}}+\cancel{E\overline{B}\overline{E}\overline{D}}$

$=\underbrace{\overline{C}BE+\overline{C}\overline{E}\overline{B}+\overline{D}BE+\overline{D}\overline{E}}_{⑭}$ Por absorcion y $X\overline{X}=0$

⑬ y ⑭: $(CD+E\overline{B}\overline{D}\overline{C})(\overline{C}BE+\overline{C}\overline{E}\overline{B}+\overline{D}BE+\overline{D}\overline{E})$

$=CD\overline{C}BE+CD\overline{C}\overline{E}\overline{B}+CD\overline{D}BE+CD\overline{D}\overline{E}+E\overline{B}\overline{D}\overline{C}\overline{C}BE+E\overline{B}\overline{D}\overline{C}\overline{C}\overline{E}\overline{B}+E\overline{B}\overline{D}\overline{C}\overline{D}BE+E\overline{B}\overline{D}\overline{C}\overline{D}\overline{E}$

$=0$ por $X*\overline{X}=0$ por lo tanto $\overline{Z}*V=0$

$\rightarrow y=w\rightarrow \overline{y}\cdot w=0$

$\rightarrow (\overline{B}\overline{C}\overline{D}\overline{E}+B\overline{C}\overline{D}\overline{E}+B\overline{C}D)=(D+\overline{E})(B+\overline{C})(\overline{B}+C+D)(B+\overline{D})(\overline{C}+\overline{D})$

Aplicamos Ley de Morgan en y:

$\overline{Y} = \overline{(\overline{B}CDE + BC\overline{D}E + B\overline{C}D)} = (B + C + D + E)(\overline{B} + \overline{C} + D + E)(\overline{B} + C + \overline{D})$

$\overline{Y} \cdot W = \underbrace{(B + C + D + E)}_{①}\underbrace{(\overline{B} + \overline{C} + D + E)}_{②}\underbrace{(\overline{B} + C + \overline{D})}_{③}\underbrace{(D + \overline{E})}_{④}\underbrace{(B + \overline{C})}_{⑤}\underbrace{(\overline{B} + C + D)}_{⑥}\underbrace{(B + \overline{D})}_{⑦}\underbrace{(\overline{C} + \overline{D})}_{⑧}$

① y ⑤: $(B + C + D + E+)(B + \overline{C})$

$= BB + \underline{B\overline{C}} + \underline{CB} + \cancel{C\overline{C}} + \underline{DB} + D\overline{C} + \underline{EB} + E\overline{C}$

$= B + D\overline{C} + E\overline{C}$ ⑨ → por ley de absorción y $X \cdot \overline{X} = 0$

② Y ⑥: $= (\overline{B} + \overline{C} + D + E)(\overline{B} + C + D)$

$= \overline{B}\overline{B} + \underline{\overline{B}C} + \underline{\overline{B}D} + \underline{\overline{C}B} + \cancel{\overline{C}C} + \underline{\overline{C}D} + \underline{D\overline{B}} + \underline{DC} + DD + \underline{E\overline{B}} + EC + ED$

$= \overline{B} + D + EC + ED$ ⑩ → por $X \cdot \overline{X} = 0$ y absorción.

③ Y ⑧: $= (\overline{B} + C + \overline{D})(\overline{C} + \overline{D})$

$= \overline{BC} + \underline{\overline{B}\overline{D}} + \cancel{C\overline{C}} + \underline{C\overline{D}} + \underline{\overline{D}C} + \overline{D}\overline{D}$

$= \overline{BC} + \overline{D}$ → ⑪ por $X \cdot \overline{X} = 0$ y absorción.

④ Y ⑨: $= (D + \overline{E})(B + \overline{D})$

$= DB + \cancel{D\overline{D}} + \underline{\overline{E}B} + \overline{E}D$

$= DB + \overline{E}D$ → ⑫ por $X \cdot \overline{X} = 0$ y consenso.

$\rightarrow \underbrace{(B + D\overline{C} + E\overline{C})}_{⑨}\underbrace{(\overline{B} + D + EC + ED)}_{⑩}\underbrace{(\overline{BC} + \overline{D})}_{⑪}\underbrace{(DB + \overline{E}D)}_{⑫}$

⑨ Y ⑫: $(B + D\overline{C} + E\overline{C})(DB + \overline{E}D)$

$= BDB + B\overline{E}D + \underline{D\overline{C}DB} + \cancel{D\overline{C}ED} + \underline{E\overline{C}DB} + \cancel{E\overline{C}ED}$

$= BD + B\overline{E}D$ ⑬ → por absorción y $X \cdot \overline{X} = 0$

⑩ Y ⑪: $(\overline{B} + D + EC + ED)(\overline{BC} + \overline{D})$

$= \overline{BBC} + \overline{BD} + \underline{D\overline{BC}} + \cancel{D\overline{D}} + EC\cancel{\overline{BC}} + EC\overline{D} + \underline{ED\overline{BC}} + \cancel{ED\overline{D}}$

$= \overline{BC} + \overline{BD} + EC\overline{D} \rightarrow$ ⑭ por absorción y $X \cdot \overline{X} = 0$

⑬ Y ⑭: $(BD + B\overline{ED})(\overline{BC} + \overline{BD} + EC\overline{D})$

$= BD\overline{BD} + BD\overline{BC} + BDEC\overline{D} + B\overline{EDBC} + B\overline{EDBD} + B\overline{ED}EC\overline{D}$

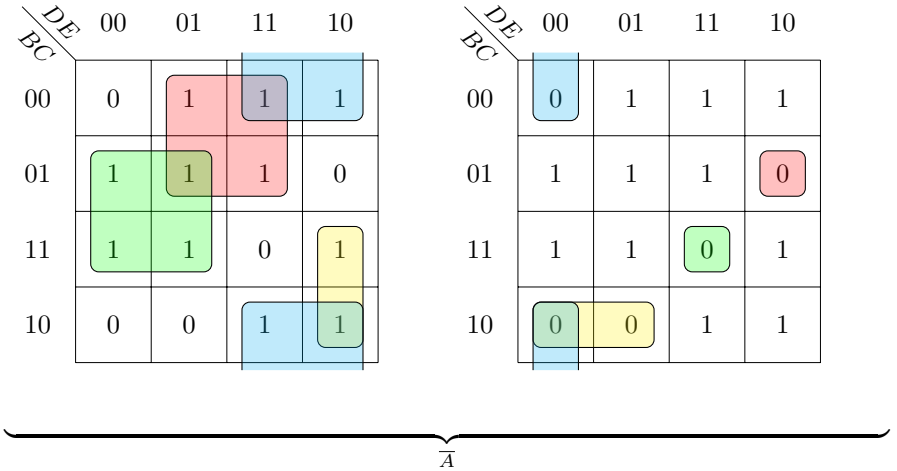
$= 0 \rightarrow$ por $X \cdot \overline{X} = 0$

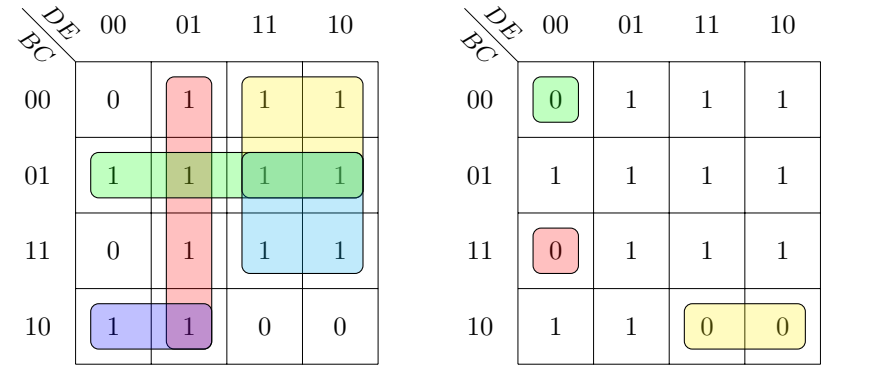
Por lo tanto, $\overline{Y} \cdot W = 0$ o $\overline{Z} \cdot V = \overline{Y} \cdot W$

Punto 5

$$\text{F(A,B,C,D,E)} = \prod M(0,6,8,9,15,16,26,27,28)$$
$$= \sum m(1,2,3,4,5,7,10,11,12,13,14,17,18,19,20,21,22,23,24,25,29,30,31)$$

	A	B	C	D	E	Y
0	0	0	0	0	0	0
1	0	0	0	0	1	1
2	0	0	0	1	0	1
3	0	0	0	1	1	1
5	0	0	1	0	1	1
6	0	0	1	1	0	0
7	0	0	1	1	1	1
8	0	1	0	0	0	0
9	0	1	0	0	1	0
10	0	1	0	1	0	1
11	0	1	0	1	1	1
12	0	1	1	0	0	1
13	0	1	1	0	1	1
14	0	1	1	1	0	1
15	0	1	1	1	1	0
16	1	0	0	0	0	0
17	1	0	0	0	1	1
18	1	0	0	1	0	1
19	1	0	0	1	1	1
20	1	0	1	0	0	1
21	1	0	1	0	1	1
22	1	0	1	1	0	1
23	1	0	1	1	1	1
24	1	1	0	0	0	1
25	1	1	0	0	1	1
26	1	1	0	1	0	0
27	1	1	0	1	1	0
28	1	1	1	0	0	0
29	1	1	1	0	1	1
30	1	1	1	1	0	1
31	1	1	1	1	1	1





$$\underbrace{\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad}_{A}$$

Producto de sumas

$$\text{F(A,B,C,D,E)}= (\underbrace{A}_{X}+\underbrace{(C+D+E)(B+\overline{C}+\overline{D}+E)(\overline{B}+\overline{C}+\overline{D}+\overline{E})(\overline{B}+C+D)}_{Z})\cdot$$
$$(\underbrace{\overline{A}}_{\overline{X}}+\underbrace{(B+C+D+E)(\overline{B}+\overline{C}+D+E)(\overline{B}+C+\overline{D})}_{Y})$$

Suma de productos

$$\text{F(A,B,C,D,E)}= \underbrace{\overline{A}}_{\overline{X}}\underbrace{(\overline{C}D+\overline{B}E+C\overline{D}+BD\overline{E})}_{V}+\underbrace{A}_{X}\underbrace{(\overline{D}E+\overline{B}C+B\overline{CD}+\overline{B}D+CD)}_{W}$$

$$XY+\overline{X}Z=(X+V)(\overline{X}+W)\rightarrow(X+Z)(\overline{X}+Y)=(X+V)(\overline{X}+W)$$

$$Z=V\rightarrow\overline{Z}V=0, Y=W$$

$$\rightarrow\underbrace{(C+D+E)(B+\overline{C}+\overline{D}+E)(\overline{B}+\overline{C}+\overline{D}+\overline{E})(\overline{B}+C+D)}_{Z}=\underbrace{(\overline{C}D+\overline{B}E+C\overline{D}+BD\overline{E})}_{V}$$

Ley de Morgan en Z

$$\overline{Z}=\overline{(C+D+E)(B+\overline{C}+\overline{D}+E)(\overline{B}+\overline{C}+\overline{D}+\overline{E})(\overline{B}+C+D)}$$

$$=\overline{CDE}+\overline{B}CD\overline{E}+BCDE+B\overline{CD}$$

$$\overline{Z}V=(\overline{CDE}+\overline{B}CD\overline{E}+BCDE+B\overline{CD})\cdot(\overline{C}D+\overline{B}E+C\overline{D}+BD\overline{E})$$

$$=\cancel{\overline{CDE}CD}+\cancel{\overline{CDE}BE}+\cancel{\overline{CDE}CD}+\cancel{\overline{CDE}BD\overline{E}}+\cancel{\overline{B}CD\overline{E}CD}+\cancel{\overline{B}CD\overline{E}BE}+\cancel{\overline{B}CD\overline{E}CD}+$$
$$\cancel{\overline{B}CDBD\overline{E}}+\cancel{\overline{BCDE}CD}+\cancel{\overline{BCDE}BE}+\cancel{\overline{BCDE}CD}+\cancel{\overline{BCDE}BD\overline{E}}+\cancel{\overline{BCDC}D}+\cancel{\overline{BCDB}E}+$$
$$\cancel{\overline{BCDC}D}+\cancel{\overline{BCDB}D\overline{E}}=0$$

Por $X\overline{X}=0$, $\overline{Z}V=0\rightarrow Z=V$

- $Y=W\rightarrow\overline{Y}\cdot W=0$

$$\rightarrow\underbrace{(B+C+D+E)(\overline{B}+\overline{C}+D+E)(\overline{B}+C+\overline{D})}_{y}=\underbrace{(\overline{D}E+\overline{B}C+B\overline{CD}+\overline{B}D+CD)}_{w}$$

Ley de Morgan en Y:

$\overline{Y} = \overline{(B+C+D+E)(\overline{B}+\overline{C}+D+E)(\overline{B}+C+\overline{D})} = \overline{BCDE} + BC\overline{DE} + B\overline{C}D$

$\overline{Y} \cdot W = (\overline{BCDE} + BC\overline{DE} + B\overline{C}D)(\overline{D}E + \overline{B}C + B\overline{CD} + \overline{B}D + CD)$

$= \overline{BCDED}E + \overline{BCDEB}C + \overline{BCDE}B\overline{CD} + \overline{BCDE}CD + BC\overline{DED}E + BC\overline{DEB}C + BC\overline{DE}B\overline{CD} +$
$BC\overline{DE}CD + B\overline{C}D\overline{D}E + B\overline{C}D\overline{B}C + B\overline{C}DB\overline{CD} + B\overline{C}D\overline{B}D + B\overline{C}DCD = 0$
por $X \cdot X = 0$ por lo tanto $\overline{Y} \cdot V = 0 \rightarrow Y = W$

Entonces $Y = W \wedge Z = W$

Punto 6

F(A,B,C,D) = $\sum m(1,2,3,7,10,11,13)$, d(A,B,C,D) = $\sum m(4,6,15)$

	A	B	C	D	Y
0	0	0	0	0	0
1	0	0	0	1	1
2	0	0	1	0	1
3	0	0	1	1	1
4	0	1	0	0	x
5	0	1	0	1	0
6	0	1	1	0	x
7	0	1	1	1	1
8	1	0	0	0	0
9	1	0	0	1	0
10	1	0	1	0	1
11	1	0	1	1	1
12	1	1	0	0	0
13	1	1	0	1	1
14	1	1	1	0	0
15	1	1	1	1	x

AB \ CD	00	01	11	10
00	0	1	1	1
01	x	0	1	x
11	0	1	x	0
10	0	0	1	1

Grupos

$(2,3,10,11)$	$\overline{B}C$
$(2,3,6,7)$	$\overline{A}C$
$(1,3)$	$\overline{A}\overline{B}D$
$(13,15)$	ABD

Suma de productos

F(A,B,C,D)= $\overline{B}C + \overline{A}C + \overline{A}\overline{B}D + ABD$