JULIÁN GARRIDO ARANA.

2.15 Sean $f_i : \mathbb{B}^3 \to \mathbb{B}$ las funciones booleanas de tres variables con $i = 63, 82, 103, 104, 116, 126, 143, 172, 188, 217$ y 231. Halla:

→ Sus formas canónicas disyuntivas y conjuntivas

→ Sus implicantes primos mediante Quine, consensos, FCC y Karnaugh.

→ Sus formas canónicas disyuntivas reducidas.

→ Sus formas no simplificables mediante Karnaugh y Petrick.

63 = 00111111

82 = 01010010

103 = 01100111

104 = 01101000

116 = 01110100

126 = 01111110

143 = 10001111

172 = 10101100

188 = 10111100

217 = 11011001

231 = 11100111.

→ Formas canónicas disyuntivas (suma minterm).

$f_{63} = m_2 + m_3 + m_4 + m_5 + m_6 + m_7 = \bar{x}y\bar{z} + \bar{x}yz + x\bar{y}\bar{z} + x\bar{y}z + xy\bar{z} + xyz$

$f_{82} = m_1 + m_3 + m_6 = \bar{x}\bar{y}z + \bar{x}yz + xy\bar{z}$

$f_{103} = m_1 + m_2 + m_5 + m_6 + m_7 = \bar{x}\bar{y}z + \bar{x}y\bar{z} + x\bar{y}z + xy\bar{z} + xyz$

$f_{104} = m_1 + m_2 + m_4 = \bar{x}\bar{y}z + \bar{x}y\bar{z} + x\bar{y}\bar{z}$

$f_{116} = m_1 + m_2 + m_3 + m_5 = \bar{x}\bar{y}z + \bar{x}y\bar{z} + \bar{x}yz + x\bar{y}z$

$f_{126} = m_1 + m_2 + m_3 + m_4 + m_5 + m_6 = \bar{x}\bar{y}z + \bar{x}y\bar{z} + \bar{x}yz + x\bar{y}\bar{z} + x\bar{y}z + xy\bar{z}$

$f_{143} = m_0 + m_4 + m_5 + m_6 + m_7 = \bar{x}\bar{y}\bar{z} + x\bar{y}\bar{z} + x\bar{y}z + xy\bar{z} + xyz.$

$f_{172} = m_0 + m_2 + m_4 + m_5 = \bar{x}\bar{y}\bar{z} + \bar{x}y\bar{z} + x\bar{y}\bar{z} + x\bar{y}z.$

$f_{188} = m_0 + m_2 + m_3 + m_4 + m_5 = \bar{x}\bar{y}\bar{z} + \bar{x}y\bar{z} + \bar{x}yz + x\bar{y}\bar{z} + x\bar{y}z.$

$f_{217} = m_0 + m_1 + m_3 + m_4 + m_7 = \bar{x}\bar{y}\bar{z} + \bar{x}\bar{y}z + \bar{x}yz + x\bar{y}\bar{z} + xyz.$

$f_{231} = m_0 + m_1 + m_2 + m_5 + m_6 + m_7 = \bar{x}\bar{y}\bar{z} + \bar{x}\bar{y}z + \bar{x}y\bar{z} + x\bar{y}z + xy\bar{z} + xyz.$

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→ Formas canónicas conjuntivas (prod. maxterm).

$f_{63} = M_0 \cdot M_1 = (x+y+z)\cdot(x+y+\bar{z})$

$f_{82} = M_0 \cdot M_2 \cdot M_4 \cdot M_5 \cdot M_7 = (x+y+z)\cdot(x+\bar{y}+z)\cdot(\bar{x}+y+z)\cdot(\bar{x}+y+\bar{z})\cdot(\bar{x}+\bar{y}+\bar{z})$

$f_{103} = M_0 \cdot M_3 \cdot M_4 = (x+y+z)\cdot(x+\bar{y}+\bar{z})\cdot(\bar{x}+y+z)$.

$f_{104} = M_0 \cdot M_3 \cdot M_5 \cdot M_6 \cdot M_7 = (x+y+z)\cdot(x+\bar{y}+\bar{z})\cdot(\bar{x}+y+\bar{z})\cdot(\bar{x}+\bar{y}+z)\cdot(\bar{x}+\bar{y}+\bar{z})$

$f_{116} = M_0 \cdot M_4 \cdot M_6 \cdot M_7 = (x+y+z)\cdot(\bar{x}+y+z)\cdot(\bar{x}+\bar{y}+z)\cdot(\bar{x}+\bar{y}+\bar{z})$.

$f_{126} = M_0 \cdot M_7 = (x+y+z)\cdot(\bar{x}+\bar{y}+\bar{z})$.

$f_{143} = M_1 \cdot M_2 \cdot M_3 = (x+y+\bar{z})\cdot(x+\bar{y}+z)\cdot(x+\bar{y}+\bar{z})$

$f_{172} = M_1 \cdot M_3 \cdot M_6 \cdot M_7 = (x+y+\bar{z})\cdot(x+\bar{y}+\bar{z})\cdot(\bar{x}+\bar{y}+z)\cdot(\bar{x}+\bar{y}+\bar{z})$

$f_{188} = M_1 \cdot M_6 \cdot M_7 = (x+y+\bar{z})\cdot(\bar{x}+\bar{y}+z)\cdot(\bar{x}+\bar{y}+\bar{z})$

$f_{217} = M_2 \cdot M_5 \cdot M_6 = (x+\bar{y}+z)\cdot(\bar{x}+y+\bar{z})\cdot(\bar{x}+\bar{y}+z)$.

$f_{231} = M_3 \cdot M_4 = (x+\bar{y}+\bar{z})\cdot(\bar{x}+y+z)$

→ Implicantes primos. → Para que el ejercicio no sea demasiado extenso y se vea por entendido el procedimiento haremos cada una de ellas con un método.

Quine:

f_{63})

xyz	1 1 1 X	1 1 – X	1 – –
$xy\bar{z}$	1 1 0 X	1 – 1 X	– 1 –
$x\bar{y}z$	1 0 1 X	– 1 1 X	
$\bar{x}yz$	0 1 1 X	1 – 0 X	
$x\bar{y}\bar{z}$	1 0 0 X	– 1 0 X	
$\bar{x}y\bar{z}$	0 1 0 X	1 0 – X	
		0 1 – X	

$\Rightarrow f_{63}(x,y,z) = x + y$

Implicantes primos = $\{x, y\}$.

f_{82})

$\bar{x}yz$	0 1 1 X	0 – 1
$xy\bar{z}$	1 1 0	
$\bar{x}\bar{y}z$	0 0 1 X	

$\Rightarrow f_{82}(x,y,z) = xy\bar{z} + \bar{x}z$

Implicantes. Primos = $\{xy\bar{z}, \bar{x}z\}$

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$f_{103})$

xyz	111 X	11-
$xy\bar{z}$	110 X	1-1
$x\bar{y}z$	101 X	-01
$\bar{x}y\bar{z}$	010 X	-10
$\bar{x}\bar{y}z$	001 X	

$\Rightarrow f_{103}(x,y,z) = xy + xz + \bar{y}z + y\bar{z}$

$I.P = \{xy,\ xz,\ \bar{y}z,\ y\bar{z}\}$

FCC:

$f_{126}) = M_0 \cdot M_7 = (x+y+z)\cdot(\bar{x}+\bar{y}+\bar{z}) = \cancel{\bar{x}x + \bar{x}y + \bar{x}z +}$

$= \cancel{\bar{x}x} + \bar{x}y + \bar{x}z + \bar{y}\cdot x + \cancel{\bar{y}y} + z\cdot\bar{y} + \bar{z}x + \bar{z}y + \cancel{\bar{z}z} =$

$= \bar{x}y + \bar{x}z + \bar{y}\cdot x + \bar{y}\cdot z + x\bar{z} + y\bar{z}$

$f_{217})(x,y,z) = M_2 \cdot M_5 \cdot M_6 = (x+\bar{y}+z)\cdot(\bar{x}+y+\bar{z})\cdot(\bar{x}+\bar{y}+\bar{z}) =$

$(\cancel{\bar{x}\cdot x} + \bar{x}\cdot\bar{y} + \bar{x}\cdot z + xy + \cancel{\bar{y}y} + zy + x\bar{z} + \bar{y}\bar{z} + \cancel{z\bar{z}})(\bar{x}+\bar{y}+\bar{z}) =$

$= (\bar{x}\cdot\bar{y} + \bar{x}\cdot z + xy + yz + x\bar{z} + \bar{y}\bar{z})(\bar{x}+\bar{y}+\bar{z}) =$

$= (\bar{x}\cdot\bar{y} + \bar{x}\cdot z + \cancel{\bar{x}\cdot yz} + \cancel{\bar{x}\bar{y}\bar{z}} + \cancel{\bar{x}\bar{y}\cdot z} + x\bar{y}\bar{z} + \bar{y}z + \cancel{\bar{x}\bar{y}\bar{z}} + \cancel{xy\bar{z}} + x\bar{z} +$

$+ \bar{y}\bar{z}) = \bar{x}\cdot\bar{y} + \bar{x}\cdot z + \bar{y}z + x\bar{z} + \bar{y}\bar{z} =$

$= \bar{x}\bar{y} + \bar{x}\cdot z + \bar{y}z + x\bar{z} + \bar{y}\bar{z} + \bar{y} =$

$= \bar{x}\cdot z + x\bar{z} + \bar{y}$

$f_{231})(x,y,z) = M_3 \cdot M_4 = (x+\bar{y}+\bar{z})\cdot(\bar{x}+y+z) =$

$= \cancel{x\bar{x}} + \bar{x}\bar{y} + \bar{x}\bar{z} + xy + \cancel{y\bar{y}} + y\bar{z} + xz + \bar{y}z + \cancel{\bar{z}z} =$

$= xy + \bar{x}\bar{y} + xz + \bar{x}\bar{z} + y\bar{z} + \bar{y}z.$

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Consensos:

$f(104) = m_1 + m_2 + m_4 = \bar{x}\bar{y}z + \bar{x}y\bar{z} + x\bar{y}\bar{z} =$

$= \bar{x}\bar{y}z + \bar{x}y\bar{z} + x\bar{y}\bar{z}$. (No consigo simplificar).

Aplico karnaugh

z \ xy	00	01	11	10
0		1		1
1	1			

→ efectivamente ya está en forma reducida.

$f(116) = m_1 + m_2 + m_3 + m_5 = \bar{x}\bar{y}z + \bar{x}y\bar{z} + \bar{x}yz + x\bar{y}z =$

$= \bar{x}\bar{y}z + \bar{x}y\bar{z} + \bar{x}yz + x\bar{y}z + \bar{x}y =$

$= \bar{x}\bar{y}z + x\bar{y}z + \bar{x}y = \bar{x}\bar{y}z + x\bar{y}z + \bar{x}y + \bar{x}z =$

$= x\bar{y}z + \bar{x}y + \bar{x}z = x\bar{y}z + \bar{x}y + \bar{x}z + \bar{y}z =$

$= \bar{x}y + \bar{x}z + \bar{y}z$

Karnaugh

$f(143)(x,y,z) = m_0 + m_4 + m_5 + m_6 + m_7 = \bar{x}\bar{y}\bar{z} + x\bar{y}\bar{z} + x\bar{y}z + xy\bar{z} + xyz$

z \ xy	00	01	11	10
0	1		1	1
1			1	1

$\Rightarrow f(143)(x,y,z) = x + \bar{y}\bar{z}$ F. reducida

$f(188)(x,y,z) = \bar{x}\bar{y}\bar{z} + \bar{x}y\bar{z} + \bar{x}yz + x\bar{y}\bar{z} + x\bar{y}z$

z \ xy	00	01	11	10
0	1	1		1
1		1		1

$\Rightarrow f(188)(x,y,z) = \bar{x}\bar{z} + \bar{x}y + x\bar{y}$ F. reducida

$f(188)(x,y,z) = \bar{x}\bar{z} + \bar{x}y + x\bar{y} + \bar{y}\bar{z}$.

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$f(172) = \bar{x}\bar{y}\bar{z} + \bar{x}y\bar{z} + x\bar{y}\bar{z} + x\bar{y}z$

z \ xy	00	01	11	10
0	1	1		1
1				1

$\Rightarrow f(172)(x,y,z) = \bar{x}\bar{z} + x\bar{y}$ form. reducida

$f(172)(x,y,z) = \bar{x}\bar{z} + x\bar{y} + \bar{y}\bar{z}$ (I.P.).

→ Sus formas canónicas disyuntivas reducidas las acabamos de obtener en este apartado anterior.

→ <u>Formas no simplificables</u> { Karnaugh, Petrick.

Mediante Karnaugh ya hemos obtenido las de $f(104)$, $f(143)$, $f(188)$ y $f(172)$. Llayamos también así $f(126)$, $f(217)$, $f(231)$ y $f(116)$:

<u>$f(126)$</u>

z \ xy	00	01	11	10
0		1	1	1
1	1	1		1

$\Rightarrow f(126)(x,y,z) = \bar{x}z + y\bar{z} + x\bar{y}$

<u>$f(116)$</u>

z \ xy	00	01	11	10
0		1		
1	1	1		1

$\Rightarrow f(116)(x,y,z) = \bar{x}y + \bar{y}z$

<u>$f(217)$</u>

z \ xy	00	01	11	10
0	1			1
1	1	1	1	

$\Rightarrow f(217)(x,y,z) = \bar{y}\bar{z} + yz + \bar{x}\bar{y}$

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f231)

z \ xy	00	01	11	10
0	1	1	1	
1	1		1	1

$\Rightarrow f231)(x,y,z) = \bar{x}\bar{y} + y\bar{z} + xz$

→ Calculamos las formas no simplificables de f63), f82) y f83) por Petrick y Quine.

f63).

	m_2 $\bar{x}y\bar{z}$	m_3 $\bar{x}yz$	m_4 $x\bar{y}\bar{z}$	m_5 $x\bar{y}z$	m_6 $xy\bar{z}$	m_7 xyz
x			X	X	X	X
y	X	X			X	X

Tanto x como y son monomios fundamentales para la exp. de f. → implicantes primos esenciales.

→ $f63)(x,y,z) = x+y.$

f82)

		m_1 $\bar{x}\bar{y}z$	m_3 $\bar{x}yz$	m_6 $xy\bar{z}$
A	$xy\bar{z}$			X
B	$\bar{x}z$	X	X	

Ambos i. primos esenciales.

$m_1 \equiv B$
$m_2 \equiv B$
$m_3 \equiv A$

$\Rightarrow A \cdot BB \Rightarrow A + B$

$\| $
AB

$f82)(x,y,z) = xy\bar{z} + \bar{x}z.$

f103) (x,y,z) =

	m_1 $\bar{x}\bar{y}z$	m_2 $\bar{x}y\bar{z}$	m_5 $x\bar{y}z$	m_6 $xy\bar{z}$	m_7 xyz
$x \cdot y$				X	X
xz			X		X
$\bar{y}z$	X		X		
$y\bar{z}$		X		X	

$\left.\begin{matrix}\bar{y}z \\ y\bar{z}\end{matrix}\right\}$ i. Primos esenciales

elegir entre $\left\{\begin{matrix}xy \\ xz.\end{matrix}\right.$

Formas óptimas $\left\{\begin{array}{l} \to f103)(x,y,z) = xy + y\bar{z} + \bar{y}z \\ \to f103)(x,y,z) = xz + y\bar{z} + \bar{y}z. \end{array}\right.$

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2.16 Sean $f_i : \mathbb{B}^4 \to \mathbb{B}$ las funciones booleanas de 4 variables con $i = 13244$, 43944 y 62640. Halla:

a) → Sus formas canónicas disyuntivas y conjuntivas

b) → sus implicantes primos.

c) → sus formas canónicas disyuntivas reducidas.

d) → sus formas no simplificables.

① = 13244 = 0011001110111100

② = 43944 = 1010101110101000

③ = 62640 = 1111010010110000

a) FORMAS CANÓNICAS DISYUNTIVAS:

$f_{①}(x,y,z,t) = m_2 + m_3 + m_6 + m_7 + m_8 + m_{10} + m_{11} + m_{12} + m_{13} =$

$= \bar x\bar y z\bar t + \bar x\bar y z t + \bar x y z\bar t + \bar x y z t + x\bar y\bar z\bar t + x\bar y z\bar t + x\bar y z t + x y\bar z\bar t + x y\bar z t.$

$f_{②}(x,y,z,t) = m_0 + m_2 + m_4 + m_6 + m_7 + m_8 + m_{10} + m_{12} =$

$= \bar x\bar y\bar z\bar t + \bar x\bar y z\bar t + \bar x y\bar z\bar t + \bar x y z\bar t + \bar x y z t + x\bar y\bar z\bar t + x\bar y z\bar t + x y\bar z\bar t.$

$f_{③}(x,y,z,t) = m_0 + m_1 + m_2 + m_3 + m_5 + m_8 + m_{10} + m_{11} =$

$= \bar x\bar y\bar z\bar t + \bar x\bar y\bar z t + \bar x\bar y z\bar t + \bar x\bar y z t + \bar x y\bar z t + x\bar y\bar z\bar t + x\bar y z\bar t + x\bar y z t.$

F.C. CONJUNTIVAS:

$f_{①}(x,y,z,t) = M_0 \cdot M_1 \cdot M_4 \cdot M_5 \cdot M_9 \cdot M_{14} \cdot M_{15} =$

$= (x+y+z+t)(x+y+z+\bar t)(x+\bar y+z+t)(x+\bar y+z+\bar t)(\bar x+y+z+\bar t)(\bar x+\bar y+\bar z+t)(\bar x+\bar y+\bar z+\bar t)$

$f_{②}(x,y,z,t) = M_1 \cdot M_3 \cdot M_5 \cdot M_9 \cdot M_{11} \cdot M_{13} \cdot M_{14} \cdot M_{15} =$

$= (x+y+z+\bar t)(x+y+\bar z+\bar t)(x+\bar y+z+\bar t)(\bar x+y+z+\bar t)(\bar x+y+\bar z+\bar t)(\bar x+\bar y+z+\bar t)(\bar x+\bar y+\bar z+t)(\bar x+\bar y+\bar z+\bar t)$

$f_{③}(x,y,z,t) = M_4 \cdot M_6 \cdot M_7 \cdot M_9 \cdot M_{12} \cdot M_{13} \cdot M_{14} \cdot M_{15} =$

$= (x+\bar y+z+t)(x+\bar y+\bar z+t)(x+\bar y+\bar z+\bar t)(\bar x+y+z+\bar t)(\bar x+\bar y+z+t)(\bar x+\bar y+z+\bar t)(\bar x+\bar y+\bar z+t)(\bar x+\bar y+\bar z+\bar t)$

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b) IMPLICANTES PRIMOS → Aplicamos Quine

f_1:

$xy\bar{z}t$	1101 X	110-	
$\bar{x}yzt$	0111 X	0-11	
$x\bar{y}zt$	1011 X	011-	
		101-	
$\bar{x}\bar{y}zt$	0011 X	0-11	
$\bar{x}yz\bar{t}$	0110 X	011-	
$x\bar{y}z\bar{t}$	1010 X	-011	
$xy\bar{z}\bar{t}$	1100 X	101-	
$\bar{x}yzt$	0111 X		
$x\bar{y}zt$	1011 X		

$\bar{x}yzt$	0111 X	0-11 X	0-1-
$x\bar{y}zt$	1011 X	011- X	-01-
$xy\bar{z}t$	1101 X	101- X	
		110-	
$\bar{x}\bar{y}zt$	0011 X	001- X	
$\bar{x}yz\bar{t}$	0110 X	0-10 X	
$x\bar{y}z\bar{t}$	1010 X	-010	
$xy\bar{z}\bar{t}$	1100 X	10-0	
		1-00	
$\bar{x}\bar{y}z\bar{t}$	0010 X		
$x\bar{y}\bar{z}\bar{t}$	1000 X		

$= xy\bar{z} + \bar{y}z\bar{t} + x\bar{y}\bar{t} + x\bar{z}\bar{t} +$
$+ \bar{x}z + \bar{y}z.$

↑

FORMA CANÓNICA REDUCIDA e IMPLICANTES PRIMOS.

f_2:

$\bar{x}yzt$	0111 X	011-	0--0
$\bar{x}yz\bar{t}$	0110 X	0-10 X	-0-0
$x\bar{y}z\bar{t}$	1010 X	01-0 X	--00
$xy\bar{z}\bar{t}$	1100 X	-010 X	
$\bar{x}\bar{y}z\bar{t}$	0010 X	10-0 X	
$\bar{x}y\bar{z}\bar{t}$	0100 X	-100 X	
$x\bar{y}\bar{z}\bar{t}$	1000 X	1-00 X	
$\bar{x}\bar{y}\bar{z}\bar{t}$	0000 X	00-0 X	
		0-00 X	
		-000 X	

$= \bar{x}yz + \bar{x}\bar{t} + \bar{y}\bar{t} + \bar{z}\bar{t}$

↑

Forma Canónica Reducida e Implicantes primos.

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$f_{③}$:

zt \ xy	00	01	11	10
00	1			1
01	1	1		
11	1			1
10	1			1

$\Rightarrow f_{③} = \bar{x}\bar{y} + \bar{y}z\bar{t} + \bar{x}\bar{z}t + x\bar{y}z$

FORMA REDUCIDA (CANÓNICA) e Implicantes primos. y Forma no simplificable.

c) → Ya hemos hallado en el paso anterior las formas canónicas disyuntivas reducidas.

d) →

$f_{①}$:

	m_2 $\bar{x}\bar{y}z\bar{t}$	m_3 $\bar{x}\bar{y}zt$	m_6 $\bar{x}yz\bar{t}$	m_7 $\bar{x}yzt$	m_8 $x\bar{y}\bar{z}\bar{t}$	m_{10} $x\bar{y}z\bar{t}$	m_{11} $x\bar{y}zt$	m_{12} $xy\bar{z}\bar{t}$	m_{13} $xy\bar{z}t$
$xy\bar{z}$								X	X
$x\bar{y}\bar{t}$					X	X			
$x\bar{z}\bar{t}$					X			X	
$\bar{y}z\bar{t}$	X					X			
$\bar{x}z$	X	X	X	X					
$\bar{y}z$	X	X				X	X		

Vemos que son implic. primos esenciales: $\bar{x}z$, $\bar{y}z$, $xy\bar{z}$

El único minterm que no queda representado por alguno de estos términos anteriores es m_8. Luego la forma no simplificable de $f_{①}$ queda:

$$f_{①}(x,y,z,t) = \begin{cases} \bar{x}z + \bar{y}z + xy\bar{z} + x\bar{y}\bar{t} \\ \bar{x}z + \bar{y}z + xy\bar{z} + x\bar{z}\bar{t} \end{cases}$$

(2 posibles F.N.S.)

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f_2:

		m_0 $\bar{x}\bar{y}\bar{z}\bar{t}$	m_2 $\bar{x}\bar{y}z\bar{t}$	m_4 $\bar{x}y\bar{z}\bar{t}$	m_6 $\bar{x}yz\bar{t}$	m_7 $\bar{x}yzt$	m_8 $x\bar{y}\bar{z}\bar{t}$	m_{10} $x\bar{y}z\bar{t}$	m_{12} $xy\bar{z}\bar{t}$
A	$\bar{x}yz$				X	X			
B	$\bar{x}\bar{t}$	X	X	X	X				
C	$\bar{y}\bar{t}$	X	X				X	X	
D	$\bar{z}\bar{t}$	X		X			X		X

→ I. Primos esenciales = $\bar{x}yz$, $\bar{y}\bar{t}$, $\bar{z}\bar{t}$.

Todos los minterm ~~son~~ contienen al menos alguno de estos términos (I.P.E) Luego la forma no simplif. queda: $f_2(x,y,z,t) = \bar{x}yz + \bar{y}\bar{t} + \bar{z}\bar{t}$.

Comprobamos con Petrick:

$m_0 = B + C + D$ $\quad m_6 = A + B$ $\quad m_{10} = C$

$m_2 = B + C$ $\quad m_7 = A$ $\quad m_{12} = D$

$m_4 = B + D$ $\quad m_8 = C + D$

$f = A + C + D$. m_0 ✓ m_2 ✓ m_4 ✓ m_6 ✓ m_7 ✓ m_8 ✓ m_{10} ✓ m_{12} ✓

f_3: (comprobación).

	m_0 $\bar{x}\bar{y}\bar{z}\bar{t}$	m_1 $\bar{x}\bar{y}\bar{z}t$	m_2 $\bar{x}\bar{y}z\bar{t}$	m_3 $\bar{x}\bar{y}zt$	m_5 $\bar{x}y\bar{z}t$	m_8 $x\bar{y}\bar{z}\bar{t}$	m_{10} $x\bar{y}z\bar{t}$	m_{11} $x\bar{y}zt$
$x\bar{y}z$							X	X
$\bar{x}\bar{z}t$		X			X			
$\bar{y}\bar{z}\bar{t}$	X					X		
$\bar{x}\bar{y}$	X	X	X	X				

→ I. Primos esenciales = $x\bar{y}z$, $\bar{x}\bar{z}t$, $\bar{y}\bar{z}\bar{t}$, $\bar{x}\bar{y}$.

Efectivamente, la forma no simplificable de f_3 es:

$$f_3(x,y,z,t) = x\bar{y}z + \bar{x}\bar{z}t + \bar{y}\bar{z}\bar{t} + \bar{x}\bar{y}$$