Laboratório 3: (resolução)

Exercício 10: Simplificação de funções através de mapas de Karnaugh

a) Para cada uma das funções abaixo, apresente a sua representação complementar recorrendo a listas de mintermos ou maxtermos, conforme a situação:

$$f_1(A,B,C) = \sum(2,3,4,5) = \prod(0,1,6,7)$$

$$f_2(C,B,A) = \prod(0,2,6,7) = \sum(1,3,4,5)$$

$$f_3(A,B,C,D) = \sum(1,4,5,6,12,14,15) = \prod(0,2,3,7,8,9,10,11,13)$$

$$f_4(A,B,C,D) = \sum(2,3,10,11,12,13,14,15) = \prod(0,1,4,5,6,7,8,9)$$

$$f_5(X,Y,W,Z) = \prod(0,5,7,13,14,15) = \sum(1,2,3,4,6,8,9,10,11,12)$$

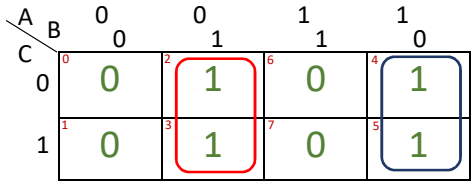
$$f_6(D,C,B,A) = \prod(0,2,5,7,8,10,13,15) = \sum(1,3,4,6,9,11,12,14)$$

$$f_7(A,B,C,D) = \sum(2,3,4,5,10,11) + d(0,1,9) = \prod(6,7,8,12,13,14,15) + d(0,1,9)$$

$$f_8(X,Y,W,Z) = \prod(0,1,6,7) + d(2,3,8,10,14,15) = \sum(4,5,9,11,12,13) + d(2,3,8,10,14,15)$$

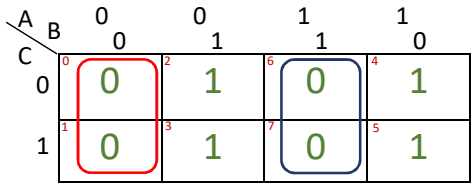
b) Simplifique as funções recorrendo a Mapas de *Karnaugh* (utilizando soma de produtos e produto de somas para cada alínea)

$f_1(A,B,C) = \sum(2,3,4,5)$

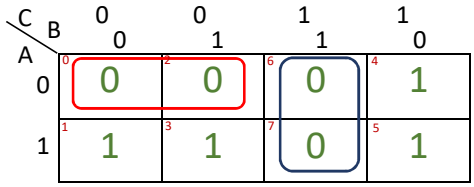


$f_1(A,B,C) = \overline{A}.B + A.\overline{B}$

$f_1(A,B,C) = (\bar{A} + \bar{B}).(A + B)$

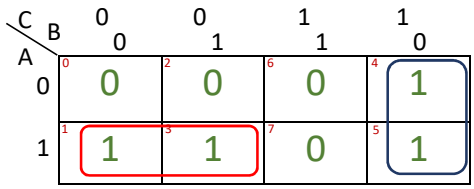


$f_2(C,B,A) = \prod(0,2,6,7)$

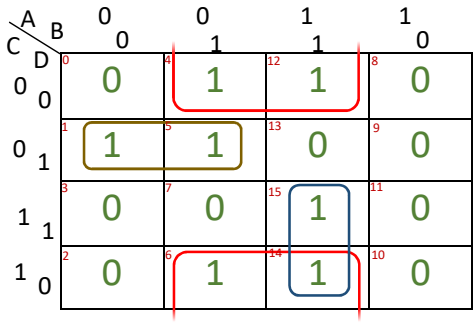


$f_2(C,B,A) = (\overline{C} + \overline{B}).(C + A)$

$f_2(C,B,A) = C.\bar{B} + A.\bar{C}$

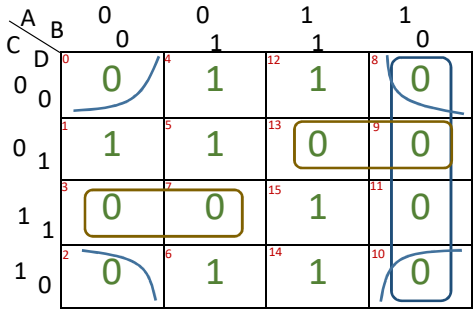


$$f_3(A,B,C,D) = \sum(1,4,5,6,12,14,15)$$

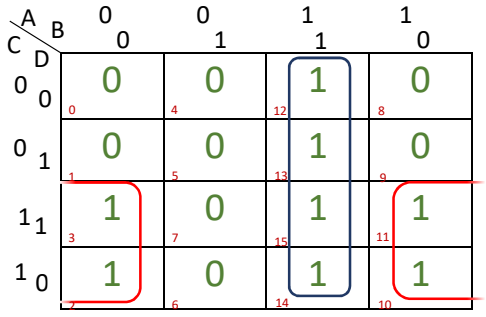


$$f_3(A,B,C,D) = B.\overline{D} + \overline{A}.\overline{C}.D + A.B.C$$

$$f_3(A,B,C,D) = (\bar{A} + B).(\bar{A} + C + \bar{D}).(A + \bar{C} + \bar{D}).(D + B)$$

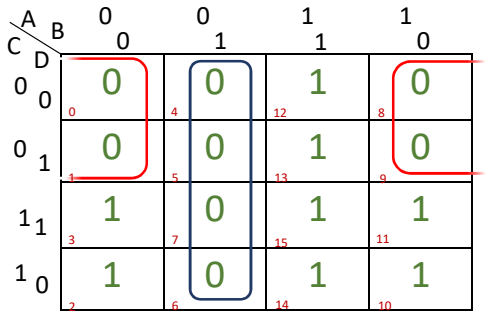


$$f_4(A,B,C,D) = \sum(2,3,10,11,12,13,14,15)$$

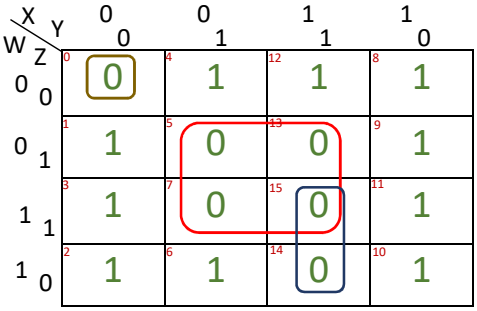


$$f_4(A,B,C,D) = A.B + \bar{B}.C$$

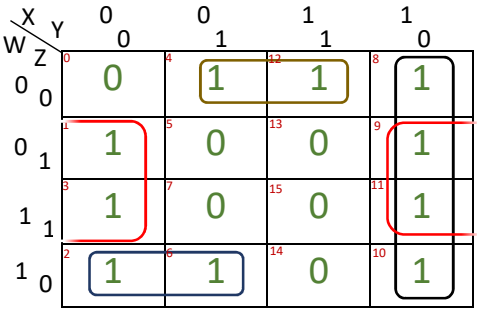
$$f_4(A,B,C,D) = (A + \bar{B}).(B + C)$$



$$f_5(X,Y,W,Z) = \prod(0,5,7,13,14,15)$$

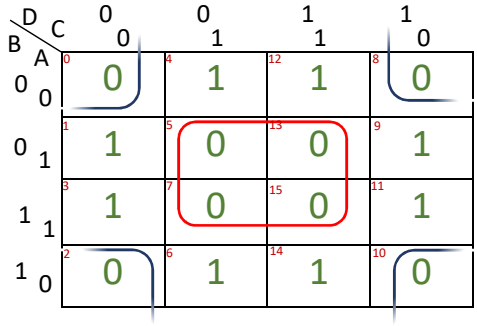


$$f_5(X,Y,W,Z) = (X+Y+W+Z).(\overline{Y}+\overline{Z}).(\overline{X}+\overline{Y}+\overline{W})$$

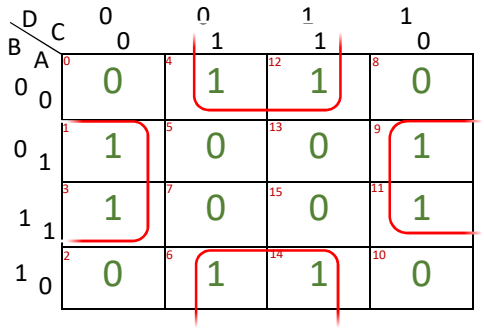


$$f_5(X,Y,W,Z) = X.\bar{Y} + \bar{Y}.Z + \bar{X}.W.\bar{Z} + Y.\overline{W}.\bar{Z}$$

$$f_6(D,C,B,A) = \prod(0,2,5,7,8,10,13,15)$$

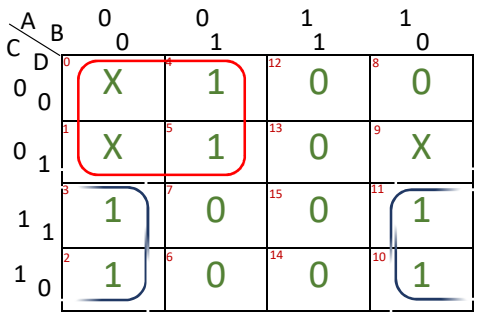


$$f_6(D,C,B,A) = (\overline{C}+\overline{A}).(A+C)$$

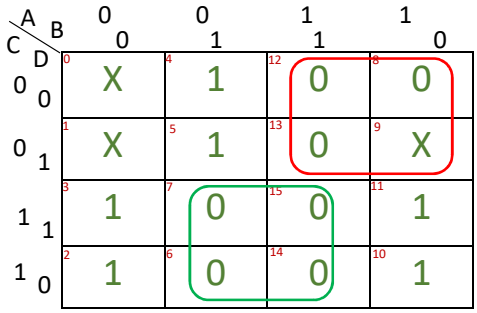


$$f_6(D,C,B,A) = C.\bar{A} + A.\bar{C}$$

$$f_7(A,B,C,D) = \sum(2,3,4,5,10,11) + d(0,1,9)$$

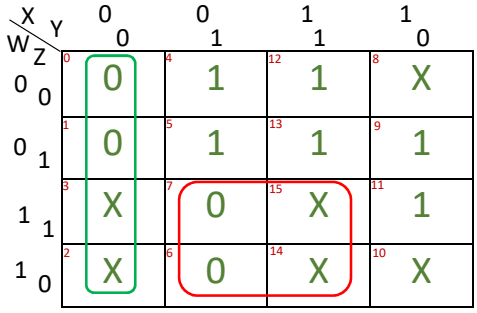


$$f_7(A,B,C,D) = \bar{B}.C + \bar{A}.\bar{C}$$

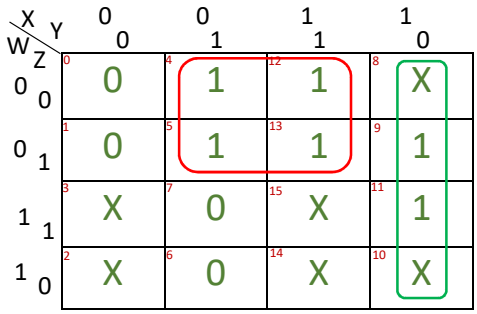


$$f_7(A,B,C,D) = (\overline{A} + C).(\bar{B} + \bar{C})$$

$$f_8(X,Y,W,Z) = \prod(0,1,6,7) + d(2,3,8,10,14,15)$$



$$f_8(X,Y,W,Z) = (X + Y).(\bar{Y} + \bar{W})$$



$$f_8(X,Y,W,Z) = Y.\bar{W} + X.\bar{Y}$$

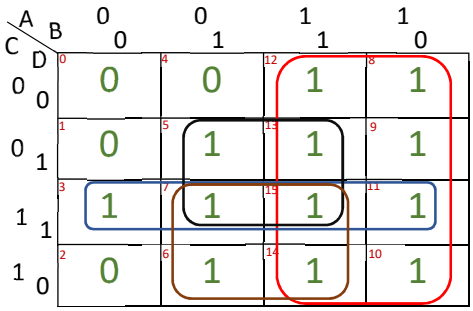
Exercício 11: Um sistema de alarme

Considere que se pretende realizar um sistema para utilizar numa empresa de inspeção de veículos, em que, com base na receção de quatro variáveis booleanas (ABCD, detete as situações em que o carro não pode circular. Considera-se que a variável A está associada a uma deficiência grave, enquanto as três restantes entradas B, C e D, estão associadas a deficiências menores.

a) Apresente a tabela de verdade da função que seja ativada sempre que exista pelo menos uma deficiência grave ou duas menores.

b) Recorra a mapas de Karnaugh para encontrar a expressão simplificada

A	B	C	D	F
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	1
1	0	1	0	1
1	0	1	1	1
1	1	0	0	1
1	1	0	1	1
1	1	1	0	1
1	1	1	1	1



$$F(A,B,C,D) = A + B.D + B.C + C.D$$

c) Apresente o diagrama lógico (esquemático).