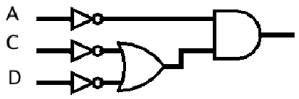
Sistemas Digitais

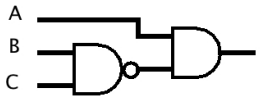
Representação e simplificação de funções – soluções

Observação: Na extracção das expressões dos mapas de Karnaugh, podem existir outras soluções diferentes da apresentada igualmente válidas – basta que sejam feitos outros agrupamentos (ver slides 13 e 14 das teóricas)

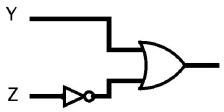
1. (a) $\overline{A}\ (\overline{C} + \overline{D})$



(b) $A\ \overline{B\ C}$



(c) $Y + \overline{Z}$



2. (a) $f(A,B,C,D) = (A\ \overline{B})\ (\overline{B}\ C + A\ D) + C$
   (b) $f(A,B,C,D) = C + A\ \overline{B}\ D$
   (c) *(pág. seguinte)*

3. (a) $f(A,B,C) = \overline{A}\ \overline{B}\ \overline{C} + \overline{A}\ B\ C + A\ \overline{B}\ C + A\ B\ \overline{C} + A\ B\ C$

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

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

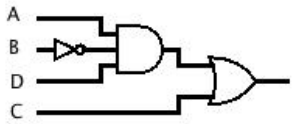


Figura 1: Resposta 2.c)

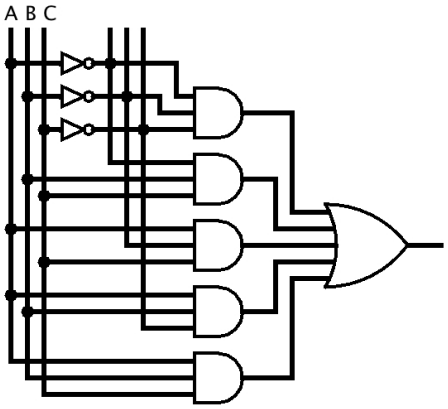


Figura 2: Resposta 3.a)

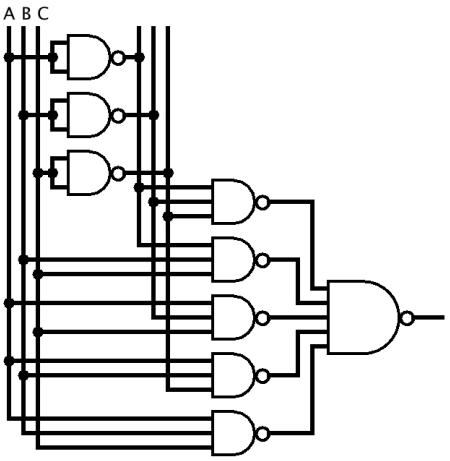


Figura 3: Resposta 3.b)

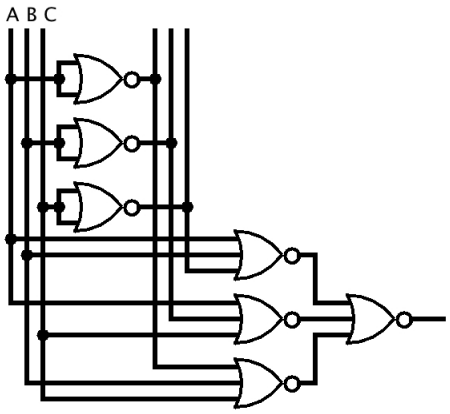


Figura 4: Resposta 3.c)

4. (a) $f(A,B,C) = \sum m(0,2,3,6,7)$

(b)

A\BC	00	01	11	10
0	1	0	1	1
1	0	0	1	1

(c) $f(A,B,C) = B + \overline{A}\ \overline{C}$

(d) $f(A,B,C) = (B + \overline{C})(\overline{A} + B)$

5. (a)

$$\begin{aligned} F(A,B,C,D) &= \sum m(4,5,8,12,13,14,15) \\ &= A\ B + B\ \overline{C} + A\ \overline{C}\ \overline{D} \\ &= (A+B)(A+\overline{C})(B+\overline{C})(B+\overline{D}) \end{aligned}$$

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

(b)

$$\begin{aligned} F(A,B,C,D) &= \prod M(2,3,6,7,10,12,13,14) \\ &= \overline{A}\ \overline{C} + \overline{B}\ \overline{C} + A\ C\ D \\ &= (A+\overline{C})(\overline{C}+D)(\overline{A}+\overline{B}+C) \end{aligned}$$

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

(c)

$$\begin{aligned} F(A,B,C,D) &= (A+\overline{B}+C)\cdot(\overline{A}+D)\cdot(B+C+\overline{D}) \\ &= C\ D+\overline{A}\ C+\overline{A}\ \overline{B}\ \overline{D}+A\ B\ D \\ &= (A+\overline{B}+C)\cdot(\overline{A}+D)\cdot(B+C+\overline{D}) \end{aligned}$$

A	B	C	D	$A+\overline{B}+C$	$\overline{A}+D$	$B+C+\overline{D}$	F
0	0	0	0	1	1	1	1
0	0	0	1	1	1	0	0
0	0	1	0	1	1	1	1
0	0	1	1	1	1	1	1
0	1	0	0	0	1	1	0
0	1	0	1	0	1	1	0
0	1	1	0	1	1	1	1
0	1	1	1	1	1	1	1
1	0	0	0	1	0	1	0
1	0	0	1	1	1	0	0
1	0	1	0	1	0	1	0
1	0	1	1	1	1	1	1
1	1	0	0	1	0	1	0
1	1	0	1	1	1	1	1
1	1	1	0	1	0	1	0
1	1	1	1	1	1	1	1

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

(d)

$$\begin{aligned} F(A,B,C,D) &= \overline{A}\ C\ \overline{B}+A\ D+B\ \overline{D}+C\ \overline{D}+A\ \overline{C}+\overline{A}\ \overline{B} \\ &= A+\overline{B}+\overline{D} \\ &= A+\overline{B}+\overline{D} \end{aligned}$$

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

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

6.

$$\begin{aligned} H(A,B,C,D,E) &= E + D + A\ \overline{B} \\ &= (A + D + E)(\overline{A} + \overline{B} + D) \end{aligned}$$

7. $F = G \cdot X + Y$

$F(A,B,C) = \prod(1,4,5,6)$

A\BC	00	01	11	10
0	1	0	1	1
1	0	0	1	0

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

A\BC	00	01	11	10
0	0	0	1	0
1	1	1	1	0

$X(A,B,C) = B$

A\BC	00	01	11	10
0	-	-	1	-
1	0	0	1	-

$Y(A,B,C) = \overline{A}\ \overline{C}$

A\BC	00	01	11	10
0	1	0	-	1
1	0	0	-	0