CIRCUITOS DIGITAIS

DECODIFICADORES

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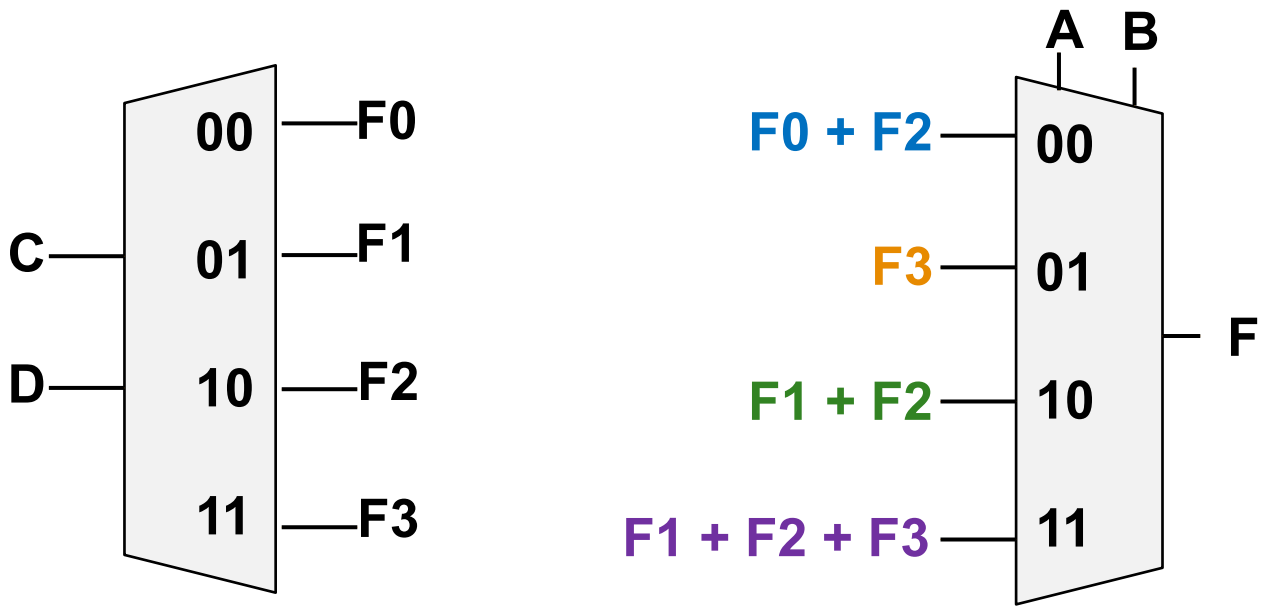
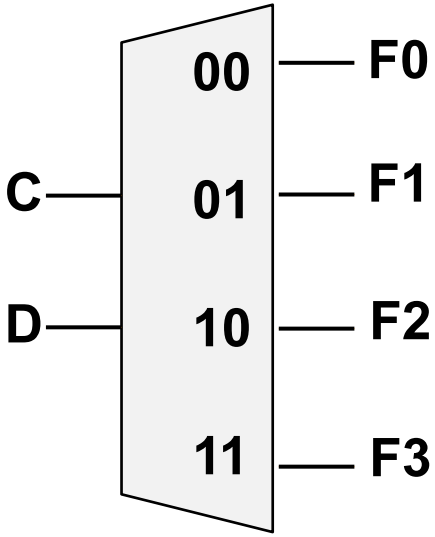
mgmandelli@unb.br

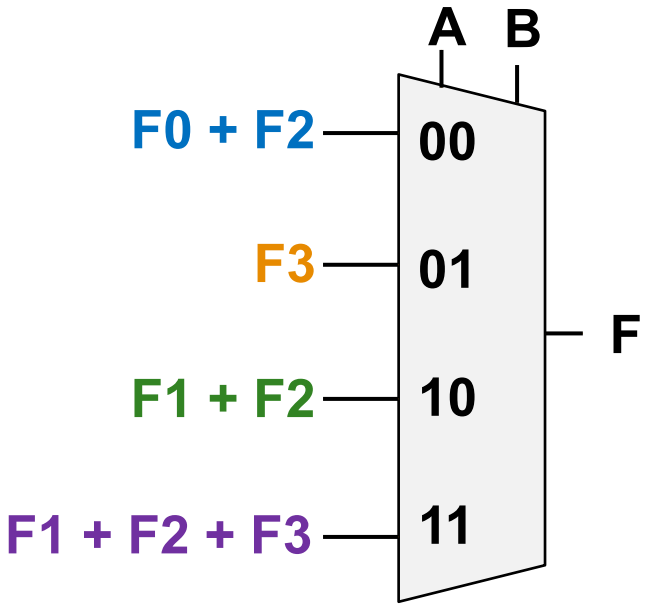
Funções Booleanas



Qual a função booleana desse circuito?

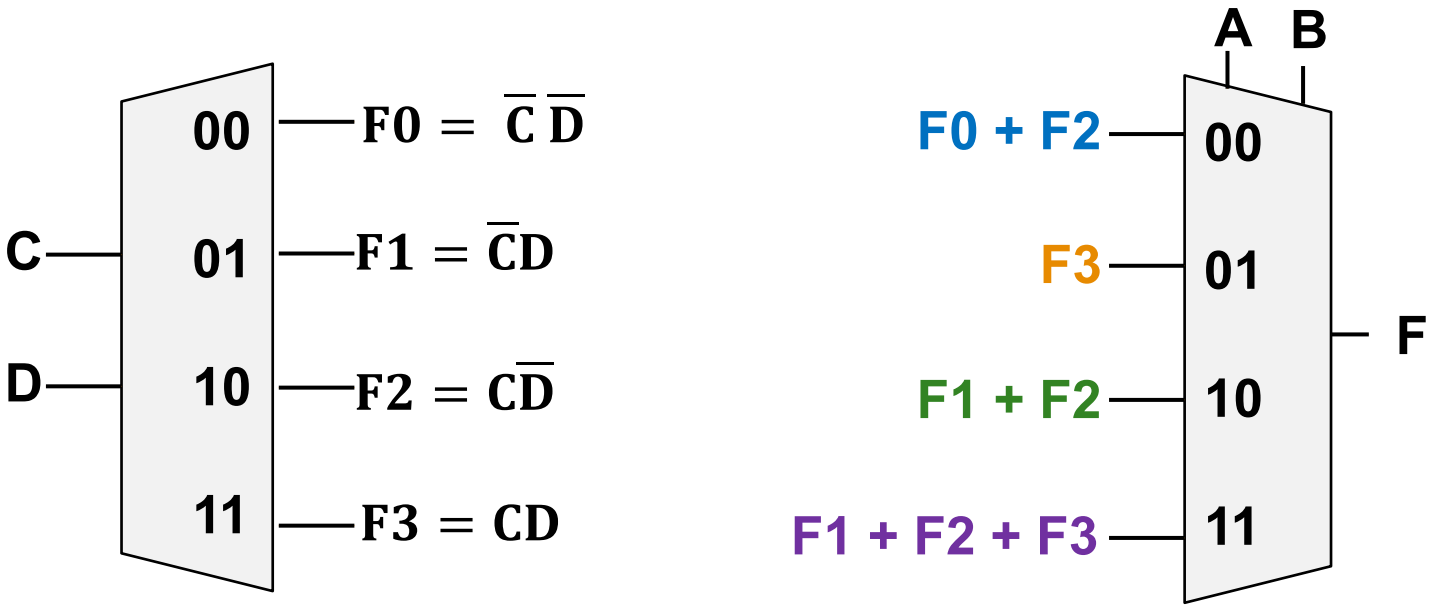
Funções Booleanas





$$\mathbf{F(A,B,C,D) = \overline{A}\,\overline{B}(F0 + F2) + \overline{A}B(F3) + A\overline{B}(F1 + F2) + AB(F1 + F2 + F3)}$$

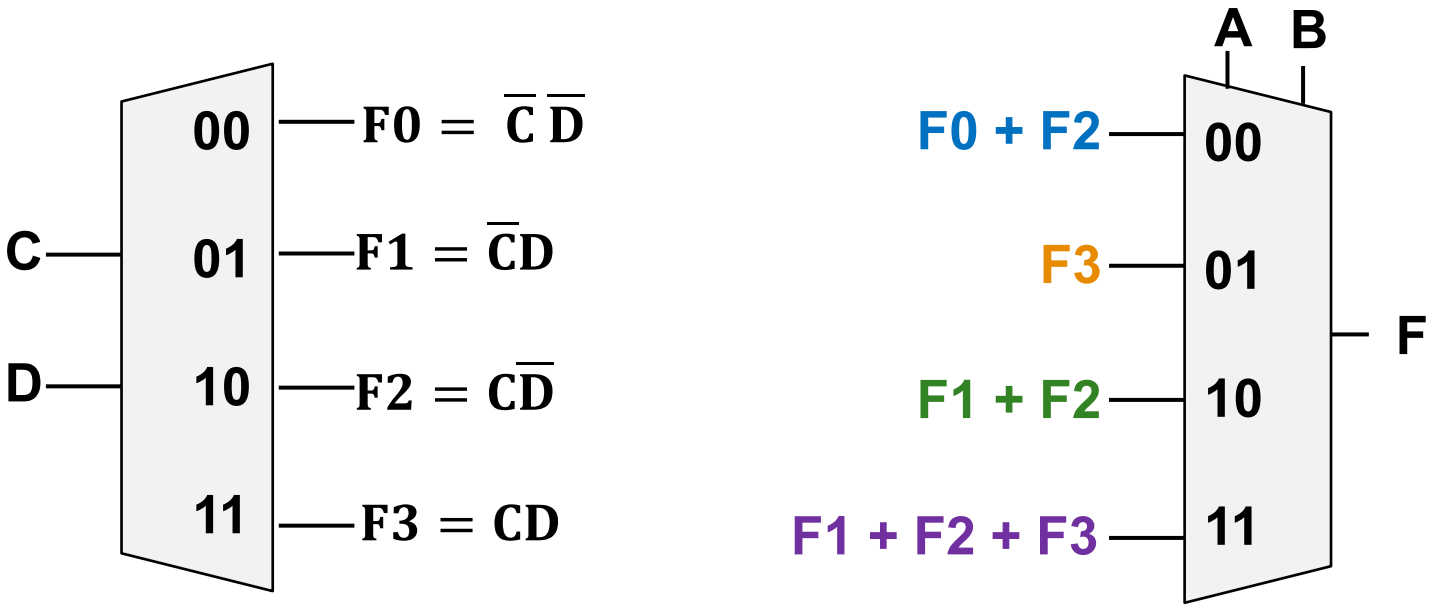
Funções Booleanas



$$F(A,B,C,D) = \overline{A}\,\overline{B}(F0 + F2) + \overline{A}B(F3) + A\overline{B}(F1 + F2) + AB(F1 + F2 + F3)$$

$$F(A,B,C,D) = \overline{A}\,\overline{B}\left(\overline{C}\,\overline{D} + C\overline{D}\right) + \overline{A}B(CD) + A\overline{B}\left(\overline{C}D + C\overline{D}\right) + AB\left(\overline{C}D + C\overline{D} + CD\right)$$

Funções Booleanas

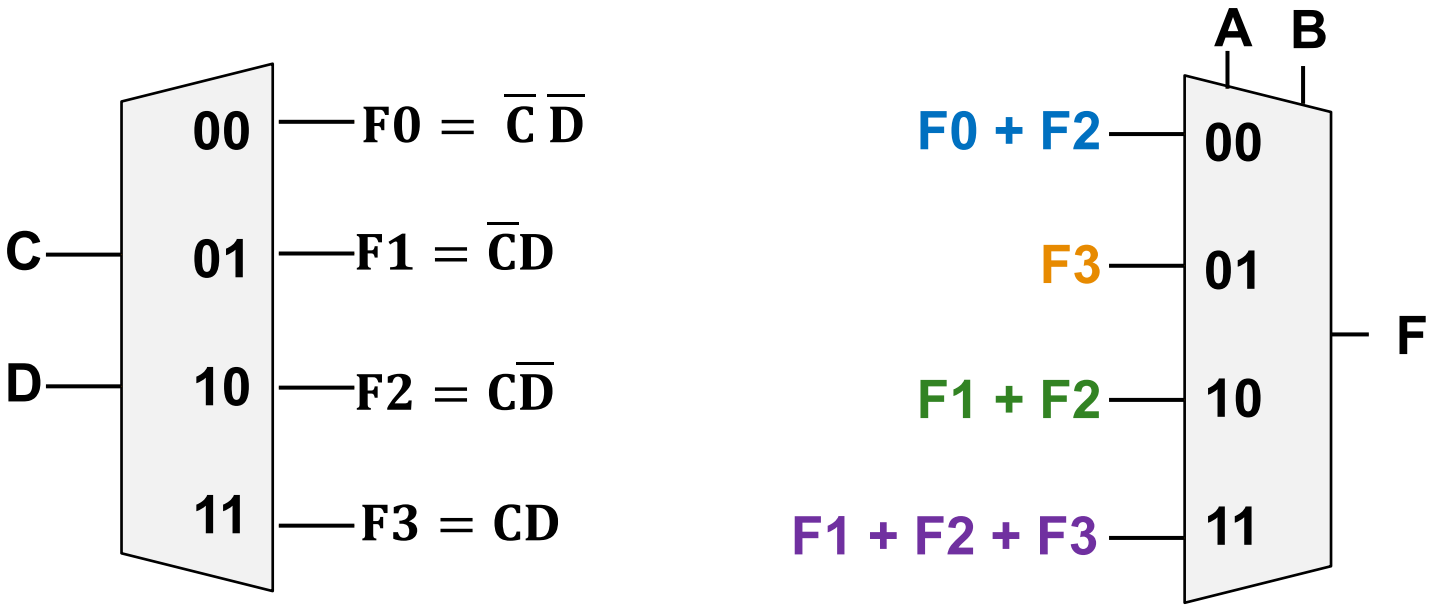


$$F(A,B,C,D) = \overline{A}\,\overline{B}(F0 + F2) + \overline{A}B(F3) + A\overline{B}(F1 + F2) + AB(F1 + F2 + F3)$$

$$F(A,B,C,D) = \overline{A}\,\overline{B}\left(\overline{C}\,\overline{D} + C\overline{D}\right) + \overline{A}B(CD) + A\overline{B}\left(\overline{C}D + C\overline{D}\right) + AB\left(\overline{C}D + C\overline{D} + CD\right)$$

$$F(A,B,C,D) = \overline{A}\,\overline{B}\,\overline{C}\,\overline{D} + \overline{A}\,\overline{B}C\overline{D} + \overline{A}BCD + A\overline{B}\,\overline{C}D + A\overline{B}C\overline{D} + AB\overline{C}D + ABC\overline{D} + ABCD$$

Funções Booleanas



$$F(A,B,C,D) = \overline{A}\,\overline{B}(F0 + F2) + \overline{A}B(F3) + A\overline{B}(F1 + F2) + AB(F1 + F2 + F3)$$

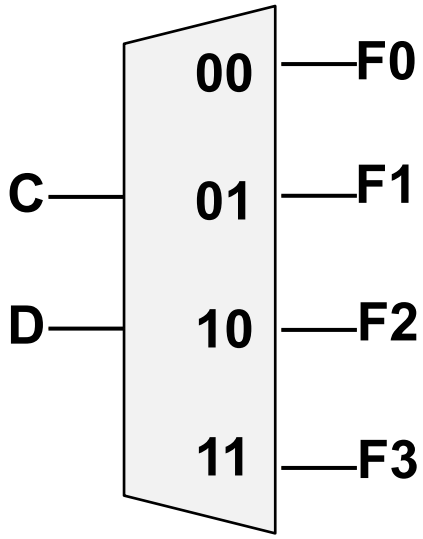
$$F(A,B,C,D) = \overline{A}\,\overline{B}\left(\overline{C}\,\overline{D} + C\overline{D}\right) + \overline{A}B(CD) + A\overline{B}\left(\overline{C}D + C\overline{D}\right) + AB\left(\overline{C}D + C\overline{D} + CD\right)$$

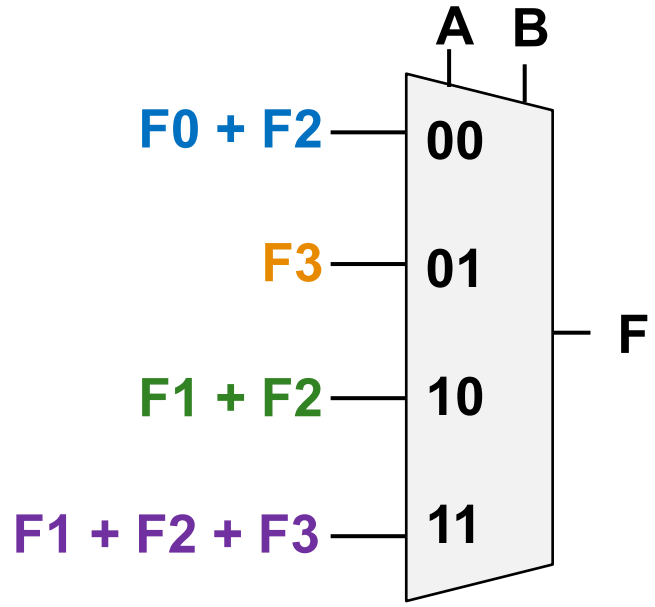
$$F(A,B,C,D) = \overline{A}\,\overline{B}\,\overline{C}\,\overline{D} + \overline{A}\,\overline{B}C\overline{D} + \overline{A}BCD + A\overline{B}\,\overline{C}D + A\overline{B}C\overline{D} + AB\overline{C}D + ABC\overline{D} + ABCD$$

$$F(A,B,C,D) = \sum m(0,2,7,9,10,13,14,15)$$

Funções Booleanas

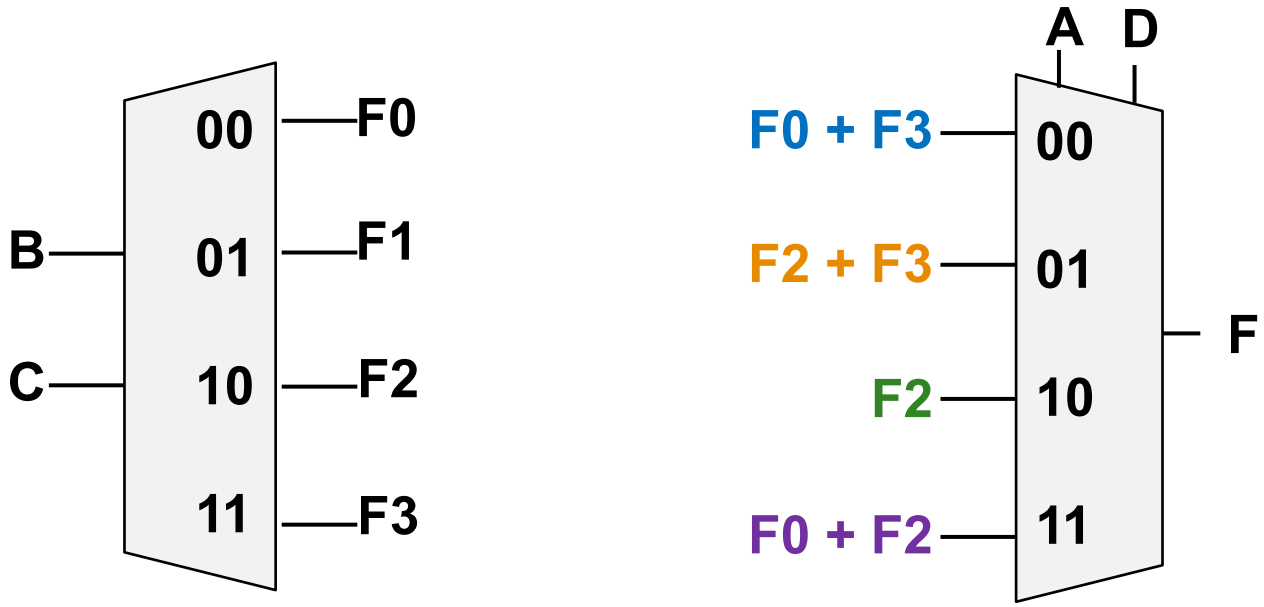
A	B	C	D	F
0	0	0	0	1
0	0	0	1	0
0	0	1	0	1
0	0	1	1	0
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0
0	1	1	1	1
1	0	0	0	0
1	0	0	1	1
1	0	1	0	1
1	0	1	1	0
1	1	0	0	0
1	1	0	1	1
1	1	1	0	1
1	1	1	1	1





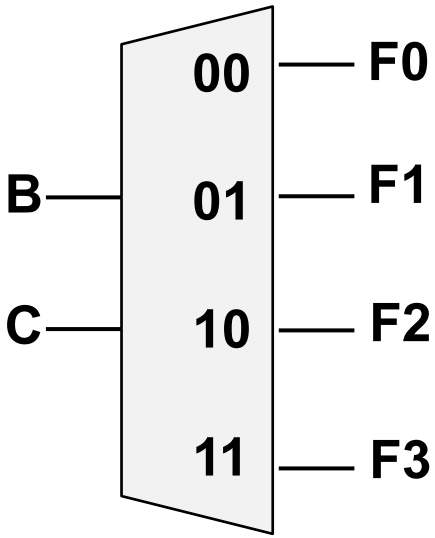
$$F(A,B,C,D) = \sum m(0,2,7,9,10,13,14,15)$$

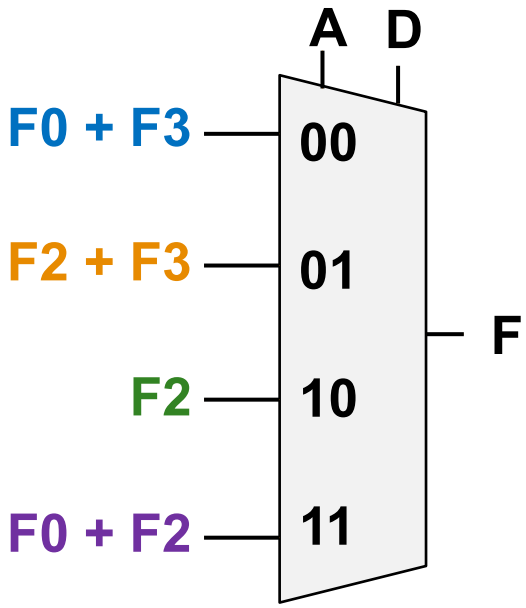
Funções Booleanas



Qual a função booleana desse circuito?

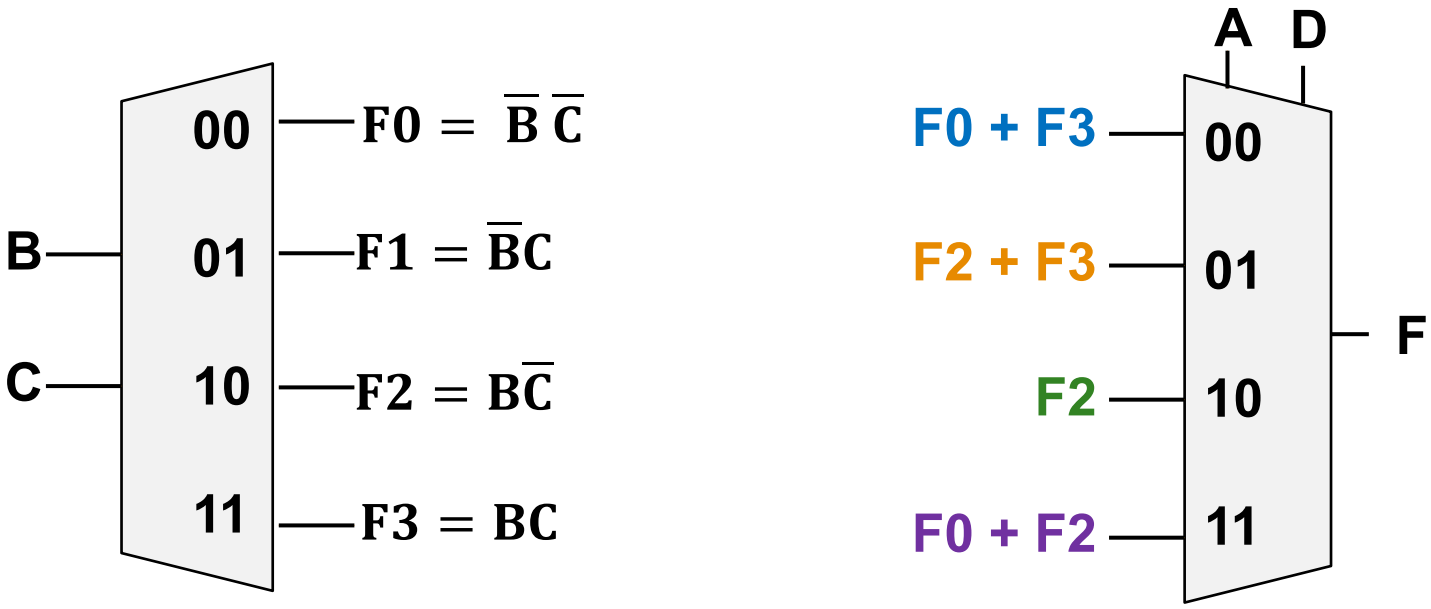
Funções Booleanas





$$\mathbf{F(A,B,C,D) = \overline{A}\,\overline{D}(F0 + F3) + \overline{A}D(F2 + F3) + A\overline{D}(F2) + AD(F0 + F2)}$$

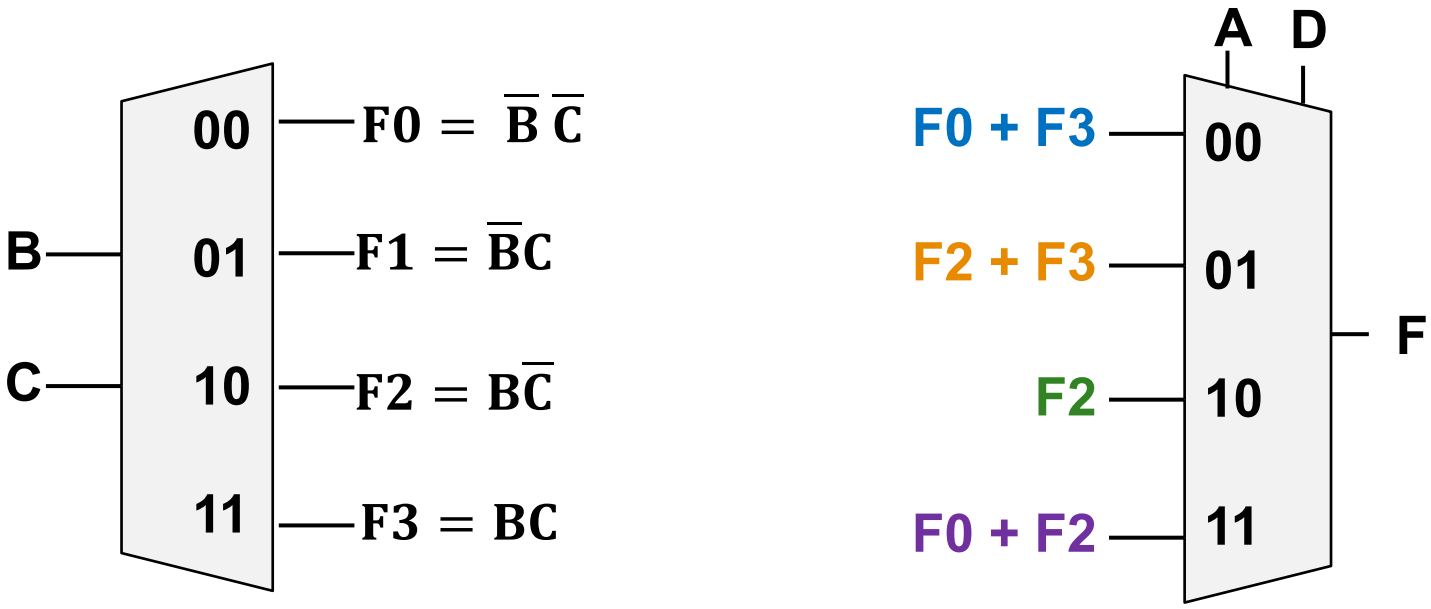
Funções Booleanas



$$F(A,B,C,D) = \overline{A}\,\overline{D}(F0 + F3) + \overline{A}D(F2 + F3) + A\overline{D}(F2) + AD(F0 + F2)$$

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

Funções Booleanas



$$F(A,B,C,D) = \bar{A}\,\bar{D}(F0 + F3) + \bar{A}D(F2 + F3) + A\bar{D}(F2) + AD(F0 + F2)$$

$$F(A,B,C,D) = \bar{A}\,\bar{D}(\bar{B}\,\bar{C} + BC) + \bar{A}D(B\bar{C} + BC) + A\bar{D}(B\bar{C}) + AD(\bar{B}\,\bar{C} + B\bar{C})$$

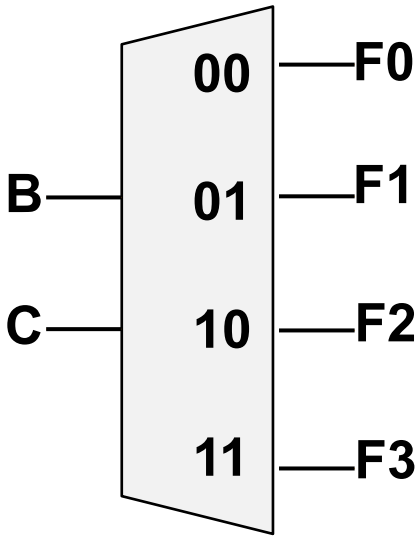
$$F(A,B,C,D) = \bar{A}\,\bar{D}\,\bar{B}\,\bar{C} + \bar{A}\,\bar{D}BC + \bar{A}DB\bar{C} + \bar{A}DBC + A\bar{D}B\bar{C} + AD\bar{B}\,\bar{C} + ADB\bar{C}$$

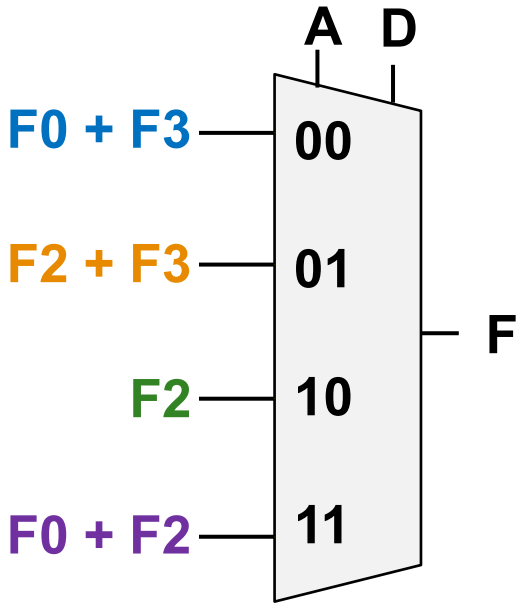
$$F(A,B,C,D) = \bar{A}\,\bar{B}\,\bar{C}\,\bar{D} + \bar{A}BC\bar{D} + \bar{A}B\bar{C}D + \bar{A}BCD + AB\bar{C}\,\bar{D} + A\bar{B}\,\bar{C}D + AB\bar{C}D$$

$$F(A,B,C,D) = \sum m(0,6,5,7,12,9,13) = \sum m(0,5,6,7,9,12,13)$$

Funções Booleanas

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

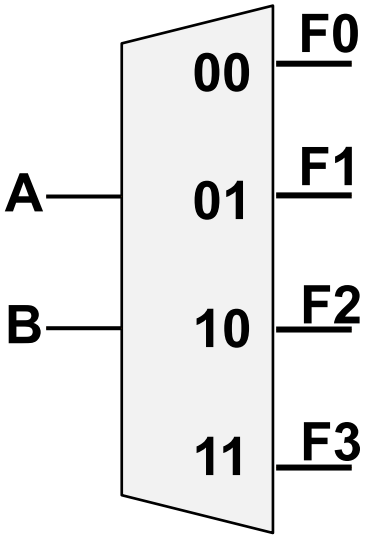




$$F(A,B,C,D) = \sum m(0,5,6,7,9,12,13)$$

Funções booleanas com DECOD 2:4

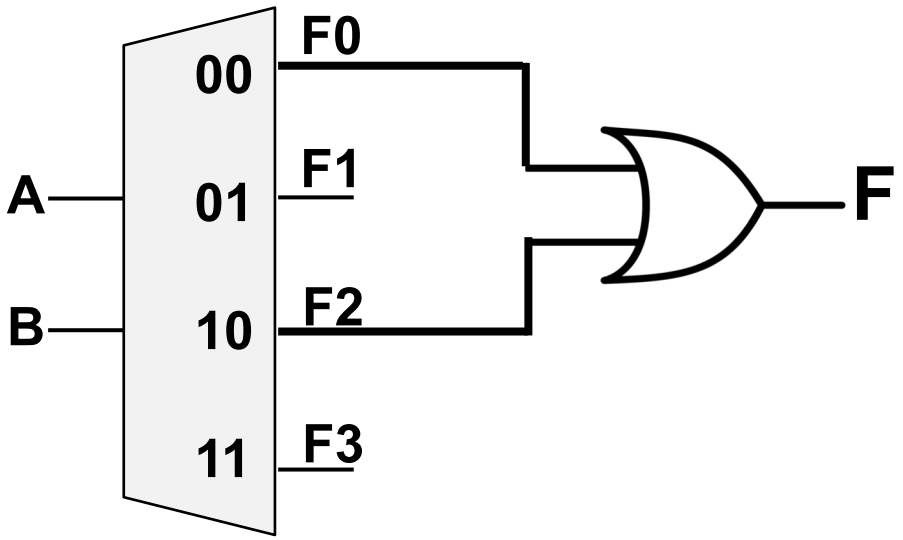
- **EXEMPLO:** $F(A,B) = \prod M(1,3)$



Como fazer?

Opção 1

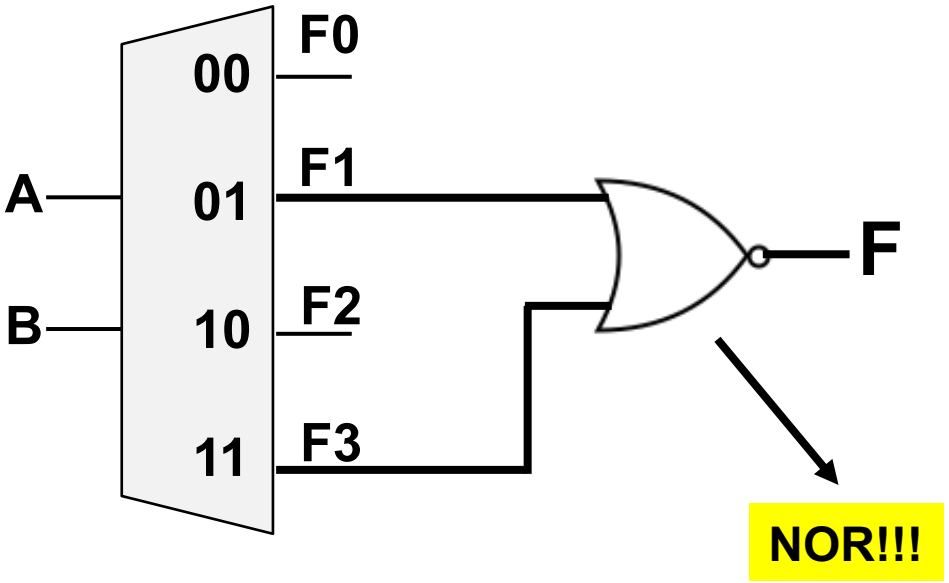
- **EXEMPLO:** $F(A,B) = \prod M(1,3) = \sum m(0,2)$



$$F(A,B) = F0 + F2$$

Opção 2

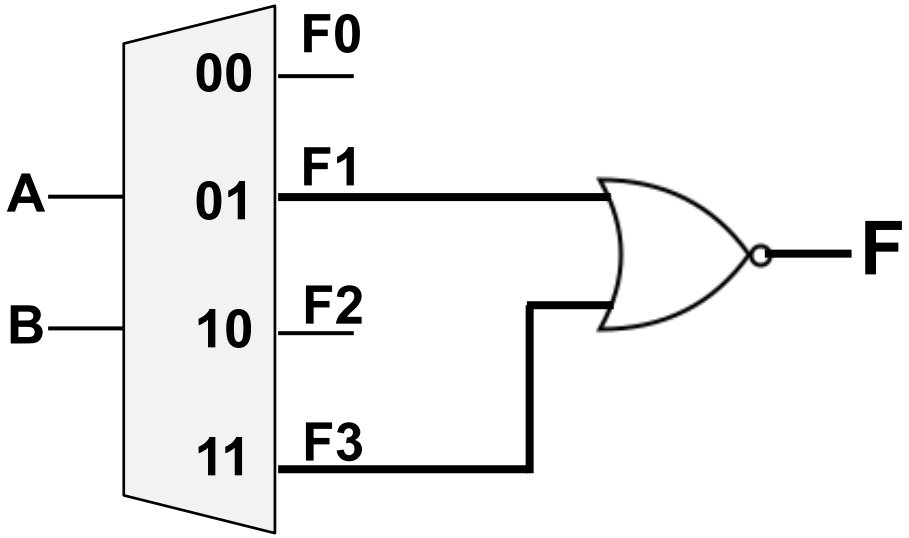
- **EXEMPLO:** $F(A,B) = \prod M(1,3) = \overline{\sum m(1,3)}$



$$F(A,B) = \overline{F1 + F3}$$

Opção 2

- **EXEMPLO:** $F(A,B) = \prod M(1,3) = \overline{\sum m(1,3)}$



$$\mathbf{F(A,B) = \overline{F1 + F3}}$$

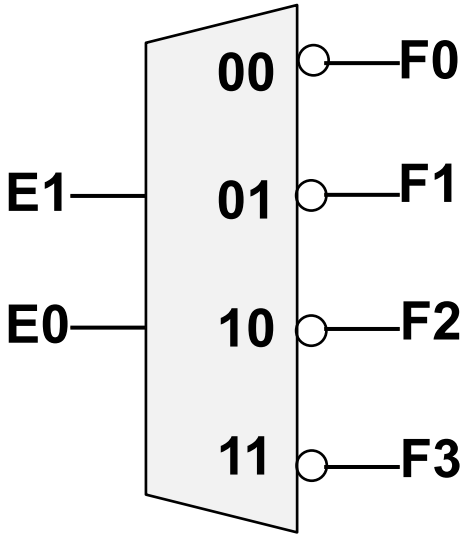
$$\mathbf{F(A,B) = \overline{\overline{A}B + AB}}$$

$$\mathbf{F(A,B) = \overline{\overline{A}B}\ \overline{AB}}$$

$$\mathbf{F(A,B) = (A + \overline{B})(\overline{A} + \overline{B})}$$

Decodificador ativo em 0

- Decodificador **2:4**



E1	E0	F0	F1	F2	F3
0	0	**0**	1	1	1
0	1	1	**0**	1	1
1	0	1	1	**0**	1
1	1	1	1	1	**0**

$$F0 = (E1 + E0) = \overline{\overline{E1}\,\overline{E0}}$$

$$F1 = \left(E1 + \overline{E0}\right) = \overline{\overline{E1}\,E0}$$

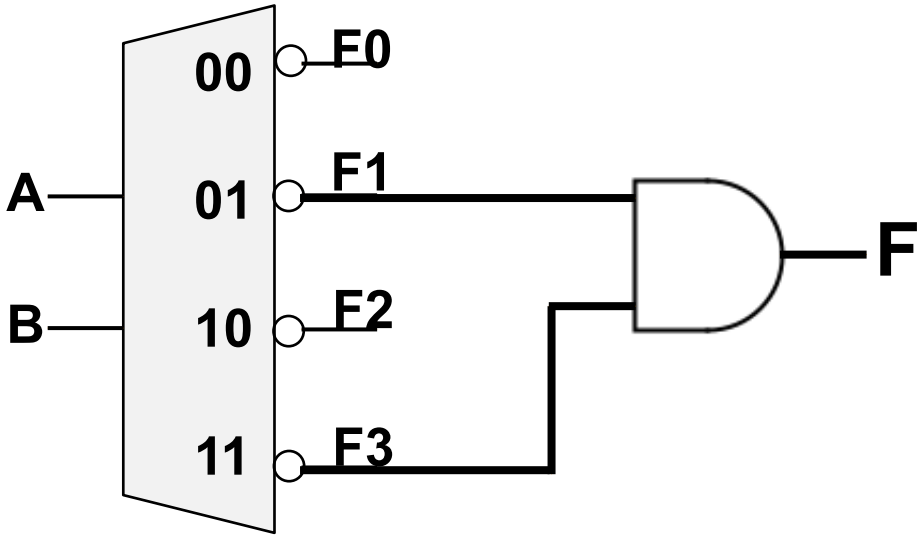
$$F2 = \left(\overline{E1} + E0\right) = \overline{E1\overline{E0}}$$

$$F3 = \left(\overline{E1} + \overline{E0}\right) = \overline{E1E0}$$

- **saída → maxtermo**

Fun. booleanas com DECOD ativ. 0

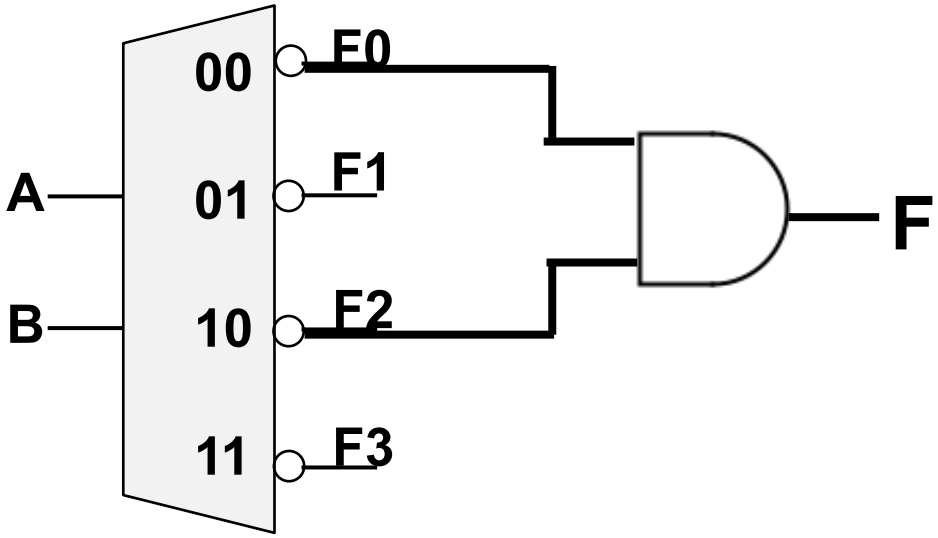
- **EXEMPLO:** $F(A,B) = \prod M(1,3)$



$$F(A,B) = F1F3$$

Fun. booleanas com DECOD ativ. 0

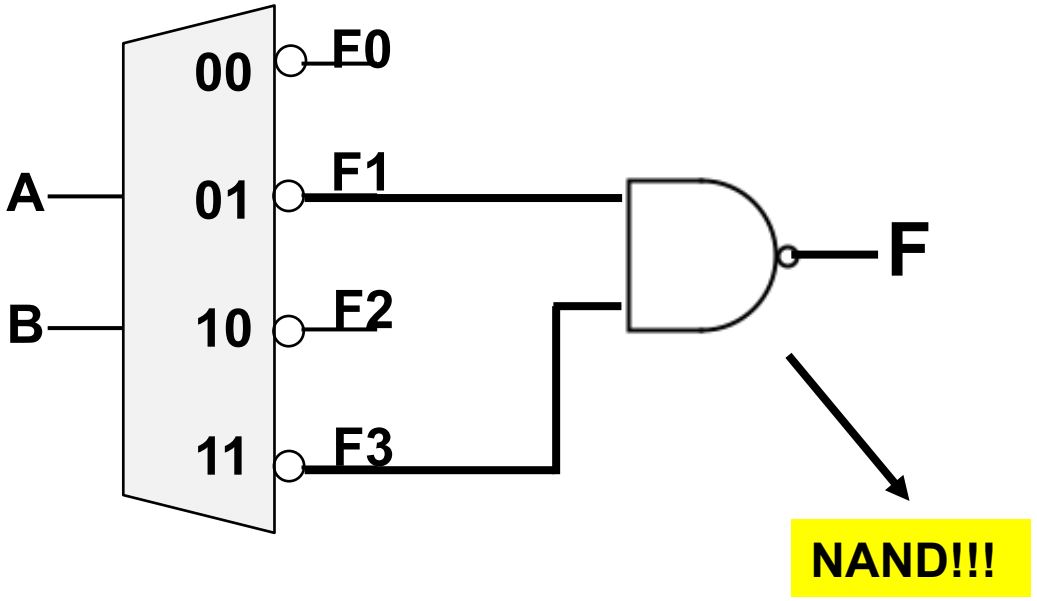
- **EXEMPLO:** $F(A,B) = \sum m(1,3) = \prod M(0,2)$



$$F(A,B) = F0F2$$

Fun. booleanas com DECOD ativ. 0

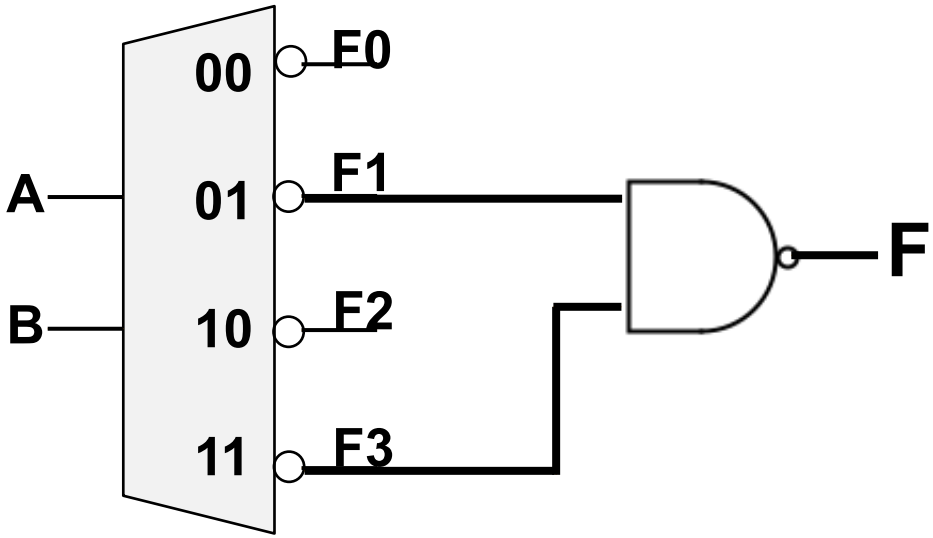
- **EXEMPLO:** $F(A,B) = \sum m(1,3) = \overline{\prod M(1,3)}$



$$F(A,B) = \overline{F1F3}$$

Fun. booleanas com DECOD ativ. 0

- **EXEMPLO:** $F(A,B) = \sum m(1,3) = \overline{\prod M(1,3)}$



$$\mathbf{F(A,B) = \overline{F1F3}}$$

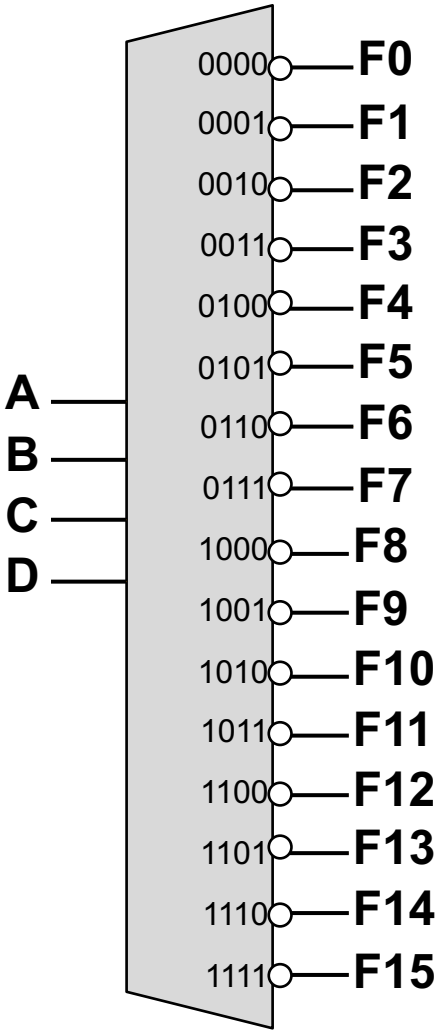
$$\mathbf{F(A,B) = \overline{(A + \overline{B})(\overline{A} + \overline{B})}}$$

$$\mathbf{F(A,B) = \overline{(A + \overline{B})} + \overline{(\overline{A} + \overline{B})}}$$

$$\mathbf{F(A,B) = \overline{A}B + AB}$$

Funções booleanas com DECOD ativo em 0

- **EXEMPLO:** $F(A,B,C,D) = \sum m(0,1,2,5,7,10,13,14,15)$



COM DECODIFICADOR 4:16

$$F = F3\ F4\ F6\ F8\ F9\ F11\ F12$$

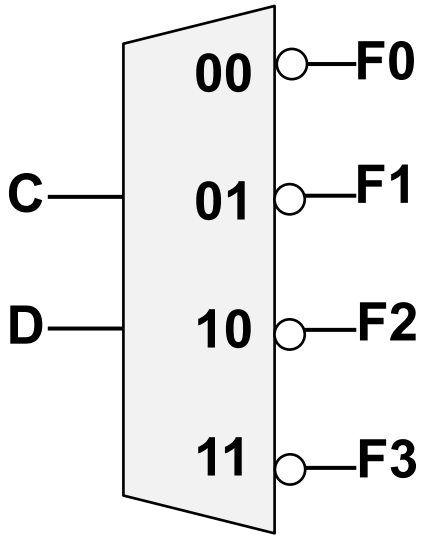
OU

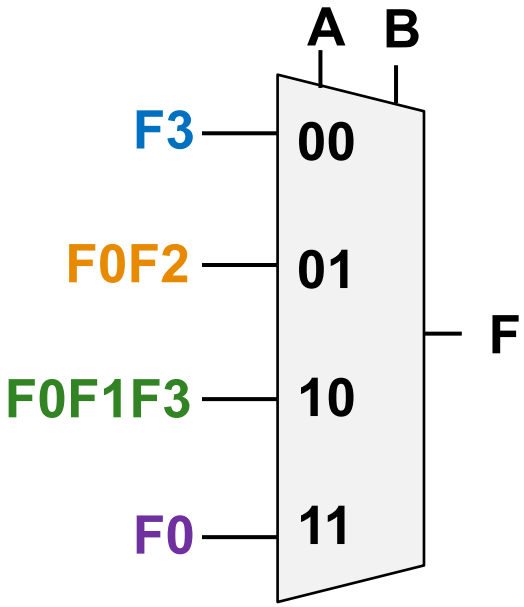
$$F = \overline{F0\ F1\ F2\ F5\ F7\ F10\ F13\ F14\ F15}$$

Funções booleanas com DECOD ativ. 0 + MUX

- **EXEMPLO:** $F(A,B,C,D) = \sum m(0,1,2,5,7,10,13,14,15)$

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

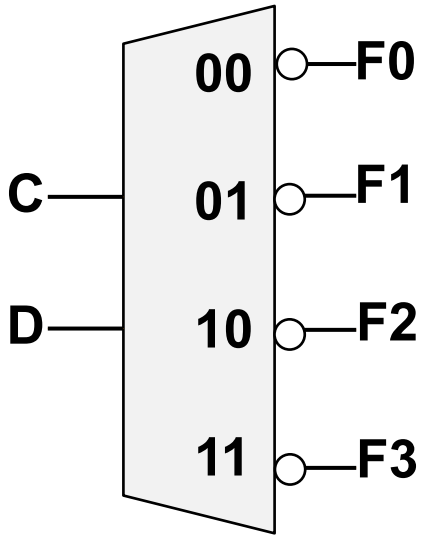


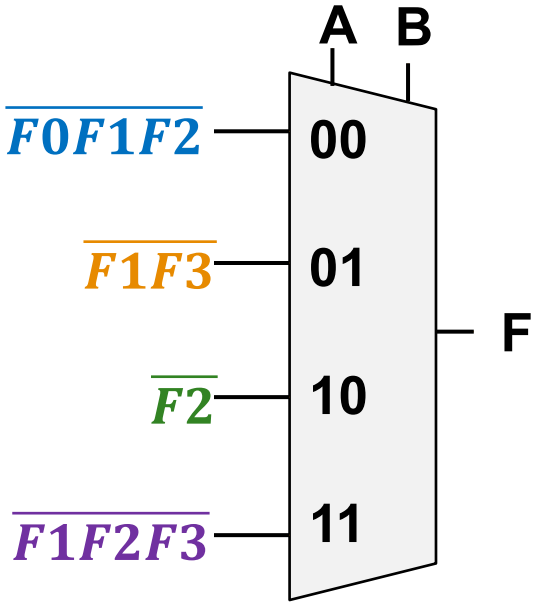


Funções booleanas com DECOD ativ. 0 + MUX

- **EXEMPLO:** $F(A,B,C,D) = \sum m(0,1,2,5,7,10,13,14,15)$

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

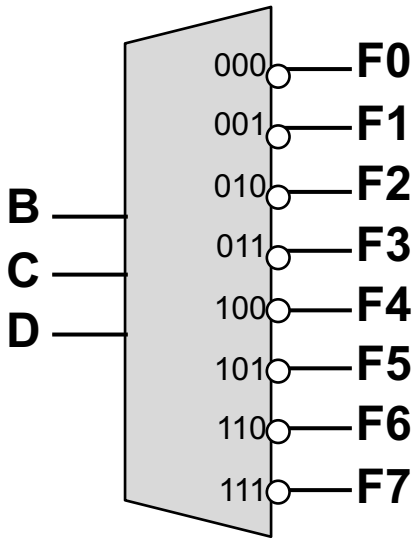


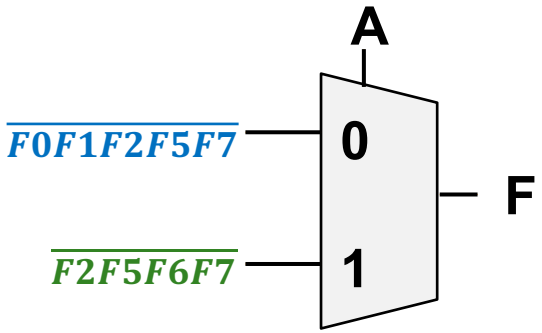


Funções booleanas com DECOD ativ. 0 + MUX

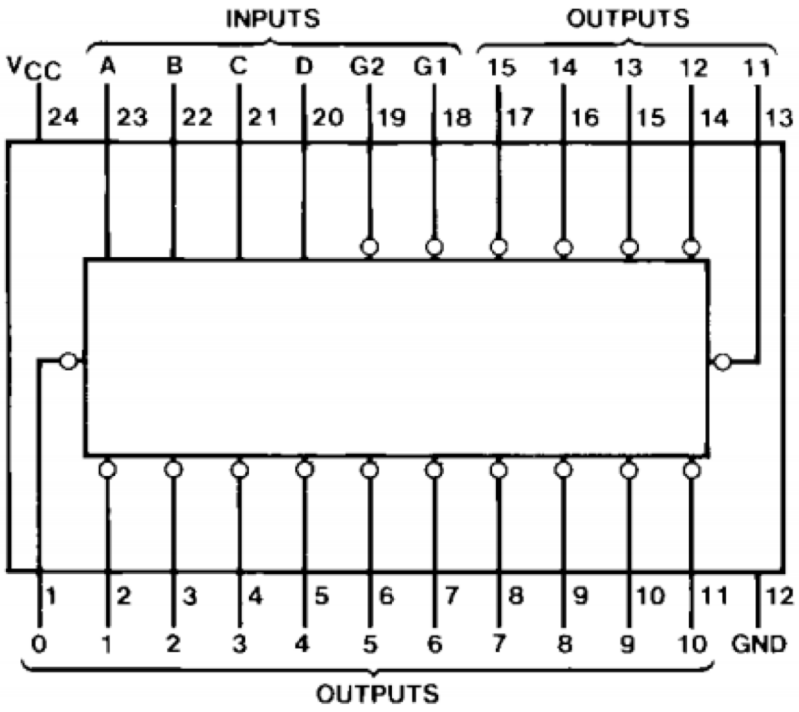
- **EXEMPLO:** $F(A,B,C,D) = \sum m(0,1,2,5,7,10,13,14,15)$

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





Decodificador 4:16 - 74154



Decodificador 4:16 - 74154

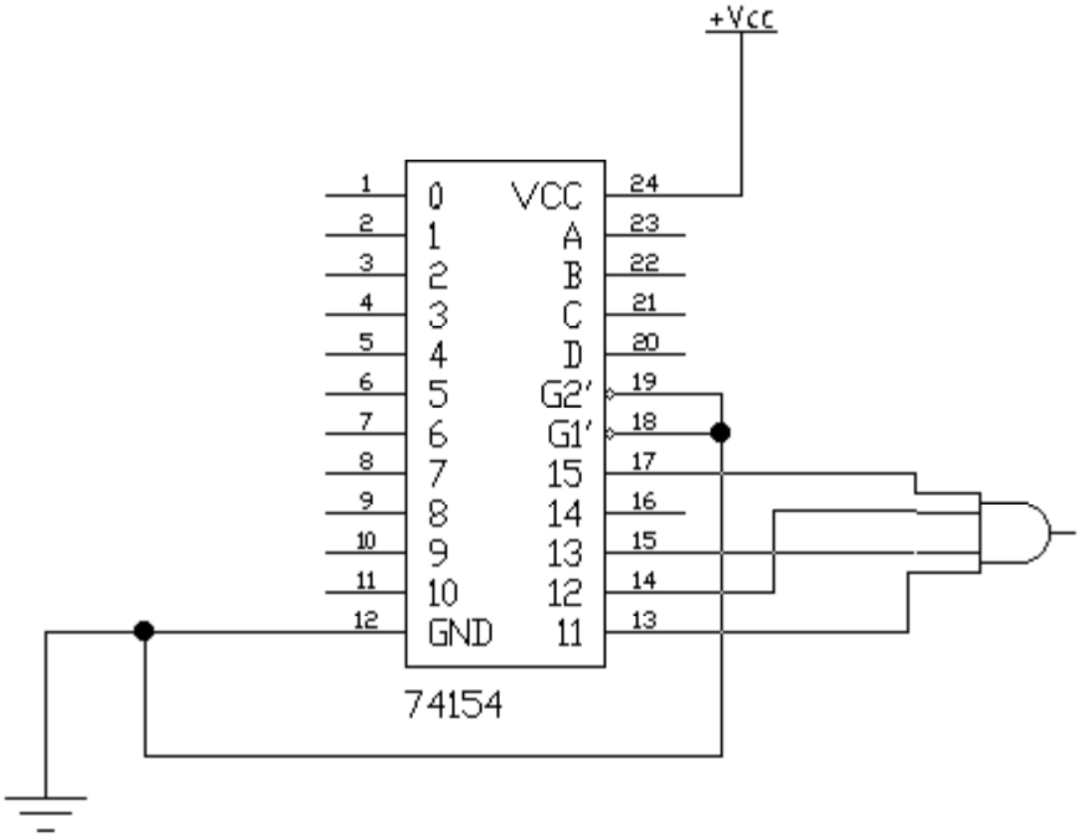
Function Table

Inputs						Outputs															
G1	G2	D	C	B	A	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
L	L	L	L	L	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H
L	L	L	L	H	L	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H
L	L	L	L	H	H	H	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H
L	L	L	H	L	L	H	H	H	H	L	H	H	H	H	H	H	H	H	H	H	H
L	L	L	H	L	H	H	H	H	H	H	L	H	H	H	H	H	H	H	H	H	H
L	L	L	H	H	L	H	H	H	H	H	H	L	H	H	H	H	H	H	H	H	H
L	L	L	H	H	H	H	H	H	H	H	H	H	L	H	H	H	H	H	H	H	H
L	L	H	L	L	L	H	H	H	H	H	H	H	H	L	H	H	H	H	H	H	H
L	L	H	L	L	H	H	H	H	H	H	H	H	H	H	L	H	H	H	H	H	H
L	L	H	L	H	L	H	H	H	H	H	H	H	H	H	H	L	H	H	H	H	H
L	L	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H	L	H	H	H	H
L	L	H	H	L	L	H	H	H	H	H	H	H	H	H	H	H	H	L	H	H	H
L	L	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L	H	H
L	L	H	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L	H
L	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L
L	H	X	X	X	X	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
H	L	X	X	X	X	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
H	H	X	X	X	X	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H

H = HIGH Level
L = Low Level
X = Don't Care

Decodificador 4:16 - 74154

- **EXEMPLO:** $F(A,B,C,D) = \prod M(11,12,13,15)$



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- **EXEMPLO:** $F(A,B,C,D) = \sum m(0,7,8,10,13,15)$