13/agosto/2021

PUCRS | ESCOLA POLITÉCNICA

4646B-04

FUNDAMENTOS DE SISTEMAS DIGITAIS

Exercícios

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MARISTA

EXERCÍCIOS

1. Usando a notação booleana, escreva uma expressão que seja 0 apenas quando todas as suas variáveis (A, B, C e D) forem 0s.

   X = A + B + C + D

2. Usando a notação booleana, escreva uma expressão que seja 0 quando uma ou mais de suas variáveis (A, B e C) forem 0s.

   X = A.B.C.D

3. Aplique os teoremas de DeMorgan a cada expressão:

a) $\overline{A + \overline{B}}$

A'.B''

A'.B

b) $\overline{\overline{A}.B}$

A'' + B'

A + B'

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

A'.B'.C'

e) $\overline{A.(B + C)}$

A' + (B + C)'

A' + B'.C'

f) $\overline{A}.B + \overline{C}.D$

A' + B' + C' + D'

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

(A + B')' + (C' + D)'

A'. B'' + C''. D'

A'. B + C. D'

4. Aplique os teoremas de DeMorgan a cada expressão:

a) $\overline{(\overline{A.B.C}).(\overline{E.F.G})} + \overline{(\overline{H.I.J}).(\overline{K.L.M})}$

((A.B.C)'.(E.F.G)')''.((H.I.J)'.(K.L.M)')''

(A.B.C)'.(E.F.G)'.(H.I.J)'.(K.L.M)'

(A'+B'+C').(E'+F'+G').(H'+I'+J').(K'+L'+M')

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

A'.(B.C')''.(C.D)' + (B.C)''

A'.(B.C').(C.D)' + (B.C)

A'.B.C'.(C'+D') + (B.C)

A'.B.C'.C' + A'.B.C'.D' + B.C

A'.B.C' + A'.B.C'.D' + B.C

A'.B.C'.(1+D') + B.C

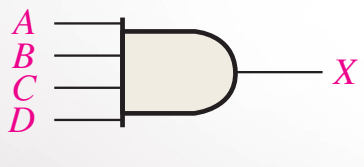
A'.B.C' + B.C

4. Aplique os teoremas de DeMorgan a cada expressão:

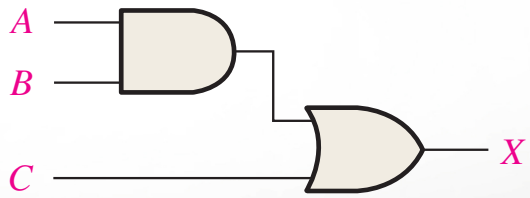
(c) $\overline{\overline{(A+B)}\,\overline{(C+D)}\,\overline{(E+F)}\,\overline{(G+H)}}$

$\bar{A}.\bar{B}\,.\bar{C}.\bar{D}\,.\bar{E}.\bar{F}\,.\bar{G}.\bar{H}$

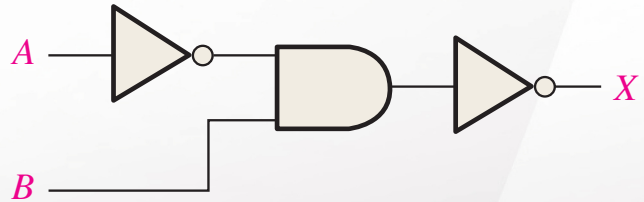
5. Escreva a expressão booleana para cada um dos circuitos lógicos abaixo.



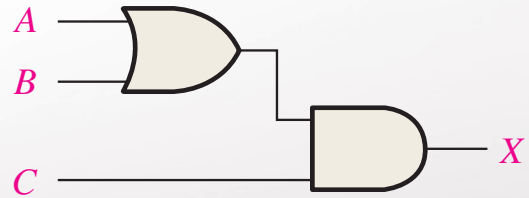
X = A.B.C.D



X = (A.B) + C



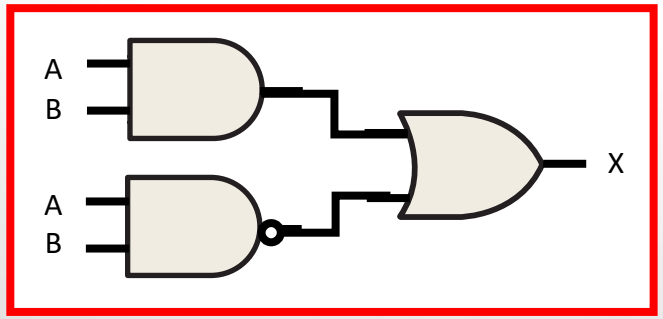
X = (A’.B)’



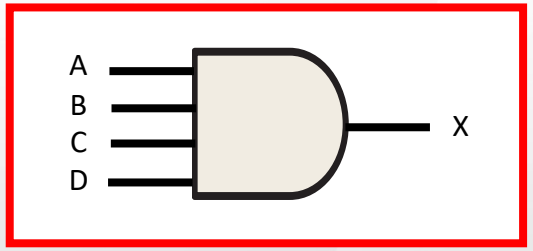
X = (A + B).C

6. Desenhe o circuito lógico representado por cada expressão:

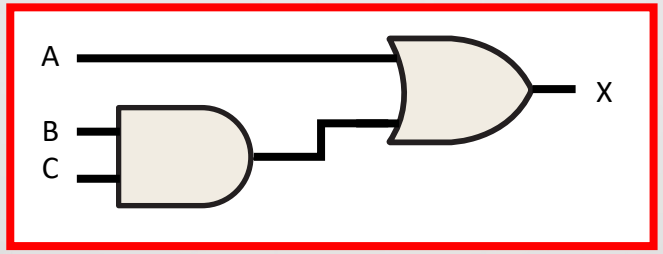
a) $A.B + \overline{A.B}$



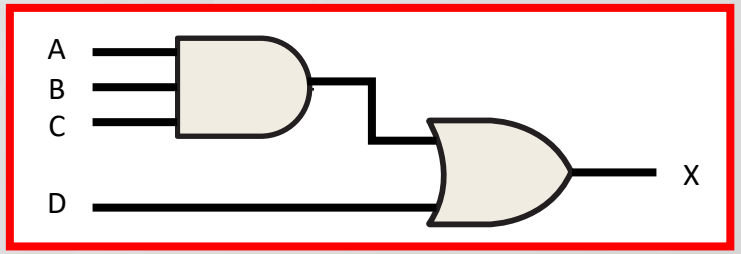
b) A.B.C.D



c) A + B.C



d) A.B.C + D



7. Usando técnicas da álgebra booleana, simplifique as seguintes expressões o máximo possível:

1. $A + 0 = A$	**7.** $A \cdot A = A$
2. $A + 1 = 1$	**8.** $A \cdot \overline{A} = 0$
3. $A \cdot 0 = 0$	**9.** $\overline{\overline{A}} = A$
4. $A \cdot 1 = A$	**10.** $A + AB = A$
5. $A + A = A$	**11.** $A + \overline{A}B = A + B$
6. $A + \overline{A} = 1$	**12.** $(A + B)(A + C) = A + BC$

a) A.(A + B)

A.A + A.B

A + A.B

A

b) A.($\overline{A}$ + A.B)

A.A' + A.A.B

A.B

c) B.C + $\overline{B}$.C

C.(B + B')

C

d) A.(A + $\overline{A}$.B)

A.A + A.A'.B

A

e) A.$\overline{B}$.C + $\overline{A}$.B.C + $\overline{A}$.$\overline{B}$.C

C.(A.B' + A'.B + A'.B')

C.(A' + B')

A'.C + B'.C

8. Usando a álgebra booleana, simplifique as seguintes expressões:

a) $C.E + C.(E + F) + \overline{E}.(E + G)$

C.E + C.E + C.F + E'.E + E'.G

C.E + C.F + E'.G

c) $(C + C.D).(C + \overline{C}.D).(C + E)$

C.(C + C'.D).(C + E)

C.C + C.C'.D + C.C + C.E

C + C.E

C

1. $A + 0 = A$	**7.** $A \cdot A = A$
2. $A + 1 = 1$	**8.** $A \cdot \overline{A} = 0$
3. $A \cdot 0 = 0$	**9.** $\overline{\overline{A}} = A$
4. $A \cdot 1 = A$	**10.** $A + AB = A$
5. $A + A = A$	**11.** $A + \overline{A}B = A + B$
6. $A + \overline{A} = 1$	**12.** $(A + B)(A + C) = A + BC$

DEMAIS EXERCÍCIOS NA LÂMINA 24 DE MINIMIZAÇÃO BOOLEANA

9. Converta as seguintes expressões no formato de soma do produto (SOP):

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

A.C + C.D' + A.D + D.D'

A.C + C.D' + A.D

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

A.A.D' + A.C

A.D' + A.C

c) (A + C).(CD +AC)

A.C.D + A.A.C + C.C.D + A.C.C

A.C.D + A.C +C.D +A.C

A.C.(1+D) + C.D

A.C + C.D

10. Escreva a tabela verdade para cada uma das seguintes expressões SOP:

$$ABC + \overline{A}\overline{B}C + AB\overline{C}$$

A	B	C	X
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	1

$$\overline{X}\overline{Y}\overline{Z} + \overline{X}Y\overline{Z} + X\overline{Y}Z + \overline{X}YZ + XY\overline{Z}$$

X	Y	Z	Q
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	0

11. Escreva a tabela verdade para cada uma das seguintes expressões SOP:

$\bar{A}B + AB\bar{C} + \bar{A}\bar{C} + A\bar{B}C$

A	B	C	X
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	0

$\bar{X} + Y\bar{Z} + WZ + X\bar{Y}Z$

W	X	Y	Z	Q
0	0	0	0	1
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	0
0	1	0	1	1
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	0
1	1	0	1	1
1	1	1	0	1
1	1	1	1	1

Mininizar: f(a,b,c,d) = $\sum(5, 6, 10, 11, 13, 14, 15)$

$(\mathbf{5}) = (\mathbf{0101})_2 \quad \bar{a}.b.\bar{c}.d$

$(\mathbf{6}) = (\mathbf{0110})_2$

$(\mathbf{10}) = (\mathbf{1010})_2$

$(\mathbf{11}) = (\mathbf{1011})_2$

$(\mathbf{13}) = (\mathbf{1101})_2$

$(\mathbf{14}) = (\mathbf{1110})_2$

$(\mathbf{15}) = (\mathbf{1111})_2$

$\bar{a}$ + a

f(a,b,c,d) = $\bar{a}.\boldsymbol{b}.\bar{c}.\boldsymbol{d} + \bar{a}.\boldsymbol{b}.\boldsymbol{c}.\bar{d} + \boldsymbol{a}.\bar{b}.\boldsymbol{c}.\bar{d} + \boldsymbol{a}.\bar{b}.\boldsymbol{c}.\boldsymbol{d} + \boldsymbol{a}.\boldsymbol{b}.\bar{c}.\boldsymbol{d} + \boldsymbol{a}.\boldsymbol{b}.\boldsymbol{c}.\bar{d} + \boldsymbol{a}.\boldsymbol{b}.\boldsymbol{c}.\boldsymbol{d}$

5 **6** **10** **11** **13** **14** **15**

$\bar{d}$ + d

$\bar{a}$ + a

$\bar{d}$ + d

f(a,b,c,d) = $b.\bar{c}.d + b.c.\bar{d} + a.\bar{b}.c + a.b.c$

$\bar{b}$ + b

f(a,b,c,d) = $\boldsymbol{b}.\bar{\boldsymbol{c}}.\boldsymbol{d} + \boldsymbol{b}.\boldsymbol{c}.\bar{\boldsymbol{d}} + \boldsymbol{a}.\boldsymbol{c}$

$$F = B.\overline{C}.D + \overline{A}.B.D + \overline{A}.C.D + A.D + A.\overline{D} + B.\overline{C}.\overline{D}$$

$$D + \overline{D}$$

$$F = B.\overline{C}.D + B.D + C.D + A + B.\overline{C}.\overline{D}$$

$$D + \overline{D}$$

$$F = B.\overline{C} + B.D + C.D + A$$

$$F = B.\overline{C} + B.\overline{C}.D + B.C.D + C.D + A$$

$$1 + D \qquad 1 + B$$

$$F = B.\overline{C} + C.D + A$$

TABLE 4–1

Basic rules of Boolean algebra.

1. $A + 0 = A$	**7.** $A \cdot A = A$
2. $A + 1 = 1$	**8.** $A \cdot \overline{A} = 0$
3. $A \cdot 0 = 0$	**9.** $\overline{\overline{A}} = A$
4. $A \cdot 1 = A$	**10.** $A + AB = A$
5. $A + A = A$	**11.** $A + \overline{A}B = A + B$
6. $A + \overline{A} = 1$	**12.** $(A + B)(A + C) = A + BC$

Propriedade 11: remove $\bar{A}$

Determinar na figura abaixo os circuitos equivalentes

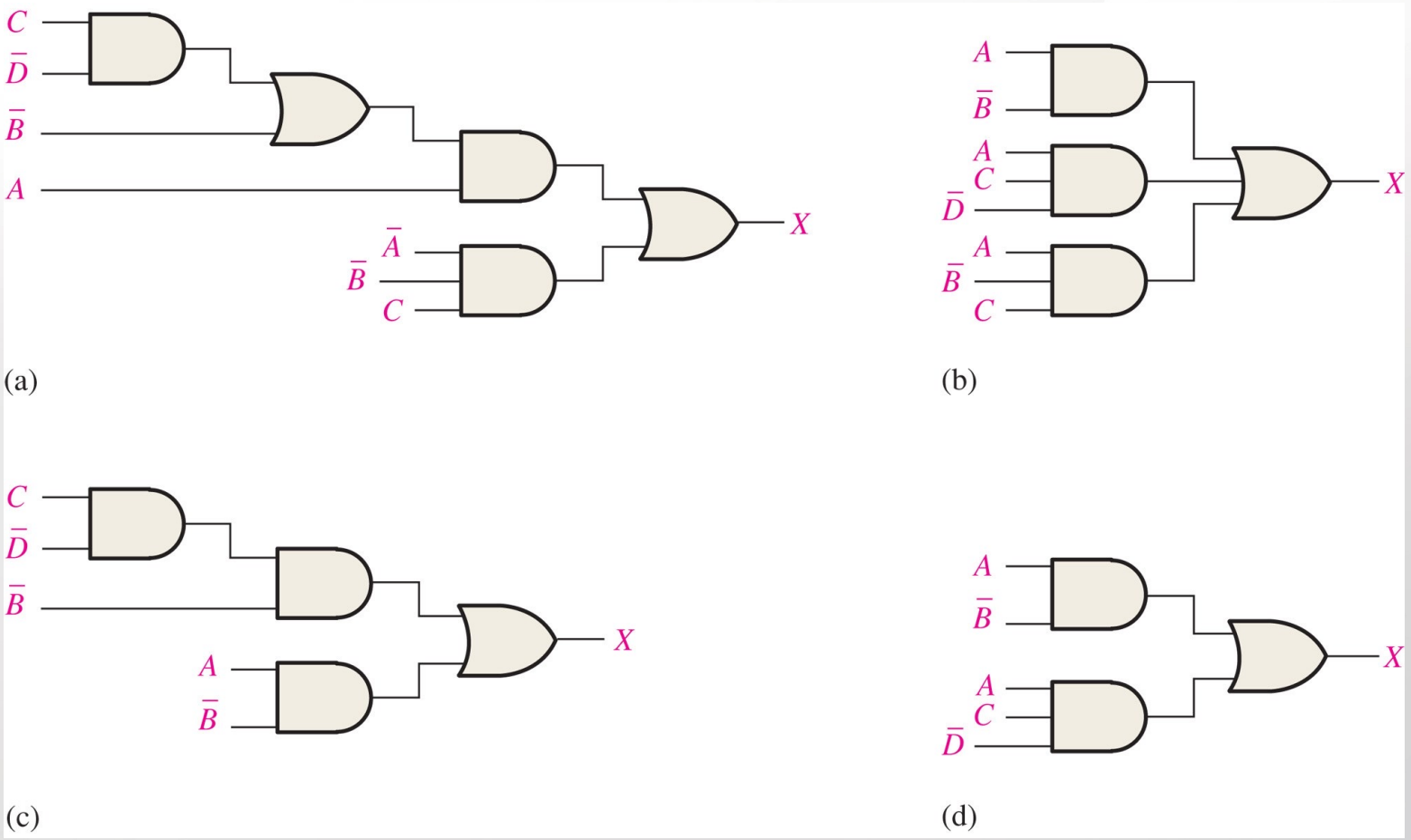


FIGURE 4-59

8. **(ENADE 2008-CC - 38) No circuito apresentado nesta questão, que possui cinco entradas — A, B, C, D e E — e uma saída f(A, B, C, D, E), qual opção apresenta uma expressão lógica equivalente à função f?**

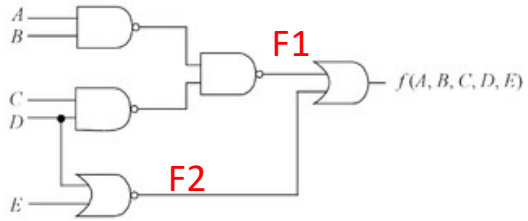
A) **F = (AB)' + (CD)' + DE**

B) **(A + B).(C+D) + D.E**

C) **A.B + C.D + D'E'**

D) **F = (AB)' + (CD)' + D + E**

E) **F = AB + CD + D + E**



$$F1 = AB + CD$$

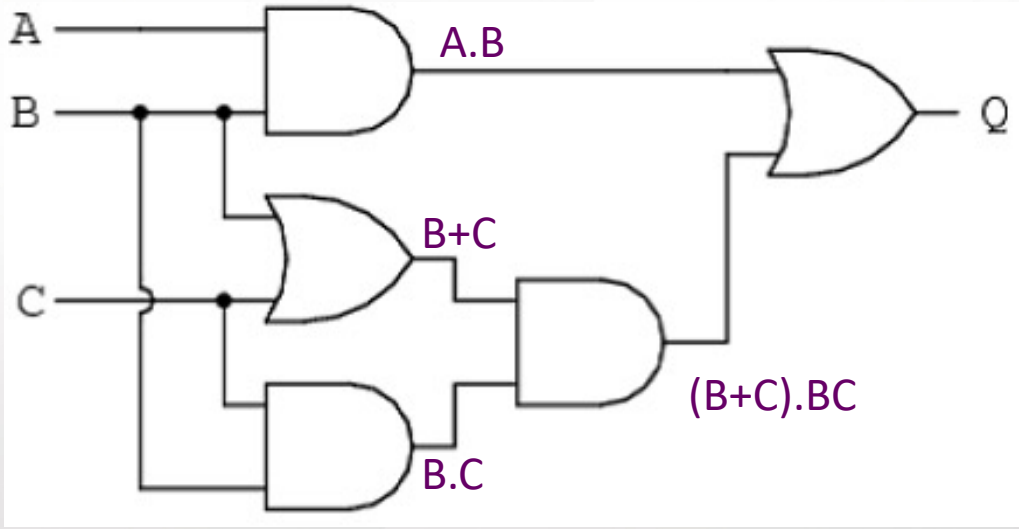
$$F2 = \overline{D + E} = \bar{D}.\bar{E}$$

$$saída = AB + CD + \bar{D}.\bar{E}$$

Letra C

(**POSCOMP 2009 - 39**) Considerando o circuito digital abaixo, qual o valor de Q?

a) A + BC
b) B (A + B + C)
c) C (A + B)
d) A (B + C)
e) B (A + C)



A.B + (B+C).(B.C)

A.B + B.C + B.C

A.B + B.C

B.(A+C) → letra E