Universidade de Brasília

Circuitos Digitais - Prof. Marcelo Grandi Mandelli

Lista de Exercícios 3 – Álgebra Booleana

1. Construa o circuito lógico para as funções booleanas abaixo:

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

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

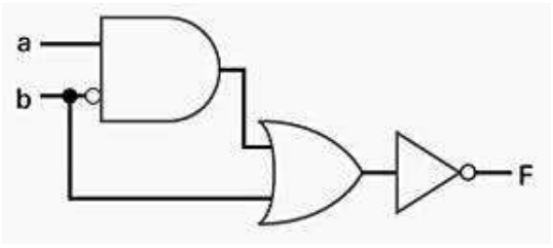
   c) $F(A,B,C) = \left(\overline{A}+B\right)C + AB\overline{C}$

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

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

2. Determine a função booleana para os circuitos lógicos abaixo:

   a)



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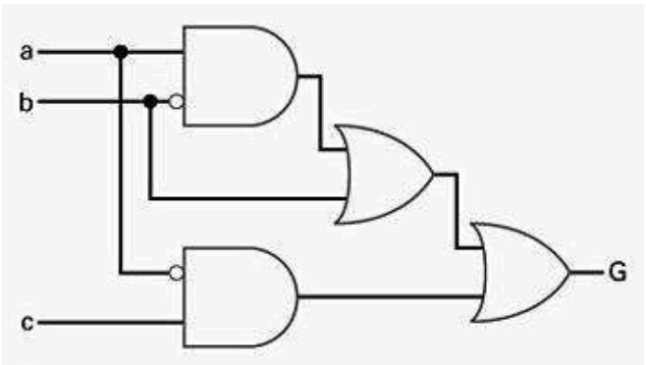
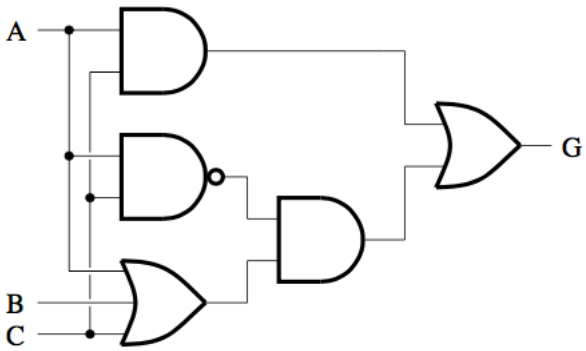
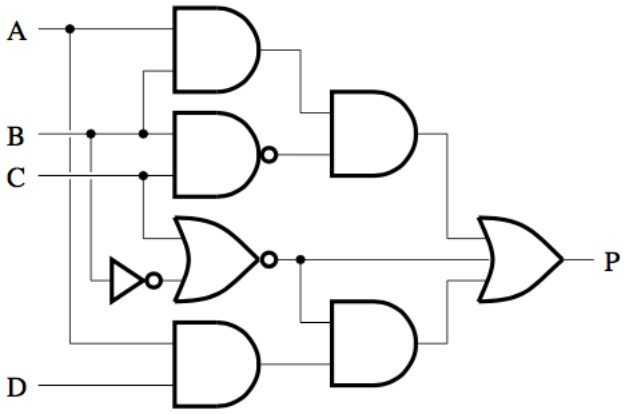


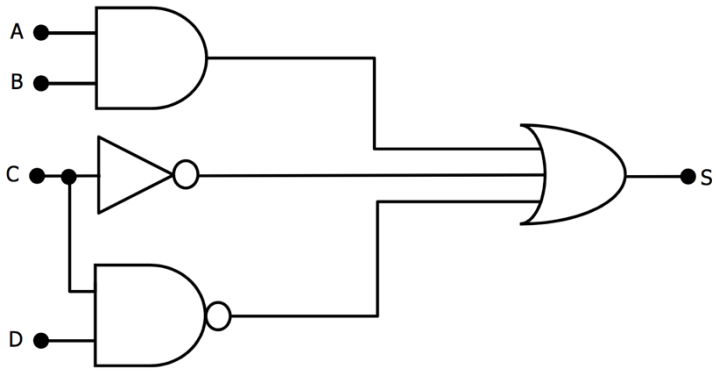
c)



d)



e)



3. Simplifique as seguintes funções booleanas usando as Leis e Regras da álgebra booleana:

a) $F(A,B,C) = AB + A(B+C) + B(B+C)$

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

c) $F(A,B,C,D) = \left(\overline{\overline{AC}+B+D}\right) + C\left(\overline{ACD}\right)$

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

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

4. Construa o circuito lógico para aa funções booleanas abaixo, utilizando somente portas NAND de duas entradas. Não simplifique as funções booleanas!

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

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

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

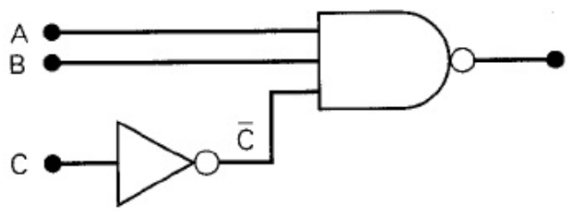
   d) $F(A,B) = \left(\overline{A + \overline{B}}\right) + AB$

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

GABARITO

1.

a)



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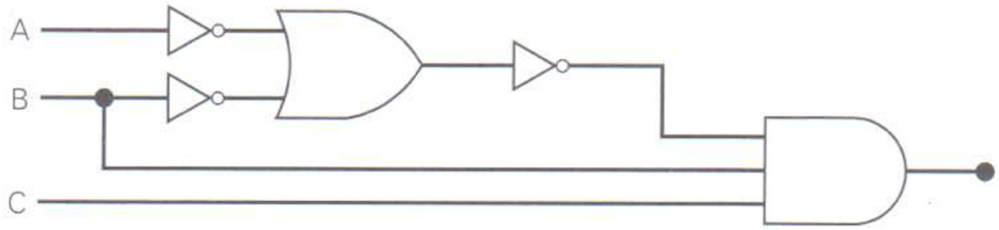

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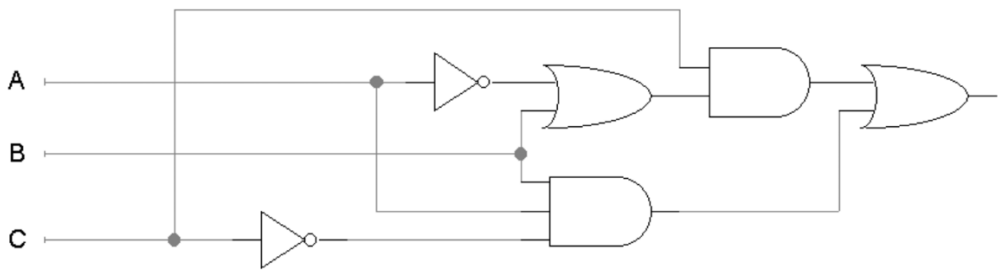

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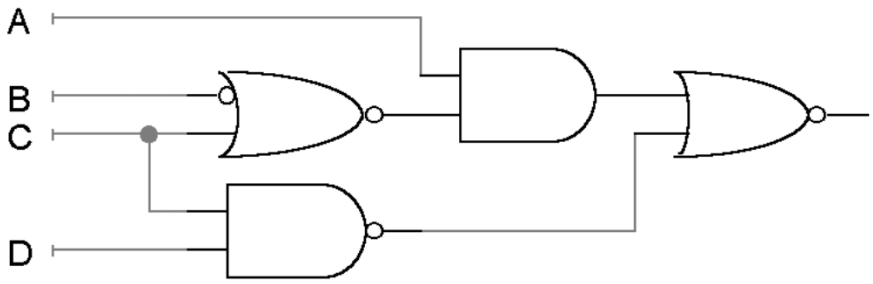

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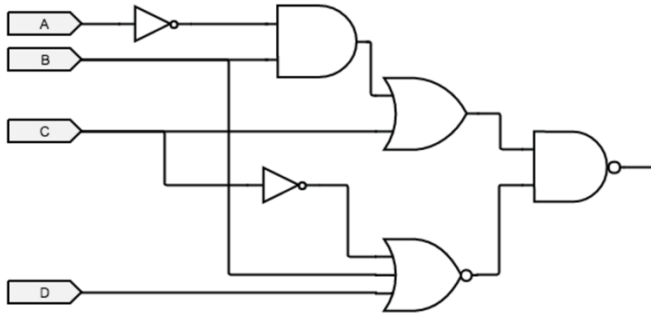


2.

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

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

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

d) $P(A,B,C,D) = AB\overline{BC} + \overline{(\overline{B} + C)} + \left[AD\overline{(\overline{B} + C)}\right]$

e) $S(A,B,C,D) = AB + \overline{C} + \overline{CD}$

3.

a) $F(A,B,C) = AB + A(B + C) + B(B + C)$

$AB + AB + AC + BB + BC$ → Lei Distributiva (3)

$(AB + AB) + AC + BB + BC$ → Lei Associativa (2)

$AB + AC + BB + BC$ → Regra 8 (A + A = A)

$AB + AC + B + BC$ → Regra 8 (AA = A)

$B(A + 1 + C) + AC$ → Lei Distributiva (3)

$B(1) + AC$ → Regra 6 (A + 1 = 1)

$\boldsymbol{B + AC}$ → Regra 7 (A • 1 = 1)

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

$AA + AC + A\overline{B} + \overline{B}C$ → Lei Distributiva (3)
$A + AC + A\overline{B} + \overline{B}C$ → Regra 8 (AA = A)
$A(1 + C + \overline{B}) + \overline{B}C$ → Lei Distributiva (3)
$A(1) + \overline{B}C$ → Regra 6 (A + 1 = 1)
$\boldsymbol{A + \overline{B}C}$ → Regra 7 (A • 1 = 1)

c) $F(A,B,C,D) = \left(\overline{\overline{AC} + B + D}\right) + C(\overline{ACD})$

$AC\overline{B}\,\overline{D} + C(\overline{A} + \overline{C} + \overline{D})$ → De Morgan
$AC\overline{B}\,\overline{D} + \overline{A}C + C\overline{C} + C\overline{D}$ → Lei Distributiva (3)
$AC\overline{B}\,\overline{D} + \overline{A}C + 0 + C\overline{D}$ → Regra 11 (A • A' = 0)
$AC\overline{B}\,\overline{D} + \overline{A}C + C\overline{D}$ → Regra 4 (A + 0 = A)
$C\overline{D}(A\overline{B} + 1) + \overline{A}C$ → Lei Distributiva (3)
$C\overline{D}(1) + \overline{A}C$ → Regra 6 (A + 1 = 1)
$C\overline{D} + \overline{A}C$ → Regra 7 (A • 1 = 1)
$C(\overline{D} + \overline{A})$ → Lei Distributiva (3)
$\boldsymbol{C\overline{(DA)}}$ → De Morgan

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

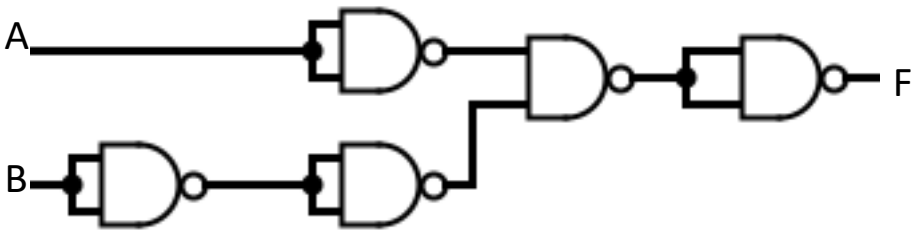
$(\overline{A}BC) + (\overline{A} + \overline{B} + C)$ → De Morgan
$\overline{A}BC + \overline{A} + \overline{B} + C$ → Lei Associativa (2)
$\overline{A}(BC + 1) + \overline{B} + C$ → Lei Distributiva (3)
$\overline{A}(1) + \overline{B} + C$ → Regra 6 (A + 1 = 1)
$\boldsymbol{\overline{A} + \overline{B} + C}$ → Regra 7 (A • 1 = 1)

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

$(\overline{A} + \overline{B})(\overline{A} + B)$ → De Morgan
$\overline{A}\,\overline{A} + \overline{A}B + \overline{A}\,\overline{B} + \overline{B}B$ → Lei Distributiva (3)
$\overline{A} + \overline{A}B + \overline{A}\,\overline{B} + \overline{B}B$ → Regra 8 (AA = A)
$\overline{A} + \overline{A}B + \overline{A}\,\overline{B} + 0$ → Regra 11 (A • A' = 0)
$\overline{A} + \overline{A}B + \overline{A}\,\overline{B}$ → Regra 4 (A + 0 = A)
$\overline{A}(1 + B + \overline{B})$ → Lei Distributiva (3)
$\overline{A}(1)$ → Regra 6 (A + 1 = 1)
$\boldsymbol{\overline{A}}$ →Regra 7 (A • 1 = 1)

4.

a)



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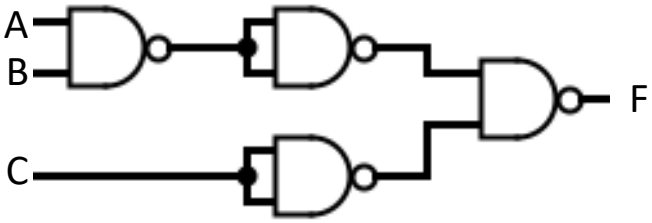

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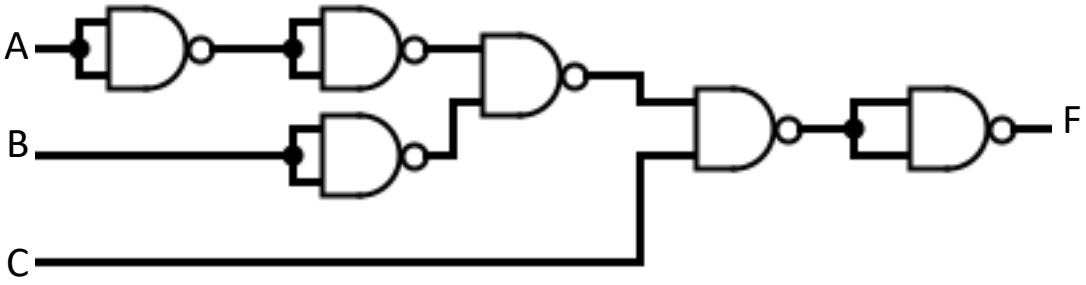

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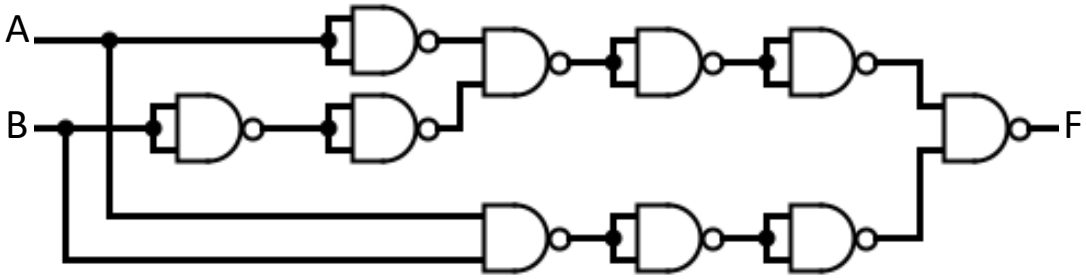

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