

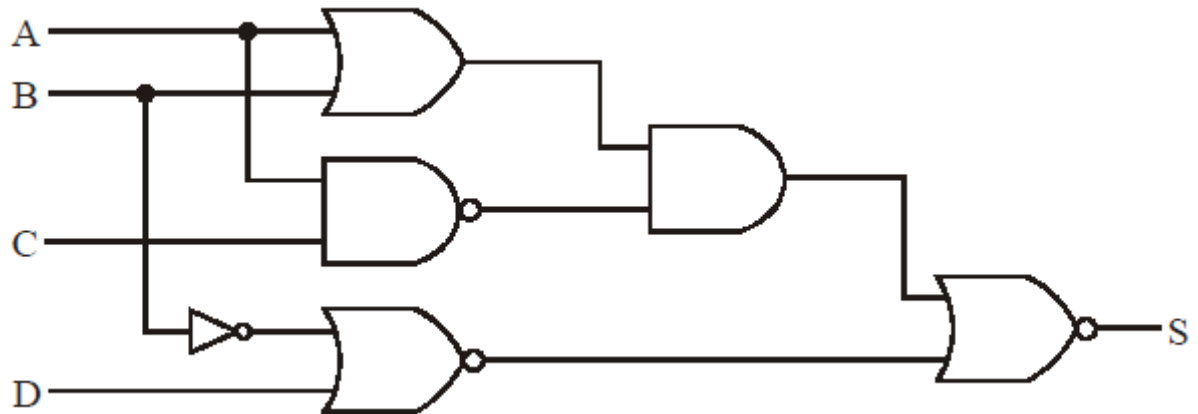
# UNASP – Sistemas Digitais

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## Lista de Exercícios 2

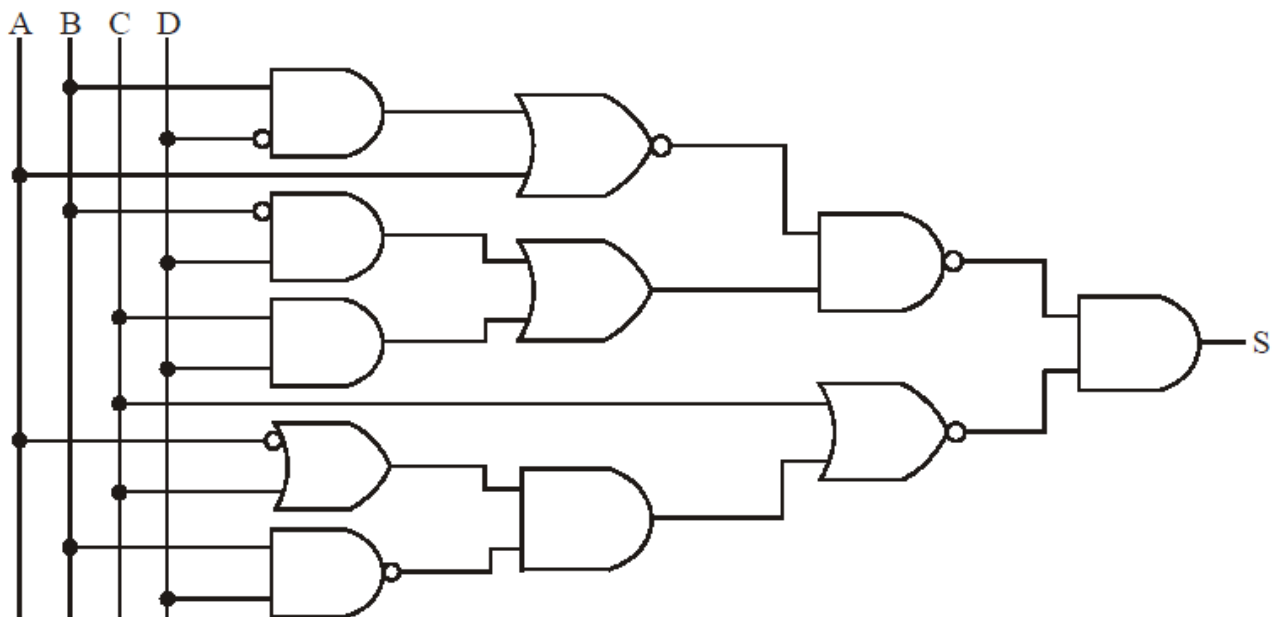
E01: Determine as expressões dos circuitos abaixo:

a) Circuito 1:



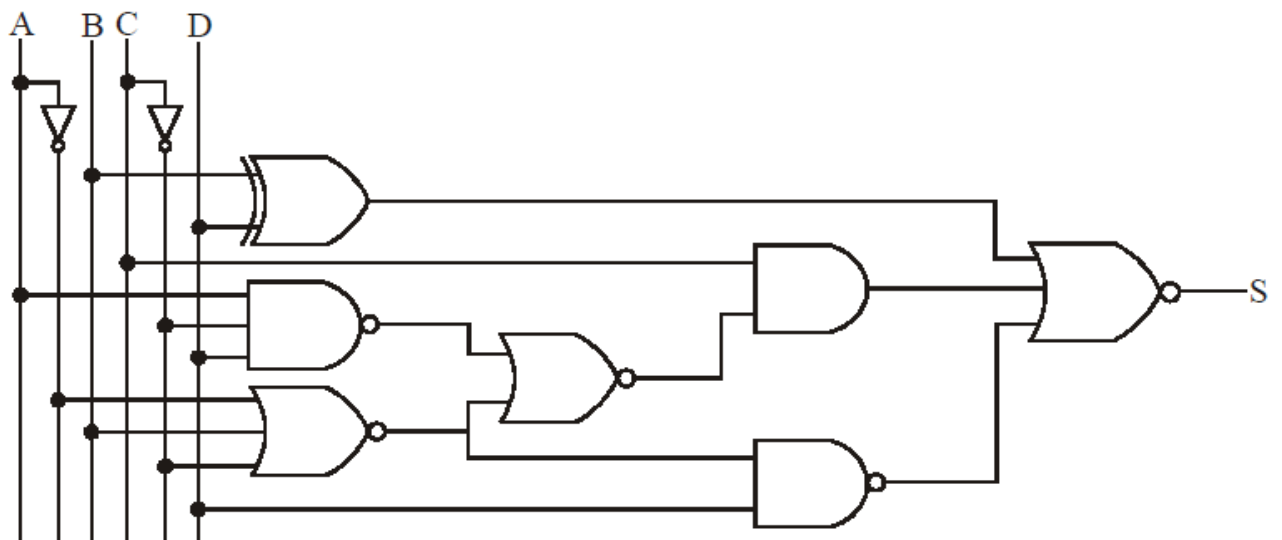
$$S = (((A + B) \cdot (A \cdot C)') + (B' + D)')'$$

b) Circuito 2:



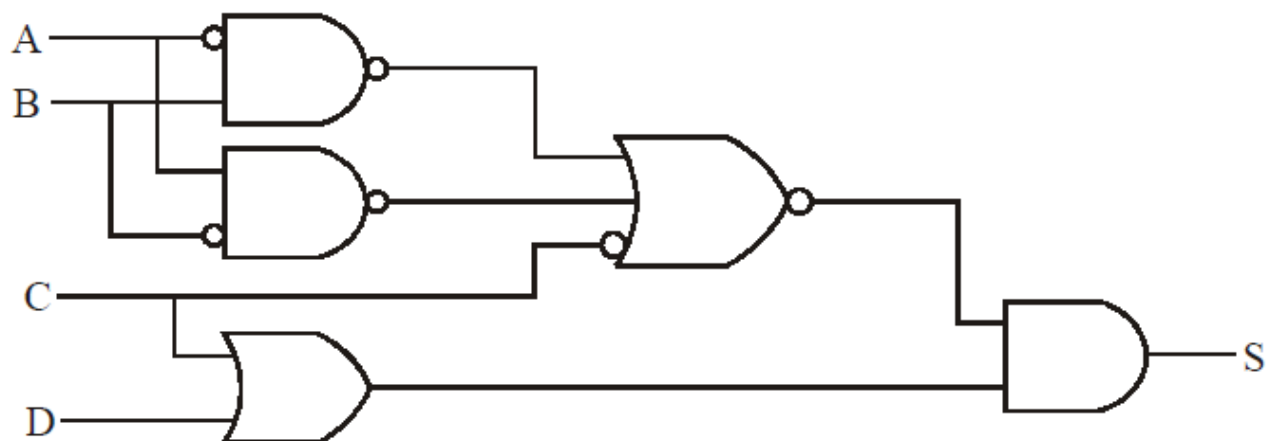
$$S = (((B \cdot D') + A)' \cdot ((B' \cdot D) + (C \cdot D)))' \cdot (C + ((A' + C) \cdot (B \cdot D)))'$$

c) Circuito 3:



$$S = ((B \oplus D) + (C \cdot ((A \cdot C' \cdot D)' + (A' + B + C')')) + ((A' + B + C')' \cdot D'))'$$

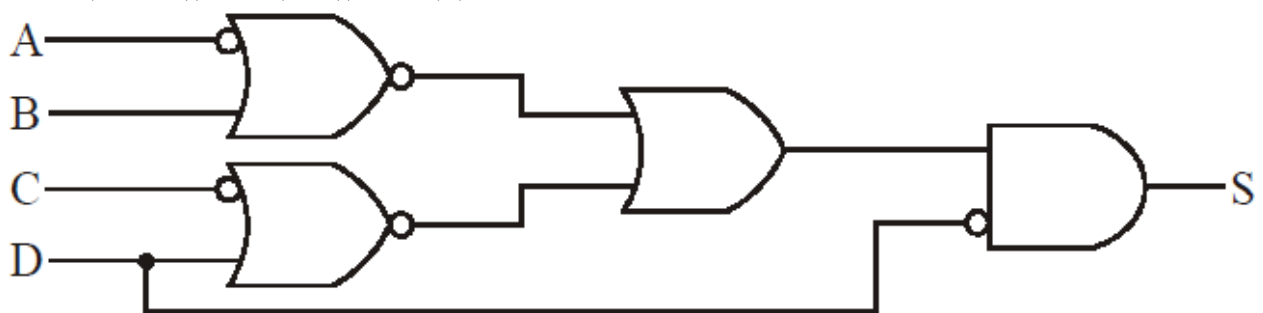
d) Circuito 4:



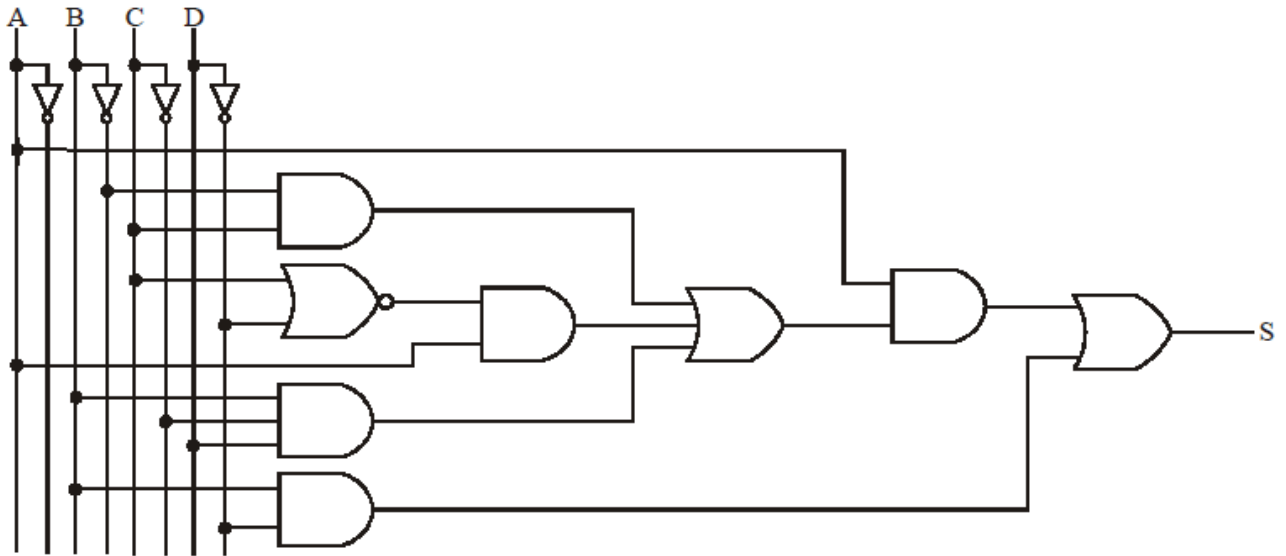
$$S = ((A' \cdot B)' + (A \cdot B')' + C')' \cdot (C + D)$$

E02: Desenhe (usando portas lógicas) o circuito que executa as seguintes expressões:

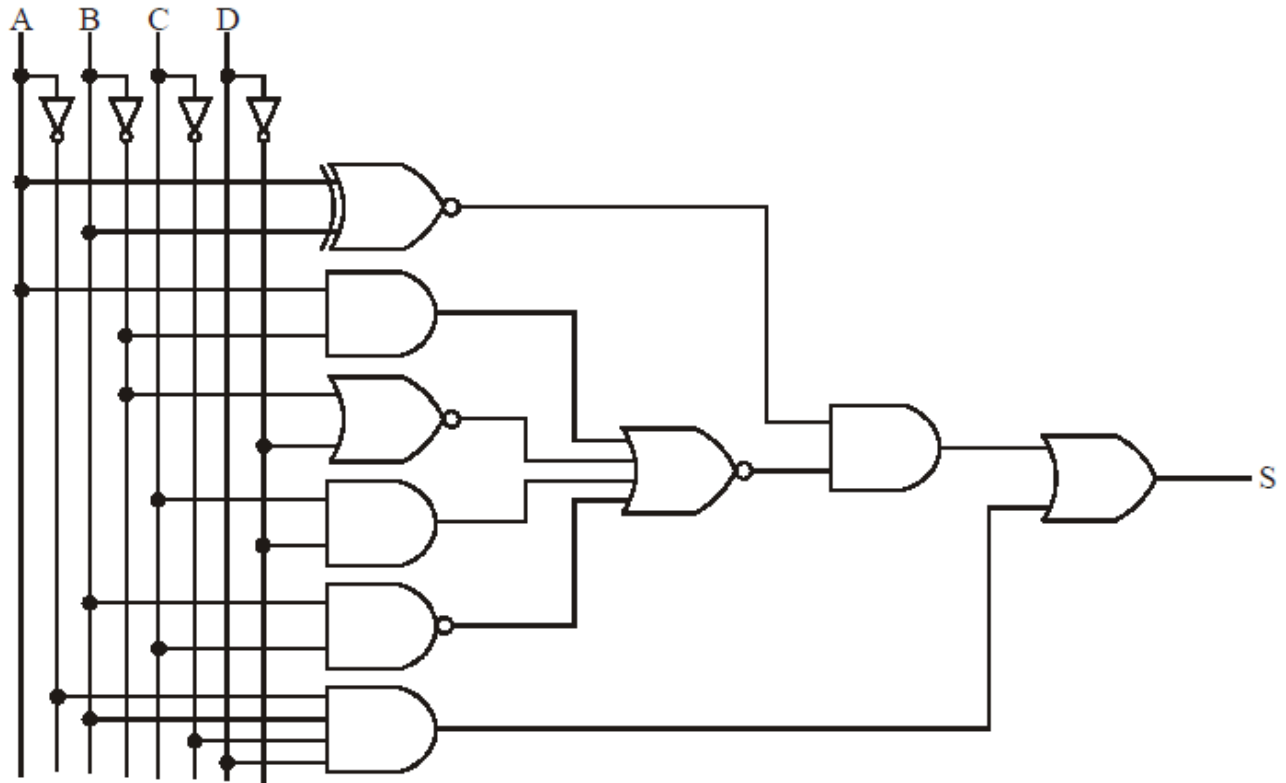
a)  $S = ((A' + B)' + ((C' + D)')) \cdot D'$



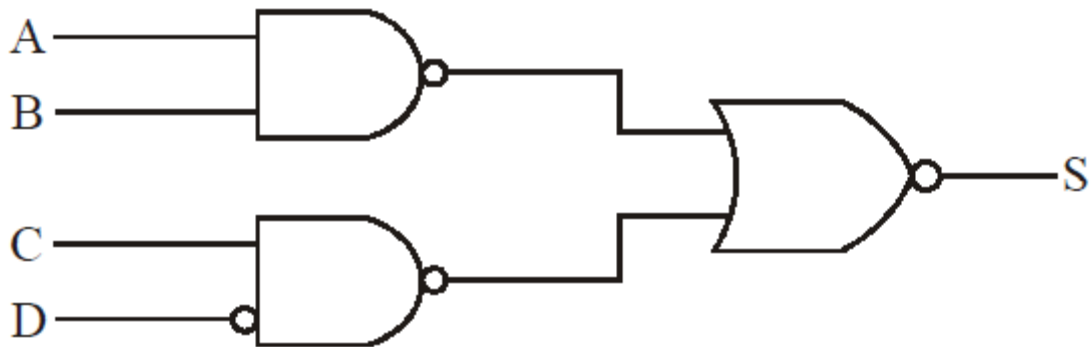
b)  $S = A \cdot (B' \cdot C + A \cdot (C + D')' + B \cdot C' \cdot D) + B \cdot D'$



c)  $S = (A \odot B) \cdot (A \cdot B' + (B' + D')' + C \cdot D' + (B \cdot C)')' + A' \cdot B \cdot C' \cdot D$



E03: Escreva a expressão característica do circuito abaixo e levante sua respectiva tabela verdade.



$$S = ((A \cdot B)' + (C \cdot D'))'$$

A	B	C	D	S
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0
0	1	1	1	0
1	0	0	0	0
1	0	0	1	0
1	0	1	0	0
1	0	1	1	0
1	1	0	0	0
1	1	0	1	0
1	1	1	0	1
1	1	1	1	0

E04: Mostre, usando simplificação por postulados e propriedades, ou seja, por transformações algébricas que:

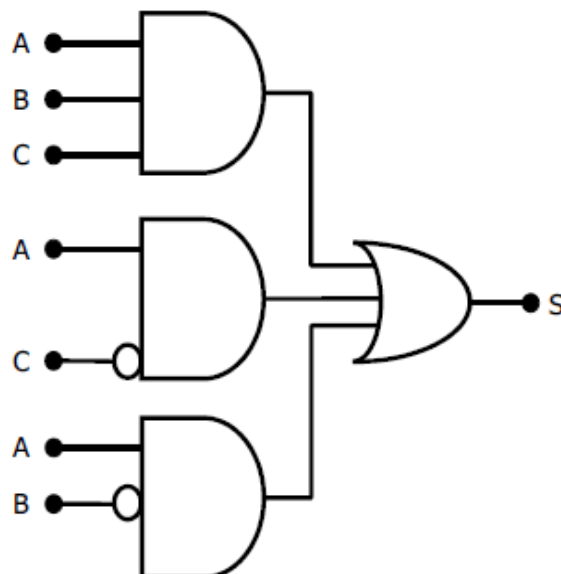
- $A + (A \cdot B) = A$
- $A \cdot (A + B) = A$
- $A + (A' \cdot B) = A + B$
- $(A' \cdot B' \cdot C') + (A' \cdot B \cdot C') + (A \cdot B' \cdot C) = (A' \cdot C') + (A \cdot B' \cdot C)$
- $(A' \cdot B') + (A' \cdot B) = A'$
- $(A' \cdot B' \cdot C') + (A' \cdot B \cdot C) + (A' \cdot B \cdot C') + (A \cdot B' \cdot C') + (A \cdot B \cdot C') = (A' \cdot B \cdot C) + C'$

Respostas:

- $A + A \cdot B$   
 $= A \cdot (1 + B)$   $\Rightarrow$  P5  
 $= A \cdot (1)$   $\Rightarrow$  T2  
 $= A$   $\Rightarrow$  P4
- $A \cdot (A + B)$

$$\begin{aligned}
&= (A.A) + (A.B) \Rightarrow P6 \\
&= A + (A.B) \Rightarrow T5 \\
&= A.(1+B) \Rightarrow P5 \\
&= A.(1) \Rightarrow T2 \\
&= A \Rightarrow P4 \\
\text{c) } &A + A'.B \\
&= (A + A'.B)'' \Rightarrow T8 \\
&= (A' . (A'.B)')' \Rightarrow T10 \\
&= (A' . (A + B'))' \Rightarrow T10 \\
&= (A'.A + A'.B')' \Rightarrow P6 \\
&= (0 + A'.B')' \Rightarrow P7 \\
&= (A'.B')' \Rightarrow P3 \\
&= A + B \Rightarrow T10 \\
\text{Ou} \\
&= (A + A').(A + B) \Rightarrow P5 \\
&= 1.(A+B) \Rightarrow P7 \\
&= A + B \Rightarrow P4 \\
\text{d) } &(A'.B'.C') + (A'.B.C') + (A.B'.C) \\
&= (A'.C'.B') + (A'.C'.B) + (A.B'.C) \Rightarrow P2 \\
&= (A'.C').(B' + B) + (A.B'.C) \Rightarrow P6 \\
&= A'.C'.(1) + A.B'.C \Rightarrow P7 \\
&= (A'.C') + (A.B'.C) \Rightarrow P4 \\
\text{e) } &(A'.B') + (A'.B) \\
&= A' . (B' + B) \Rightarrow P6 \\
&= A' . (1) \Rightarrow P7 \\
&= A' \Rightarrow P4 \\
\text{f) } &(A'.B'.C') + (A'.B.C) + (A'.B.C') + (A.B'.C') + (A.B.C') \\
&= (A'.B.C) + ((A'.B') + (A'.B) + (A.B') + (A.B)).C' \Rightarrow P6 \\
&= (A'.B.C) + ((A'.(B' + B)) + (A.(B' + B))).C' \Rightarrow P6 \\
&= (A'.B.C) + ((A'.(1)) + (A.(1))).C' \Rightarrow P7 \\
&= (A'.B.C) + (A' + A).C' \Rightarrow P4 \\
&= (A'.B.C) + (1).C' \Rightarrow P7 \\
&= (A'.B.C) + C' \Rightarrow P4
\end{aligned}$$

E05: Encontre a equação do circuito abaixo e, com base nos postulados e teoremas da lógica booleana, simplifique o circuito escrevendo o novo circuito.



Resposta:

$$\begin{aligned} S &= (A.B.C) + (A.C') + (A.B') \\ &= A.((B.C) + C' + B') && \Rightarrow P6 \\ &= A.((B.C) + (C' + B')) && \Rightarrow P1 \\ &= A.((B.C) + ((C' + B')')) && \Rightarrow T8 \\ &= A.((B.C) + (C.B')) && \Rightarrow T10 \\ &= A.((B.C) + (B.C')) && \Rightarrow P2 \\ &= A.(1) && \Rightarrow P7 \\ &= A && \Rightarrow P4 \end{aligned}$$



E06: Escreva as funções referentes as tabelas verdades abaixo utilizando as somas dos produtos (mintermos).

a)

A	B	f (A,B)	mintermos
0	0	1	$A'.B'$
0	1	0	-
1	0	0	-
1	1	1	$A.B$

$$f(A,B) = A'.B' + A.B$$

b)

A	B	f (A,B)	mintermos
0	0	0	-
0	1	1	$A'.B$
1	0	1	$A.B'$
1	1	0	-

$$f(A,B) = A'.B + A.B'$$

c)

A	B	C	f (A,B,C)	mintermos
0	0	0	0	-
0	0	1	0	-
0	1	0	1	$A'.B.C'$
0	1	1	1	$A'.B.C$
1	0	0	0	-
1	0	1	1	$A.B'.C$
1	1	0	0	-
1	1	1	1	$A.B.C$

$$f(A,B,C) = A'.B.C' + A'.B.C + A.B'.C + A.B.C$$

d)

A	B	C	f (A,B,C)	mintermos
0	0	0	1	$A'.B'.C'$
0	0	1	0	-
0	1	0	0	-
0	1	1	0	-
1	0	0	1	$A.B'.C'$
1	0	1	0	-
1	1	0	0	-
1	1	1	1	$A.B.C$

$$f(A,B,C) = A'.B'.C' + A.B'.C' + A.B.C$$

e)

A	B	C	D	f (A,B,C,D)	mintermos
0	0	0	0	0	-
0	0	0	1	0	-
0	0	1	0	0	-
0	0	1	1	1	$A'.B'.C.D$
0	1	0	0	1	$A'.B.C'.D'$
0	1	0	1	1	$A'.B.C'.D$
0	1	1	0	0	-
0	1	1	1	0	-
1	0	0	0	0	-
1	0	0	1	0	-
1	0	1	0	0	-
1	0	1	1	1	$A.B'.C.D$
1	1	0	0	0	-
1	1	0	1	0	-
1	1	1	0	1	$A.B.C.D'$
1	1	1	1	0	-

$$f(A,B,C,D) = A'.B'.C.D + A'.B.C'.D' + A'.B.C'.D + A.B'.C.D + A.B.C.D'$$

f)

A	B	C	D	f (A,B,C,D)	mintermos
0	0	0	0	1	$A'.B'.C'.D'$
0	0	0	1	0	-
0	0	1	0	0	-
0	0	1	1	1	$A'.B'.C.D$
0	1	0	0	0	-
0	1	0	1	0	-
0	1	1	0	0	-
0	1	1	1	0	-
1	0	0	0	1	$A.B'.C'.D'$
1	0	0	1	0	-
1	0	1	0	0	-
1	0	1	1	0	-
1	1	0	0	0	-
1	1	0	1	1	$A.B.C'.D$
1	1	1	0	1	$A.B.C.D'$
1	1	1	1	0	-

$$f(A,B,C,D) = A'.B'.C'.D' + A'.B'.C.D + A.B'.C'.D' + A.B.C'.D + A.B.C.D'$$

E07: Escreva as funções referentes as tabelas verdades abaixo utilizando os produtos das somas (maxtermos).

a)

A	B	f (A,B)	maxtermos
0	0	1	-
0	1	0	$A+B'$
1	0	1	-
1	1	0	$A'+B'$

$$f(A,B) = (A+B') . (A'+B')$$

b)

A	B	f (A,B)	maxtermos
0	0	0	$A+B$
0	1	0	$A+B'$
1	0	1	-
1	1	1	-

$$f(A,B) = (A+B) . (A+B')$$

c)

A	B	C	f (A,B,C)	maxtermos
0	0	0	1	-
0	0	1	1	-
0	1	0	1	-
0	1	1	0	$A+B'+C'$
1	0	0	1	-
1	0	1	0	$A'+B+C'$
1	1	0	1	-
1	1	1	1	-

$$f(A,B,C) = (A+B'+C') . (A'+B+C')$$



d)

A	B	C	f (A,B,C)	maxtermos
0	0	0	0	$A+B+C$
0	0	1	0	$A+B+C'$
0	1	0	0	$A+B'+C$
0	1	1	1	-
1	0	0	1	-
1	0	1	1	-
1	1	0	0	$A'+B'+C$
1	1	1	0	$A'+B'+C'$

$$f(A,B,C) = (A+B+C) \cdot (A+B+C') \cdot (A+B'+C) \cdot (A'+B'+C) \cdot (A'+B'+C')$$

e)

A	B	C	D	f (A,B,C,D)	maxtermos
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	1	-
0	1	1	0	1	-
0	1	1	1	1	-
1	0	0	0	0	$A'+B+C+D$
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	-

$$f(A,B,C,D) = A'+B+C+D$$

f)

A	B	C	D	f (A,B,C,D)	maxtermos
0	0	0	0	0	$A+B+C+D$
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	$A+B'+C+D'$
0	1	1	0	1	-
0	1	1	1	1	-
1	0	0	0	1	-
1	0	0	1	1	-
1	0	1	0	0	$A'+B+C'+D$
1	0	1	1	1	-
1	1	0	0	1	-
1	1	0	1	1	-
1	1	1	0	1	-
1	1	1	1	0	$A'+B'+C'+D'$

$$f(A,B,C,D) = (A+B+C+D) \cdot (A+B'+C+D') \cdot (A'+B+C'+D) \cdot (A'+B'+C'+D')$$