Exercícios de Lógica: Lista 2b

Dadas as tabelas verdades abaixo, mostre a função lógica correspondente na forma de soma de produtos. Obs.: a, b, c e d são entradas e y é a saída. Após, simplifique a expressão obtida, passo a passo, utilizando e mostrando as propriedades booleanas utilizadas em cada passo:

a)

a	b	c	y
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	0

b)

a	b	c	y
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

c)

a	b	c	y
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	0

d)

a	b	c	d	y
0	0	0	0	1
0	0	0	1	1
0	0	1	0	0
0	0	1	1	1
0	1	0	0	1
0	1	0	1	1
0	1	1	0	0
0	1	1	1	1
1	0	0	0	1
1	0	0	1	1
1	0	1	0	0
1	0	1	1	1
1	1	0	0	1
1	1	0	1	1
1	1	1	0	0
1	1	1	1	1

e)

a	b	c	d	y
0	0	0	0	0
0	0	0	1	1
0	0	1	0	1
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	1
1	1	0	0	0
1	1	0	1	0
1	1	1	0	1
1	1	1	1	1

f)

a	b	c	d	y
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	1
0	1	0	1	0
0	1	1	0	0
0	1	1	1	0
1	0	0	0	1
1	0	0	1	1
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

Respostas

a)
$y = \overline{a}.\overline{b}.\overline{c} + \overline{a}.\overline{b}.c + \overline{a}.b.\overline{c} + \overline{a}.b.c + a.b.\overline{c}$
$y = \overline{a}.\overline{b}.(\overline{c}+c) \qquad + \overline{a}.b.(\overline{c}+c) \qquad + a.b.\overline{c} \quad (8)$
$y = \overline{a}.\overline{b} \ . \ (1) \qquad + \overline{a}.b \ . \ (1) \qquad + a.b.\overline{c} \quad (4)$
$y = \overline{a}.\overline{b} \qquad\qquad + \overline{a}.b \qquad\qquad + a.b.\overline{c} \quad (1)$
$y = \overline{a}.(\overline{b}+b) \qquad\qquad\qquad\qquad + a.b.\overline{c} \quad (8)$
$y = \overline{a}.(1) \qquad\qquad\qquad\qquad\quad + a.b.\overline{c} \quad (4)$
$y = \overline{a} \qquad\qquad\qquad\qquad\qquad + a.b.\overline{c} \quad (1)$
$y = \overline{a} + b.\overline{c} \qquad (10)$

b)
$y = \overline{a}.\overline{b}.c + a.\overline{b}.c + a.b.\overline{c} + a.b.c$
$y = c.\overline{b}(\overline{a}+a) + a.b(\overline{c}+c) \quad (8)$
$y = c.\overline{b}(1) + a.b(1) \qquad (4)$
$y = c.\overline{b} + a.b \qquad\qquad (1)$
$y = ab + \overline{b}c$

c)
$y = \overline{a}.\overline{b}.\overline{c} + \overline{a}.b.\overline{c} + \overline{a}.b.c + a.\overline{b}.\overline{c} + a.b.\overline{c}$
$y = \overline{a}.\overline{c}.(\overline{b}+b)+ \overline{a}.b.c + a.\overline{c}.(\overline{b}+b) \ (8)$
$y = \overline{a}.\overline{c}.(1) + \overline{a}.b.c + a.\overline{c}.(1) \quad (4)$
$y = \overline{a}.\overline{c} + \overline{a}.b.c + a.\overline{c} \qquad\qquad (1)$
$y = \overline{c}.(\overline{a}+a) + \overline{a}.b.c \quad (8)$
$y = \overline{c}.(1) + \overline{a}.b.c \quad (4)$
$y = \overline{c} + \overline{a}.b.c \ (1)$
$y = \overline{c} + \overline{a}b \qquad (10)$

d)
$y = \overline{a}.\overline{b}.\overline{c}.\overline{d} + \overline{a}.\overline{b}.\overline{c}.d + \overline{a}.\overline{b}.c.d + \overline{a}.b.\overline{c}.\overline{d} + \overline{a}.b.\overline{c}.d + \overline{a}.b.c.d +$
$\qquad a.\overline{b}.\overline{c}.\overline{d} + a.\overline{b}.\overline{c}.d + a.\overline{b}.c.d + a.b.\overline{c}.\overline{d} + a.b.\overline{c}.d + a.b.c.d$

$y = \overline{a}.(\overline{b}.\overline{c}.\overline{d} + \overline{b}.\overline{c}.d + \overline{b}.c.d + b.\overline{c}.\overline{d} + b.\overline{c}.d + b.c.d) +$
$\qquad a.(\overline{b}.\overline{c}.\overline{d} + \overline{b}.\overline{c}.d + \overline{b}.c.d + b.\overline{c}.\overline{d} + b.\overline{c}.d + b.c.d) \qquad (8)$

$y = \overline{a}.(\overline{b}.\overline{c}.(\overline{d}+d) + (\overline{b}+b).c.d + (b.\overline{c}.(\overline{d}+d)) +$
$\qquad a.(\overline{b}.\overline{c}.(\overline{d}+d) + (\overline{b}+b).c.d + (b.\overline{c}.(\overline{d}+d)) \qquad\qquad (8)$

$y = \overline{a}.(\overline{b}.\overline{c}.(1) + (1).c.d + (b.\overline{c}.(1)) +$
$\qquad a.(\overline{b}.\overline{c}.(1) + (1).c.d + (b.\overline{c}.(1)) \qquad\qquad (4)$

$y = \overline{a}.(\overline{b}.\overline{c} + c.d + b.\overline{c}) + a.(\overline{b}.\overline{c} + c.d + b.\overline{c}) \qquad (1)$
$y = \overline{a}.(\overline{c}.(\overline{b}+b) + c.d) + a.(\overline{c}.(\overline{b}+b) + c.d) \qquad (8)$
$y = \overline{a}.(\overline{c}.(1) + c.d) + a.(\overline{c}.(1) + c.d) \qquad (4)$
$y = \overline{a}.(\overline{c} + c.d) + a.(\overline{c} + c.d) \qquad (1)$
$y = \overline{a}.(\overline{c} + d) + a.(\overline{c} + d) \qquad (10)$
$y = (\overline{c} + d).\overline{a} + (\overline{c} + d).a \qquad (6)$
$y = (\overline{c} + d). (\overline{a}+a) \qquad (8)$
$y = (\overline{c} + d). (1) \qquad (4)$
$y = \overline{c} + d \qquad (1)$

outra estratégia

$$y = \overline{a}.\overline{b}.\overline{c}.\overline{d} + \overline{a}.\overline{b}.\overline{c}.d + \overline{a}.\overline{b}.c.d + \overline{a}.b.\overline{c}.\overline{d} + \overline{a}.b.\overline{c}.d + \overline{a}.b.c.d +$$
$$a.\overline{b}.\overline{c}.\overline{d} + a.\overline{b}.\overline{c}.d + a.\overline{b}.c.d + a.b.\overline{c}.\overline{d} + a.b.\overline{c}.d + a.b.c.d$$

reordenando

$$y = \overline{a}.\overline{b}.\overline{c}.\overline{d} + \overline{a}.\overline{b}.\overline{c}.d + \overline{a}.b.\overline{c}.\overline{d} + \overline{a}.b.\overline{c}.d +$$
$$a.\overline{b}.\overline{c}.\overline{d} + a.\overline{b}.\overline{c}.d + a.b.\overline{c}.\overline{d} + a.b.\overline{c}.d +$$
$$a.b.c.d + \overline{a}.b.c.d + \overline{a}.\overline{b}.c.d + a.\overline{b}.c.d \qquad (6)$$

$$y = \overline{a}.\overline{b}.\overline{c}.(\overline{d}+d) + \overline{a}.b.\overline{c}.(\overline{d}+d) +$$
$$a.\overline{b}.\overline{c}.(\overline{d}+d) + a.b.\overline{c}.(\overline{d}+d) +$$
$$(a+\overline{a}).b.c.d + (\overline{a}+a).\overline{b}.c.d \qquad (8)$$

$$y = \overline{a}.\overline{b}.\overline{c}.(1) + \overline{a}.b.\overline{c}.(1) +$$
$$a.\overline{b}.\overline{c}.(1) + a.b.\overline{c}.(1) +$$
$$(1).b.c.d + (1).\overline{b}.c.d \qquad (4)$$

$$y = \overline{a}.\overline{b}.\overline{c} + \overline{a}.b.\overline{c} + a.\overline{b}.\overline{c} + a.b.\overline{c} + b.c.d + \overline{b}.c.d \quad (1)$$
$$y = \overline{a}.\overline{c}.(\overline{b}+b) + a.\overline{c}.(\overline{b}+b) + c.d.(b+\overline{b}) \qquad\qquad (8)$$
$$y = \overline{a}.\overline{c}.(1) \quad + a.\overline{c}.(1) \quad + c.d.(1) \qquad\qquad (4)$$
$$y = \overline{a}.\overline{c} \qquad + a.\overline{c} \qquad + c.d \qquad\qquad\qquad (1)$$
$$y = \overline{c}.(\overline{a}+a) + c.d \quad (8)$$
$$y = \overline{c}.(1) + c.d \qquad (4)$$
$$y = \overline{c} + c.d \qquad\quad (1)$$
$$y = \overline{c} + d \qquad\qquad (10)$$

ou

$$y = \overline{c} \qquad\quad + c.d$$
$$y = \overline{c}.1 \qquad + c.d$$
$$y = \overline{c}.(1+d) \quad + c.d$$
$$y = \overline{c}.1+ \overline{c}.d + c.d$$
$$y = \overline{c} \;\; + \overline{c}.d + c.d$$
$$y = \overline{c} \;\; + d.(\overline{c}+c)$$
$$y = \overline{c} \;\; + d$$

e)

$y = \bar{a}.\bar{b}.\bar{c}.d + \bar{a}.\bar{b}.c.\bar{d} + \bar{a}.\bar{b}.c.d + \bar{a}.b.c.\bar{d} + \bar{a}.b.c.d +$
$\quad\ a.\bar{b}.c.\bar{d} + a.\bar{b}.c.d + a.b.c.\bar{d} + a.b.c.d$

$y = \bar{a}.\bar{b}.\bar{c}.d + \bar{a}.\bar{b}.c.(\bar{d}+d) \qquad + \bar{a}.b.c.(\bar{d}+d) +$
$\quad\ a.\bar{b}.c.(\bar{d}+d) + a.b.c.(\bar{d}+d) \qquad\qquad\qquad (8)$

$y = \bar{a}.\bar{b}.\bar{c}.d + \bar{a}.\bar{b}.c.(1)+ \bar{a}.b.c.(1)+ a.\bar{b}.c.(1) + a.b.c.(1)\ (8)$
$y = \bar{a}.\bar{b}.\bar{c}.d + \bar{a}.\bar{b}.c\ \ + \bar{a}.b.c\ \ + a.\bar{b}.c\ \ + a.b.c \qquad (4)$
$y = \bar{a}.\bar{b}.\bar{c}.d + \bar{a}.\bar{b}.c + \bar{a}.b.c + a.\bar{b}.c + a.b.c \qquad\qquad (1)$
$y = \bar{a}.\bar{b}.\bar{c}.d + \bar{a}.c.(\bar{b}+b)\qquad + a.c.(\bar{b}+b)\quad (8)$
$y = \bar{a}.\bar{b}.\bar{c}.d + \bar{a}.c.(1)\qquad + a.c.(1)\qquad (4)$
$y = \bar{a}.\bar{b}.\bar{c}.d + \bar{a}.c + a.c\quad (1)$
$y = \bar{a}.\bar{b}.\bar{c}.d + c.(\bar{a}+a)\qquad (8)$
$y = \bar{a}.\bar{b}.\bar{c}.d + c.(1)\qquad (4)$
$y = \bar{a}.\bar{b}.\bar{c}.d + c\qquad (1)$
$y = c + \bar{c}.(\bar{a}.\bar{b}.d)\qquad (6)$
$y = c + \bar{a}.\bar{b}.d\qquad (10)$

f)

$y = a.\bar{b}.\bar{c}.d + a.\bar{d} + \bar{a}.b.\bar{c}.\bar{d}$

$y = \bar{a}.b.\bar{c}.\bar{d} + a.\bar{b}.\bar{c}.\bar{d} + a.\bar{b}.\bar{c}.d + a.\bar{b}.c.\bar{d} + a.b.\bar{c}.\bar{d} + a.b.c.\bar{d}$
$y = \bar{a}.b.\bar{c}.\bar{d} + a.\bar{b}.\bar{c}.(\bar{d}+d)\qquad + a.c.\bar{d}.(\bar{b}+b) + a.b.\bar{c}.\bar{d}\quad (8)$
$y = \bar{a}.b.\bar{c}.\bar{d} + a.\bar{b}.\bar{c}.(1)\qquad + a.c.\bar{d}.(1)\quad + a.b.\bar{c}.\bar{d}\quad (4)$
$y = \bar{a}.b.\bar{c}.\bar{d} + a.\bar{b}.\bar{c}\qquad\qquad + a.c.\bar{d}\qquad + a.b.\bar{c}.\bar{d}\quad (1)$
$y = b.\bar{c}.\bar{d}.(\bar{a}+a) + a.\bar{b}.\bar{c} + a.c.\bar{d}\quad (8)$
$y = b.\bar{c}.\bar{d}.(1)\quad + a.\bar{b}.\bar{c} + a.c.\bar{d}\quad (4)$
$y = b.\bar{c}.\bar{d}\qquad + a.\bar{b}.\bar{c} + a.c.\bar{d}\quad (1)$
$y = b.\bar{c}.\bar{d} + a(\bar{b}.\bar{c} + c.\bar{d})\qquad (8)$

ou

$y = \bar{a}.b.\bar{c}.\bar{d} + a.\bar{b}.\bar{c}.\bar{d} + a.\bar{b}.\bar{c}.d + a.\bar{b}.c.\bar{d} + a.b.\bar{c}.\bar{d} + a.b.c.\bar{d}$
$y = \bar{a}.b.\bar{c}.\bar{d} + a.(\bar{b}.\bar{c}.\bar{d} + \bar{b}.\bar{c}.d + \bar{b}.c.\bar{d} + b.\bar{c}.\bar{d} + b.c.\bar{d})\quad (8)$
$y = \bar{a}.b.\bar{c}.\bar{d} + a.(\bar{b}.\bar{c}.(\bar{d} + d)\quad + c.\bar{d}.(\bar{b}+b) + b.\bar{c}.\bar{d})\qquad (8)$
$y = \bar{a}.b.\bar{c}.\bar{d} + a.(\bar{b}.\bar{c}.(1)\qquad + c.\bar{d}.(1)\quad + b.\bar{c}.\bar{d})\qquad (4)$
$y = \bar{a}.b.\bar{c}.\bar{d} + a.(\bar{b}.\bar{c} + c.\bar{d} + b.\bar{c}.\bar{d})\qquad\qquad (1)$
$y = \bar{a}.b.\bar{c}.\bar{d} + a.(\bar{b}.\bar{c} + \bar{d}.(c+b.\bar{c})\quad (8)$
$y = \bar{a}.b.\bar{c}.\bar{d} + a.(\bar{b}.\bar{c} + \bar{d}.(c+b))\qquad (10)$
$y = \bar{a}.b.\bar{c}.\bar{d} + a.(\bar{b}.\bar{c} + \bar{d}.c + \bar{d}.b)\quad (8)$
$y = \bar{a}.b.\bar{c}.\bar{d} + a.\bar{b}.\bar{c} + a.\bar{d}.c + a.\bar{d}.b\ (8)$
$y = \bar{d}.(\bar{a}.b.\bar{c}+ + a.c + a.b) + a.\bar{b}.\bar{c}\quad (8)$
$y = \bar{d}.(b(\bar{a}.\bar{c}+a) + a.c) + a.\bar{b}.\bar{c}\qquad (8)$
$y = \bar{d}.(b(\bar{c}+a) + a.c) + a.\bar{b}.\bar{c}\qquad (10)$
$y = \bar{d}.(b\bar{c}+ba + ac) + a.\bar{b}.\bar{c}\qquad (8)$
$y = \bar{d}b\bar{c} + \bar{d}ba + \bar{d}ac + a.\bar{b}.\bar{c}\qquad (8)$
$y = \bar{d}b\bar{c} + a(\bar{d}b + \bar{d}c + \bar{b}.\bar{c})\qquad (8)$