# Lista - Parte I

① O número $1011101011_2 = (2^9 + 2^7 + 2^6 + 2^5 + 2^3 + 2^1 + 2^0)_{10} = 747_{10}$

②

| | | |
|---|---|---|
| 23087 | 11543 | 1 |
| 11543 | 5771 | 1 |
| 5771 | 2885 | 1 |
| 2885 | 1442 | 1 |
| 1442 | 721 | 0 |
| 721 | 360 | 1 |

| | | |
|---|---|---|
| 360 | 180 | 0 |
| 180 | 90 | 0 |
| 90 | 45 | 0 |
| 45 | 22 | 1 |
| 22 | 11 | 0 |
| 11 | 5 | 1 |

| | | |
|---|---|---|
| 5 | 2 | 1 |
| 2 | 1 | 0 |
| 1 | 0 | 1 |

R. $101101000101111_2$

③ 01110010 → 10001101 → 10001110,

④ A = 0110 = 6
B = 1010 = -6
C = 0100 = 4

- 8 até 7

A+B *
```
 (1)
  0110
+ 1010
  0000
```

A-B
```
 (0)
  0110
+ 0110
  0001
```

B-A
```
 (1)
  1010
  1010
  0101
```

B+C
```
  1010
  0100
  1110
```

* B - C
```
 1 1010
   1100
   0110
```

Overflow: *

⑤ a = 0, b = 1, c = 0, d = 1

⑥ $\bar{a}bc$ ; $\bar{a}b$

⑦ não é necessário.

⑧ a, c, f

⑨ a, c, f.

⑩ a, b, f

⑪ a) $f(a,b,c) = \overline{abc} = \bar{a} + \bar{b} + \bar{c}$

b) $f(a,b,c) = a+b+c$

c) $f(a,b,c,d) = (a+b)(b+c+d) = ab + ac + ad + b + bc + ba = ac + ad + b$

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

⑫ a) $f(a,b,c) = \overline{a+b+c} = \bar{a} \cdot \bar{b} \cdot c$  b) $f(a,b,c) = abc$.

⑬ É uma expressão com o menor número de produtos que se pode achar, e os produtos mais simples quanto possível. minimizar o circuito lógico

⑭ a) $b\bar{c}$

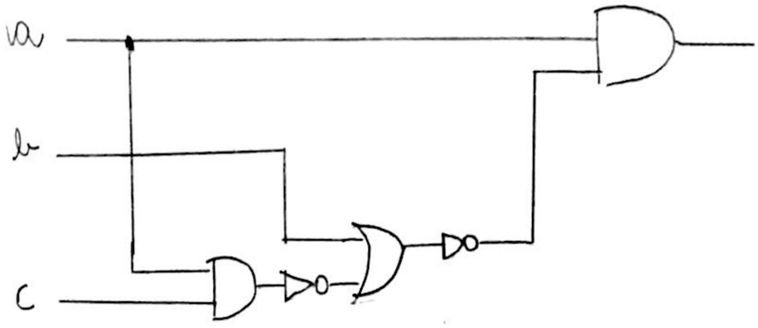
b) [000, 010, 100, 110]

c) $\bar{a}b\bar{c}$

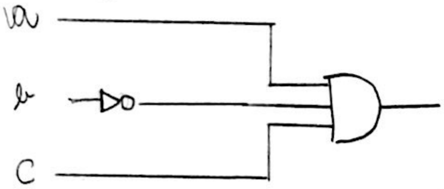
d) $a\bar{c} = 1X0$ ⇒ [100, 110]

(15) $f(a,b,c) = a\cdot(\overline{b+\overline{ac}})$

| a | b | c | f |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 |
| 0 | 1 | 0 | 0 |
| 0 | 1 | 1 | 0 |
| 1 | 0 | 0 | 0 |
| 1 | 0 | 1 | 1 |
| 1 | 1 | 0 | 0 |
| 1 | 1 | 1 | 0 |




(16) $f(a,b,c) = a\cdot\overline{(b+\overline{ac})} = a\cdot\overline{(b+\bar a+\bar c)} = a\cdot(a\bar b c) = a\bar b c$




(17) $f(a,b,c) = \sum m(1,2,3,4,5,6)$

$= \bar a b + a\cdot\bar c + \bar b\cdot c$

| c \ ab | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 0 | | 1 | 1 | 1 |
| 1 | 1 | 1 | | 1 |

$\bar a\cdot b$, $a\cdot\bar c$, $\bar b\cdot c$

| c \ ab | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 0 | | 1 | 1 | 1 |
| 1 | 1 | 1 | | 1 |

$b\cdot\bar c$, $\bar a\cdot c$, $a\cdot\bar b$

$f(a,b,c) = b\bar c + \bar a\cdot c + a\bar b$

(18) $f(a,b,c,d) = \sum m(0,2,3,6,7,8,9,10,13)$

$= \bar a c + \bar b\cdot\bar d + a\bar c d$

| cd \ ab | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | 1 | | | 1 |
| 01 | | | 1 | 1 |
| 11 | 1 | 1 | | |
| 10 | 1 | 1 | | 1 |

$\bar b\cdot\bar d$, $a\bar c d$, $\bar a c$

(19) $f(x,y,z) = \prod M(0,1,6,7)$

$= (x+y)(\bar x+\bar y)$

| z \ xy | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 0 | 0 | | 0 | |
| 1 | 0 | | 0 | |

(20) $f(a,b,c,d) = \sum m(0,2,8,12,13) = \prod M(1,3,4,5,6,7,9,10,11,14,15)$

| cd \ ab | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | 1 | 0 | 1 | 1 |
| 01 | 0 | 0 | 1 | 0 |
| 11 | 0 | 0 | 0 | 0 |
| 10 | 1 | 0 | 0 | 0 |

SoP: $ab\bar c + \bar b\bar c\bar d + \bar a\bar c\bar d$

PoS: $(a+\bar b)(b+\bar d)(\bar a+\bar c)$

(21) $f(w,x,y,z) = \sum m(0,7,8,10,12) + d(2,6,11) = \bar{b}\cdot\bar{d} + \bar{a}bc + a\bar{c}\bar{d}$

| cd \ ab | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | 1 | | 1 | 1 |
| 01 | | | | |
| 11 | | 1 | | X |
| 10 | X | X | | 1 |

(22) $f(a,b,c,d) = \sum m(0,2,8,9) + d(1,13) = \bar{b}\bar{c} + \bar{a}\bar{b}\bar{d}$

| cd \ ab | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | 1 | | | 1 |
| 01 | X | | X | 1 |
| 11 | | | | |
| 10 | 1 | | | |

(23) $f_1(a,b,c,d) = \sum m(0,2,6,7,15) + d(8,10,14) = bc + \bar{b}\bar{d}$ → grafite

| cd \ ab | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | 11 | | | X |
| 01 | 1 | | | |
| 11 | 1 | 11 | 11 | |
| 10 | 1 | 1 | X | X |

$f_2(a,b,c,d) = \sum m(0,1,3,7,15) + d(8,10,14) = bcd + \bar{a}\bar{b}d + \bar{b}\bar{c}\bar{d}$ → azul

Pode, com mais don't cares.

(24)

| a | b | c | d | base 10 | f |
|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 1 | 1 | 0 |
| 0 | 0 | 1 | 0 | 2 | 0 |
| 0 | 0 | 1 | 1 | 3 | 1 |
| 0 | 1 | 0 | 0 | 4 | 0 |
| 0 | 1 | 0 | 1 | 5 | 0 |
| 0 | 1 | 1 | 0 | 6 | 1 |
| 0 | 1 | 1 | 1 | 7 | 0 |
| 1 | 0 | 0 | 0 | 8 | 0 |
| 1 | 0 | 0 | 1 | 9 | 1 |
| 1 | 0 | 1 | 0 | 10 | 0 |
| 1 | 0 | 1 | 1 | 11 | 0 |
| 1 | 1 | 0 | 0 | 12 | 1 |
| 1 | 1 | 0 | 1 | 13 | 0 |
| 1 | 1 | 1 | 0 | 14 | 0 |
| 1 | 1 | 1 | 1 | 15 | 1 |

| cd \ ab | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | 0 | 0 | 1 | 0 |
| 01 | 0 | 0 | 0 | 1 |
| 11 | 1 | 0 | 1 | 0 |
| 10 | 0 | 1 | 0 | 0 |

$f(a,b,c,d) = \bar{a}\bar{b}cd + \bar{a}bc\bar{d} + a\bar{b}\bar{c}d + ab\bar{c}\bar{d} + abcd$

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

(25)

| $X_2X_1$ | $Y_2Y_1$ | $Z_2Z_1$ |
|---|---|---|
| 00 | 00 | 00 |
| 00 | 01 | 01 |
| 00 | 10 | 10 |
| 00 | 11 | 11 |
| 01 | 00 | 01 |
| 01 | 01 | 10 |
| 01 | 10 | 11 |
| 01 | 11 | 00 |
| 10 | 00 | 10 |
| 10 | 01 | 11 |
| 10 | 10 | 00 |
| 10 | 11 | 01 |
| 11 | 00 | 11 |
| 11 | 01 | 00 |
| 11 | 10 | 01 |
| 11 | 11 | 10 |

| cd \ ab | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | | | 1 | 1 |
| 01 | | 1 | | 1 |
| 11 | 1 | . | 1 | . |
| 10 | 1 | 1 | . | |

$z_2 = \bar{a}cd + \bar{a}\bar{b}c + \bar{a}b\bar{c}d$

$abcd + ac\bar{d} + a\bar{b}\bar{c}$

=

| cd \ ab | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | . | 1 | 1 | . |
| 01 | 1 | . | . | 1 |
| 11 | 1 | . | . | 1 |
| 10 | . | 1 | 1 | . |

$z_1 = \bar{b}d + b\bar{d}$

(26)

w

| cd \ ab | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | | | 1 | 1 |
| 01 | | | X | |
| 11 | | 1 | X | X |
| 10 | | | X | X |

$w = a\bar{d} + bcd$

(27)

| ab | cd | fg |
|---|---|---|
| 00 | 00 | 00 |
| 00 | 01 | XX |
| 00 | 10 | XX |
| 00 | 11 | XX |
| 01 | 00 | 01 |
| 01 | 01 | 00 |
| 01 | 10 | XX |
| 01 | 11 | XX |

| ab | cd | fg |
|---|---|---|
| 10 | 00 | 10 |
| 10 | 01 | 01 |
| 10 | 10 | 00 |
| 10 | 11 | XX |
| 11 | 00 | 11 |
| 11 | 01 | 10 |
| 11 | 10 | 01 |
| 11 | 11 | 00 |

Feito em sala.

(28) $B^n = \underbrace{B \times B \times \dots \times B}_{n \text{ vezes}}$ $\quad X = (x_1, x_2, \ \ , x_n)$

$(x_1, x_2, \ \ , x_n) + (y_1, y_2, \ \ , y_n) = (x_1 + y_1, x_2 + y_2, \dots, x_n + y_n)$

$(x_1, x_2, \dots, x_n) \cdot (y_1, y_2, \dots, y_n) = (x_1 \cdot y_1, x_2 \cdot y_2, \dots, x_n \cdot y_n)$

$\overline{(x_1, x_2, \ \ , x_n)} = (\overline{x_1}, \overline{x_2}, \dots, \overline{x_n}) \qquad 0 = (0, 0, \dots, 0) \qquad 1 = (1, 1, \dots, 1)$

A1. $X + Y = Y + X$ $\quad$ A2. $X \cdot (Y + Z) = (X \cdot Y) + (X \cdot Z)$

A3. $X + 0 = X$, $X \cdot 1 = X$ $\quad$ A4. $X + \bar{X} = 1$ $\quad X \cdot \bar{X} = 0$.

Para provar aqui, basta expandir X como $(x_1, x_2, \dots, x_n)$ e assim por diante. Chegaremos nos axiomas originais

(29) a) $y\bar{z}(\bar{z} + \bar{z}x) + (\bar{x} + \bar{y})(\bar{x}y + \bar{x}z)$

$y\bar{z}\bar{z}x + y\bar{z}\bar{z} + (\bar{x} + \bar{y})(\bar{x})(y + z)$

$y\bar{z}x + y\bar{z} + (\bar{x})(y + z)$

$y\bar{z}(1 + x) + \bar{x}y + \bar{x}z = y\bar{z} + \bar{x}y + \bar{x}z = y\bar{z} + \bar{x}y(z + \bar{z}) + \bar{x}z = yz + \bar{x}yz + \bar{x}y\bar{z} + \bar{x}z =$

$yz(1 + \bar{x}) + \bar{x}\bar{z}(1 + y) = yz + \bar{x}z$

b) $x + xyz + yz\bar{x} + wx + \bar{w}x + \bar{x}y$

$x(1 + yz) + \bar{x}(y + yz) + x(w + \bar{w})$

$x + \bar{x}(y) + x = x + \bar{x}y$

(30) $x\bar{y} = 0 \Longleftrightarrow x \cdot y = x$

$(xy) \cdot \bar{y} = 0$

$xy \cdot \bar{y} = 0$

$x \cdot 0 = 0$

$xy = x$

$xy = x(y + \bar{y})$

$xy = xy + x\bar{y}$

$xy = xy + 0$

$xy = xy$

Provando dos dois lados

4

(31) Está no material.