# Problema 1-01

Bits necesarios

| n | $2^n$ | n | $2^n$ | n | $2^n$ |
|---|---|---|---|---|---|
| 0 | 1 | 11 | 2048 | 22 | 4194304 |
| 1 | 2 | 12 | 4096 | 23 | ... |
| 2 | 4 | 13 | 8192 | 24 | |
| 3 | 8 | 14 | 16384 | 25 | |
| 4 | 16 | 15 | 32768 | 26 | |
| 5 | 32 | 16 | 65536 | 27 | |
| 6 | 64 | 17 | 131072 | 28 | |
| 7 | 128 | 18 | 262144 | 29 | |
| 8 | 256 | 19 | 524288 | 30 | |
| 9 | 512 | 20 | 1048576 | 31 | |
| 10 | 1024 = 1 K | 21 | 2097152 | 32 | |

a) 50: 6 bit

b) 1.000: 10 bit

c) 5.000: 13 bit

d) 100.000: 17 bit

e) 1.000.000: 20 bit

# Problema 1-02

Magnitud representada

a) $534_{(8} = 5 \cdot 8^2 + 3 \cdot 8^1 + 4 \cdot 8^0 = 348$

b) $111010_{(2} = 1 \cdot 2^5 + 1 \cdot 2^4 + 1 \cdot 2^3 + 1 \cdot 2^1 = 58$

c) $3A_{(16} = 3 \cdot 16^1 + 10 \cdot 16^0 = 58$

d) $1101{,}110_{(2} = 2^3 + 2^2 + 2^0 + 2^{-1} + 2^{-2} = 13{,}75$

e) $23{,}42_{(8} = 2 \cdot 8 + 3 + 4 \cdot 8^{-1} + 2 \cdot 8^{-2} = 19{,}53$

# Problema 1-03

Representación de magnitudes

a) **52** en binario:

| 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
|---|---|---|---|---|---|---|---|
| | | 1 | 1 | 0 | 1 | 0 | 0 |

b) **38** en hexadecimal:

| 16 | 1 |
|---|---|
| 2 | 6 |

c) **23** en octal:

| 512 | 64 | 8 | 1 |
|---|---|---|---|
| | | 2 | 7 |

d) 41,5 en binario:

$0{,}5 \cdot 2 = 1{,}0 \Rightarrow 41{,}5 = 101001{,}1_{(2}$

| 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
|---|---|---|---|---|---|---|---|
| | | 1 | 0 | 1 | 0 | 0 | 1 |

e) 12,75 en octal:

$0{,}75 \cdot 8 = 6{,}0 \Rightarrow 12{,}75 = 14{,}6_{(8}$

| 512 | 64 | 8 | 1 |
|---|---|---|---|
| | | 1 | 4 |

f) **125,32** en hexadecimal:

| 16 | 1 |
|---|---|
| 7 | D |

**0,32·16 = 5,12**
**0,12·16 = 1,92**
**0,92·16 = 14,72**
*0,72·16 = 11,52*

**125,32 = 7D’51E$_{(16}$** [TRUNCAMIENTO]
**125,32 = 7D’51F$_{(16}$** [REDONDEO]

# Problema 1-04

Magnitud 6

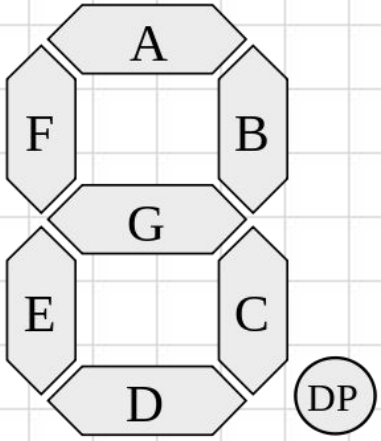
a) Código Gray asumiendo que se representa el rango **[0, 15]**:

| GRAY 4 BITS | SIGNIFICADO |
|---|---|
| 0000 | 0 |
| 0001 | 1 |
| 0011 | 2 |
| 0010 | 3 |
| 0110 | 4 |
| 0111 | 5 |
| 0101 | 6 |
| 0100 | 7 |
| 1100 | 8 |
| 1101 | 9 |
| 1111 | 10 |
| 1110 | 11 |
| 1010 | 12 |
| 1011 | 13 |
| 1001 | 14 |
| 1000 | 15 |

b) Código BCD:

| BCD | SIGNIFICADO |
|---|---|
| 0000 | 0 |
| 0001 | 1 |
| 0010 | 2 |
| 0011 | 3 |
| 0100 | 4 |
| 0101 | 5 |
| 0110 | 6 |
| 0111 | 7 |
| 1000 | 8 |
| 1001 | 9 |

c) Código 7 segmentos:




| DP | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 |

d) Binario con 7 bits incluyendo bit de paridad par:

| | | | | | | |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 1 | 1 | 0 |

e) Binario con 7 bits incluyendo bit de paridad impar:

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 1 | 1 | 0 |

# Problema 1-05

Dígitos Gray

| Base 10 | Base 2 | Gray (2 bits) | Gray (3 bits) | Gray (4 bits) | Gray (4 bits) + bit paridad par |
|---|---|---|---|---|---|
| 0 | 0 | 00 | 000 | 0000 | 00000 |
| 1 | 1 | 01 | 001 | 0001 | 10001 |
| 2 | 10 | 11 | 011 | 0011 | 00011 |
| 3 | 11 | 10 | 010 | 0010 | 10010 |
| 4 | 100 | | 110 | 0110 | 00110 |
| 5 | 101 | | 111 | 0111 | 10111 |
| 6 | 110 | | 101 | 0101 | 00101 |
| 7 | 111 | | 100 | 0100 | 10100 |
| 8 | 1000 | | | 1100 | 01100 |
| 9 | 1001 | | | 1101 | 11101 |
| 10 | 1010 | | | 1111 | 01111 |
| 11 | 1011 | | | 1110 | 11110 |
| 12 | 1100 | | | 1010 | 01010 |
| 13 | 1101 | | | 1011 | 11011 |
| 14 | 1110 | | | 1001 | 01001 |
| 15 | 1111 | | | 1000 | 11000 |

# Problema 1-06

Interpretación de cadena

Interprete el siguiente dato de 8 bits **10010111**, según los siguientes códigos binarios:

a) Binario natural:

10010111 = 151

b) S-M:

1.0010111 = -23

c) Ca2

10010111

01101001 = 105

10010111 = -105

d) BCD

1001.0111 = 97

# Problema 1-07

Direcciones IP

a) 150.214.141.3 =

10010110.11010110.10001101.00000011

b) 255.255.255.0 =

11111111.11111111.11111111.00000000

c) 10.0.1.1 =

00001010.00000000.00000001.00000001

# Problema 1-08

Simplificación de funciones

~~a) f = (bc’ + a’d)(ab’ + cd’)~~ ***[f = 0]***

b) f = b’d + a’bc’ + acd + a’bc

~~c) f = [(ab’)a][(ab)’b]~~ ***[f = 0]***

d) f = ab’ + c’d’

e) f = (ab + ac)ab

f) f = xy(v + w)[(x + y)v]

g) f = x + yz

h) f = (a+ b + c)(d + a) + bc + ac

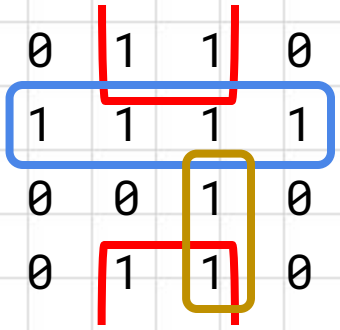
b)

f = b'd + a'bc' + acd + a'bc =

= b'd + a'b(c' + c) + acd = **b'd** + **a'b** + **acd**

| abcd | f | abcd | f |
|---|---|---|---|
| 0000 | 0 | 1000 | 0 |
| 0001 | 1 | 1001 | 1 |
| 0010 | 0 | 1010 | 0 |
| 0011 | 1 | 1011 | 1 |
| 0100 | 1 | 1100 | 0 |
| 0101 | 1 | 1101 | 0 |
| 0110 | 1 | 1110 | 0 |
| 0111 | 1 | 1111 | 1 |

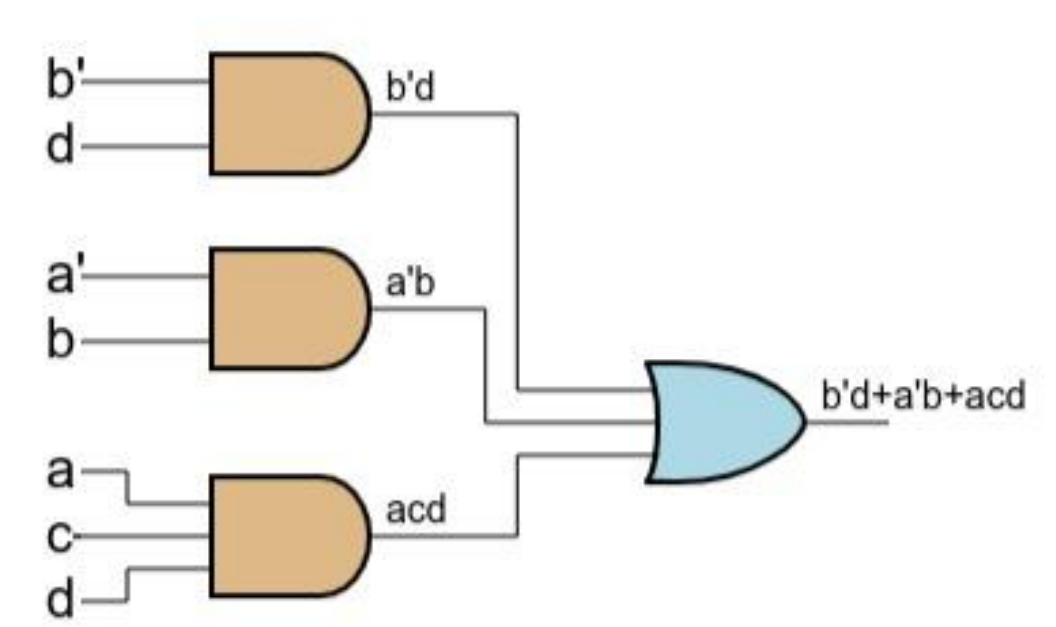
| ab \ cd | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | 0 | 1 | 1 | 0 |
| 01 | 1 | 1 | 1 | 1 |
| 11 | 0 | 0 | 1 | 0 |
| 10 | 0 | 1 | 1 | 0 |



**f**

b)

f = b'd + a'b + acd



# Problema 1-09

Conjuntos de mintérminos y maxtérminos

F1 = ∏(1, 2, 3, 5, 6, 7, 13, 14, 15)  F2 = ∑(0, 4, 8, 9, 10, 14, 15)

| Pos | F1 | F2 | F1+F2 | F1·F2 | F1⊕F2 | F1⊙F2 |
|---|---|---|---|---|---|---|
| **0** | 1 | 1 | 1 | 1 | 0 | 1 |
| **1** | 0 | 0 | 0 | 0 | 0 | 1 |
| **2** | 0 | 0 | 0 | 0 | 0 | 1 |
| **3** | 0 | 0 | 0 | 0 | 0 | 1 |
| **4** | 1 | 1 | 1 | 1 | 0 | 1 |
| **5** | 0 | 0 | 0 | 0 | 0 | 1 |
| **6** | 0 | 0 | 0 | 0 | 0 | 1 |
| **7** | 0 | 0 | 0 | 0 | 0 | 1 |
| **8** | 1 | 1 | 1 | 1 | 0 | 1 |
| **9** | 1 | 1 | 1 | 1 | 0 | 1 |
| **10** | 1 | 1 | 1 | 1 | 0 | 1 |
| **11** | 1 | 0 | 1 | 0 | 1 | 0 |
| **12** | 1 | 0 | 1 | 0 | 1 | 0 |
| **13** | 0 | 0 | 0 | 0 | 0 | 1 |
| **14** | 0 | 1 | 1 | 0 | 1 | 0 |
| **15** | 0 | 1 | 1 | 0 | 1 | 0 |

$F1+F2 = \sum(0, 4, 8, 9, 10, 11, 12, 14, 15)$
$F1 \cdot F2 = \sum(0, 4, 8, 9, 10)$
$F1 \oplus F2 = \sum(11, 12, 14, 15)$
$F1 \odot F2 = \sum(0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 13)$

$F1+F2 = \sum(0, 4, 8, 9, 10, 11, 12, 14, 15)$
$F1+F2 = \prod(1, 2, 3, 5, 6, 7, 13)$

$F1 \cdot F2 = \sum(0, 4, 8, 9, 10)$
$F1 \cdot F2 = \prod(1, 2, 3, 5, 6, 7, 11, 12, 13, 14, 15)$

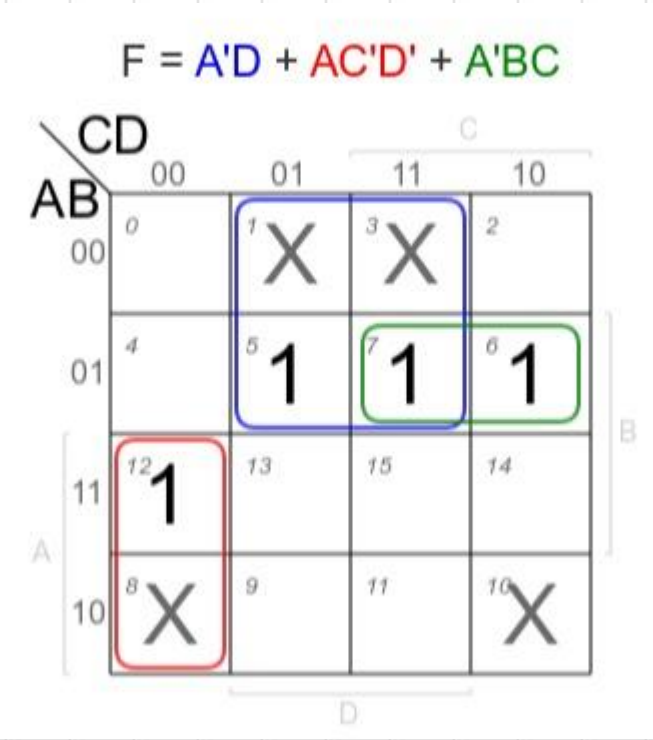
$F1 \oplus F2 = \sum(11, 12, 14, 15)$
$F1 \oplus F2 = \prod(0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 13)$

$F1 \odot F2 = \sum(0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 13)$
$F1 \odot F2 = \prod(11, 12, 14, 15)$

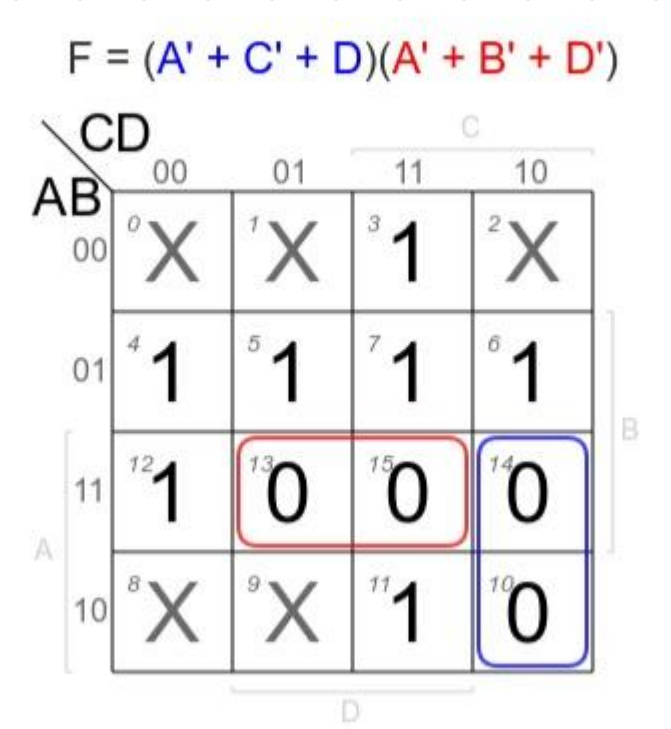
# Problema 1-10

Obtención de mapas

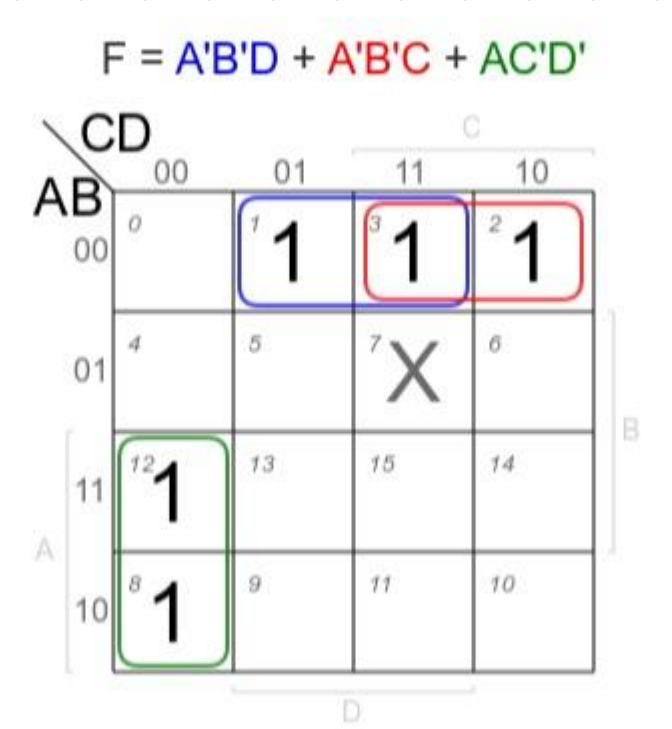
a) f = ∑(5, 6, 7, 12) + d(1, 3, 8, 10)



b) f = Π(10, 13, 14, 15) · d(0, 1, 2, 8, 9)



c) f = ∑(1, 2, 3, 8, 12) + d(7)


F = A'B'D + A'B'C + AC'D'
CD
AB
00
01
11
10
C
B
A
D
0
1
1
3
1
2
1
4
5
7
X
6
12
1
13
15
14
8
1
9
11
10

# Problema 1-11

Suma de mintérminos y producto de maxtérminos

a) F(A, B, C) = A + B’ + C

| Pos | ABC | F |
|---|---|---|
| 0 | 000 | 1 |
| 1 | 001 | 1 |
| 2 | 010 | 0 |
| 3 | 011 | 1 |
| 4 | 100 | 1 |
| 5 | 101 | 1 |
| 6 | 110 | 1 |
| 7 | 111 | 1 |

$F = \sum(0, 1, 3, 4, 5, 6, 7)$ $F = \prod(2)$

b) $F(A, B, C) = [(A + B)'(B + C)]'$

$$F(A, B, C) = [(A + B)'(B + C)]' = [(A'B'(B + C)]' =$$
$$= [\cancel{A'B'B} + A'B'C]' = [A'B'C]' = A + B + C'$$

| Pos | ABC | F |
|---|---|---|
| 0 | 000 | 1 |
| 1 | 001 | 0 |
| 2 | 010 | 1 |
| 3 | 011 | 1 |
| 4 | 100 | 1 |
| 5 | 101 | 1 |
| 6 | 110 | 1 |
| 7 | 111 | 1 |

$F = \sum(0, 2, 3, 4, 5, 6, 7)$ $F = \prod(1)$

c) $F(A, B, C, D) = (AB + BCD')' + A'CD'$

$$F(A, B, C) = (AB + BCD')' + A'CD' =$$

$$= (AB)'(BCD')' + A'CD' = (A' + B')(B' + C' + D) + A'CD' =$$

$$= A'B' + A'C' + A'D + B' + B'C' + B'D + A'CD' =$$

$$= \cancel{A'B'} + A'C' + A'D + B' + \cancel{B'C'} + \cancel{B'D} + A'CD' =$$

$$= B' + A'(C' + D + CD') = B' + A'(C' + D + C) = A' + B'$$

| Pos | ABCD | F | Pos | ABCD | F |
|---|---|---|---|---|---|
| 0 | 0000 | 1 | 8 | 1000 | 1 |
| 1 | 0001 | 1 | 9 | 1001 | 1 |
| 2 | 0010 | 1 | 10 | 1010 | 1 |
| 3 | 0011 | 1 | 11 | 1011 | 1 |
| 4 | 0100 | 1 | 12 | 1100 | 0 |
| 5 | 0101 | 1 | 13 | 1101 | 0 |
| 6 | 0110 | 1 | 14 | 1110 | 0 |
| 7 | 0111 | 1 | 15 | 1111 | 0 |

$F = \sum(0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11)$ $F = \prod(12, 13, 14, 15)$

d) F(A, B, C, D) = (A’ + C)D + B’D

F(A, B, C, D) = (A’ + C)D + B’D =
= A’D + CD + B’D = (D)(A’ + B’ + C)

| Pos | ABCD | F | Pos | ABCD | F |
|---|---|---|---|---|---|
| 0 | 0000 | 0 | 8 | 1000 | 0 |
| 1 | 0001 | 1 | 9 | 1001 | 1 |
| 2 | 0010 | 0 | 10 | 1010 | 0 |
| 3 | 0011 | 1 | 11 | 1011 | 1 |
| 4 | 0100 | 0 | 12 | 1100 | 0 |
| 5 | 0101 | 1 | 13 | 1101 | 0 |
| 6 | 0110 | 0 | 14 | 1110 | 0 |
| 7 | 0111 | 1 | 15 | 1111 | 1 |

F = ∑(1, 3, 5, 7, 9, 11, 15)  F = ∏(0, 2, 4, 6, 8, 10, 12, 13, 14)

e) $F(X, Y, Z) = (XY + Z)'(Y + XZ)$

$$F(X, Y, Z) = (XY + Z)'(Y + XZ) = (XY)'Z'(Y + XZ) =$$
$$= (X' + Y')(Z'Y + Z'XZ) = (X' + Y')Z'Y = X'Z'Y + Y'Z'Y = X'YZ'$$

| Pos | XYZ | F |
|---|---|---|
| 0 | 000 | 0 |
| 1 | 001 | 0 |
| 2 | 010 | 0 |
| 3 | 011 | 0 |
| 4 | 100 | 0 |
| 5 | 101 | 1 |
| 6 | 110 | 0 |
| 7 | 111 | 0 |

$F = \sum(5)$ $F = \prod(0, 1, 2, 3, 4, 6, 7)$

f) $F(A, B, C) = (AB'C + ABC')'$

$$F(A, B, C) = (AB'C + ABC')' = [A(B'C + BC')]' = [A(B \oplus C)]' =$$
$$= A' + (B \odot C) = A' + BC + B'C'$$

| Pos | ABC | F |
|---|---|---|
| 0 | 000 | 1 |
| 1 | 001 | 1 |
| 2 | 010 | 1 |
| 3 | 011 | 1 |
| 4 | 100 | 1 |
| 5 | 101 | 0 |
| 6 | 110 | 0 |
| 7 | 111 | 1 |

$F = \sum(0, 1, 2, 3, 4, 7)$ $F = \prod(5, 6)$

g) F(A, B, C) = (AB’ + C(A’ + B))(B + C)

$$F(A, B, C) = (AB' + C(A' + B))(B + C) = (AB' + CA' + CB)(B + C) =$$
$$= AB'B + AB'C + CA'B + CA'C + CB + CB =$$
$$= \cancel{AB'B} + AB'C + \cancel{CA'B} + CA'C + CB + \cancel{CB} = AB'C + A'C + BC =$$
$$= C(AB' + A' + B) = C(A + A' + B) = C$$

| Pos | ABC | F |
|---|---|---|
| 0 | 000 | 0 |
| 1 | 001 | 1 |
| 2 | 010 | 0 |
| 3 | 011 | 1 |
| 4 | 100 | 0 |
| 5 | 101 | 1 |
| 6 | 110 | 0 |
| 7 | 111 | 1 |

$F = \sum(1, 3, 5, 7)$ $F = \prod(0, 2, 4, 6)$