

## Sistemes de Numeració

Decimal  $abc_{10} : a 10^0 + b 10^1 + c 10^2 \quad a, b, c, \dots \in [0, 1, 2, 3, 4, 5, 6, 7, 8, 9]$

Binari  $abc_2 : a 2^0 + b 2^1 + c 2^2 \quad a, b, c, \dots \in [0, 1]$

Octal  $abc_8 : a 8^0 + b 8^1 + c 8^2 \quad a, b, c, \dots \in [0, 1, 2, 3, 4, 5, 6, 7]$

Hexadecimal  $abc_{16} : a 16^0 + b 16^1 + c 16^2$

$a, b, c, \dots \in [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F]$

## Exercicis

1. Expressa en binari : 67 , 164 , 345 , 866 , 1311, 4318
2. Expressa en decimal : 111001111, 1010101010 , 11110001111001, 1110100011100
3. Expressa en octal : 67 , 164 , 345 , 866 , 1311, 4318
4. Expressa en decimal :  $33_o$  ,  $164_o$  ,  $457_o$  ,  $73642_o$
5. Expressa en hexadecimal : 67 , 164 , 345 , 866 , 1311, 4318
6. Expressa en decimal : 3A8B , 5BF9D, ABC, CACA, DEDE, FAFA

Operacions :

Sumar :

- a) binari :  $10101010 + 11110111$  ;  $111101111 + 111011110 + 101110111$
- b) octal :  $437_o + 652_o$  ,  $777616_o + 457467_o + 555666_o$  ;  $656565_o + 767676_o + 354675_o$
- c) hexadecimal :  $ABC987 + 89FDAB$  ;  $99FFAB + CAD79B + FE6AD9$  ;  
 $ABCDEF + 987654 + FEDCBA$

Restar

- a) binari :  $110101 - 101111$  ;  $1110100 - 1101111$  ;  $1100100 - 1011111$
- b) octal :  $4352_o - 2563_o$  ;  $76502_o - 67754_o$  ;  $650453_o - 476575_o$
- c) hexadecimal :  $A79BF - 89AEC$  ;  $CDABC - 9FBED$  ;  $F4B8E - B7CAF$

Producte :  $11110101 * 1011$  ;  $37475_o * 605_o$  ;  $9FAD7E * ACE$

## Sistemes Binaris : Àlgebra de Boole

Propietats bàsiques :

$$\overline{0} = 1; \overline{1} = 0;$$

$$a \cdot \overline{a} = 0; a + \overline{a} = 1;$$

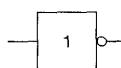
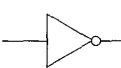
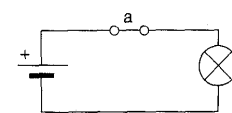
$a + ab = a$  Llei d'absorció

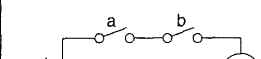
Lleis de Morgan

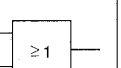
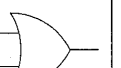
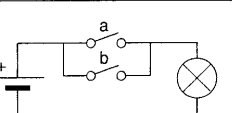
$$1. \overline{abc} = \overline{a} + \overline{b} + \overline{c}$$

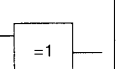
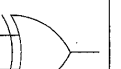
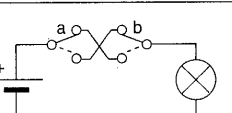
$$2. a + b + c = \overline{\overline{a} \cdot \overline{b} \cdot \overline{c}}$$

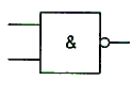
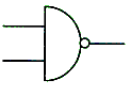
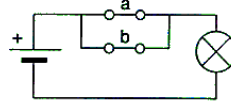
## Portes Lògiques i Taules de veritat

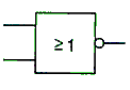
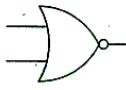
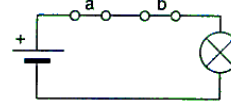
| Denominació           | Funció             | Símbol                                                                             |                                                                                    | Taula de veritat                                                                                       |   | Circuit elèctric equivalent |   |   |   |   |                                                                                      |
|-----------------------|--------------------|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|---|-----------------------------|---|---|---|---|--------------------------------------------------------------------------------------|
|                       |                    | DIN                                                                                | ASA                                                                                |                                                                                                        |   |                             |   |   |   |   |                                                                                      |
| Inversora NO<br>(NOT) | $F = \overline{a}$ |  |  | <table><tr><th>a</th><th>F</th></tr><tr><td>0</td><td>1</td></tr><tr><td>1</td><td>0</td></tr></table> | a | F                           | 0 | 1 | 1 | 0 |  |
| a                     | F                  |                                                                                    |                                                                                    |                                                                                                        |   |                             |   |   |   |   |                                                                                      |
| 0                     | 1                  |                                                                                    |                                                                                    |                                                                                                        |   |                             |   |   |   |   |                                                                                      |
| 1                     | 0                  |                                                                                    |                                                                                    |                                                                                                        |   |                             |   |   |   |   |                                                                                      |

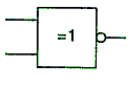
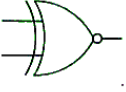
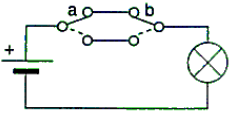
| Denominació         | Funció          | Símbol                                                                              |                                                                                     | Taula de veritat                                                                                                                                                                                                                                          |     |     | Circuit elèctric equivalent |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                       |
|---------------------|-----------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|-----------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---------------------------------------------------------------------------------------|
|                     |                 | DIN                                                                                 | ASA                                                                                 |                                                                                                                                                                                                                                                           |     |     |                             |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                       |
| Producte I<br>(AND) | $F = a \cdot b$ |  |  | <table><tr><td><math>a</math></td><td><math>b</math></td><td><math>F</math></td></tr><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td></tr><tr><td>1</td><td>1</td><td>1</td></tr></table> | $a$ | $b$ | $F$                         | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 1 |  |
| $a$                 | $b$             | $F$                                                                                 |                                                                                     |                                                                                                                                                                                                                                                           |     |     |                             |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                       |
| 0                   | 0               | 0                                                                                   |                                                                                     |                                                                                                                                                                                                                                                           |     |     |                             |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                       |
| 0                   | 1               | 0                                                                                   |                                                                                     |                                                                                                                                                                                                                                                           |     |     |                             |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                       |
| 1                   | 0               | 0                                                                                   |                                                                                     |                                                                                                                                                                                                                                                           |     |     |                             |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                       |
| 1                   | 1               | 1                                                                                   |                                                                                     |                                                                                                                                                                                                                                                           |     |     |                             |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                       |

| Denominació    | Funció      | Símbol                                                                              |                                                                                     | Taula de veritat                                                                                                                                                                                                                        |          |          | Circuit elèctric equivalent |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                       |
|----------------|-------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------|-----------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---------------------------------------------------------------------------------------|
|                |             | DIN                                                                                 | ASA                                                                                 |                                                                                                                                                                                                                                         |          |          |                             |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                       |
| Suma O<br>(OR) | $F = a + b$ |  |  | <table><tr><td><i>a</i></td><td><i>b</i></td><td><i>F</i></td></tr><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td><td>1</td></tr></table> | <i>a</i> | <i>b</i> | <i>F</i>                    | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 |  |
| <i>a</i>       | <i>b</i>    | <i>F</i>                                                                            |                                                                                     |                                                                                                                                                                                                                                         |          |          |                             |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                       |
| 0              | 0           | 0                                                                                   |                                                                                     |                                                                                                                                                                                                                                         |          |          |                             |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                       |
| 0              | 1           | 1                                                                                   |                                                                                     |                                                                                                                                                                                                                                         |          |          |                             |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                       |
| 1              | 0           | 1                                                                                   |                                                                                     |                                                                                                                                                                                                                                         |          |          |                             |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                       |
| 1              | 1           | 1                                                                                   |                                                                                     |                                                                                                                                                                                                                                         |          |          |                             |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                       |

| Denominació                             | Funció                                           | Símbol                                                                              |                                                                                     | Taula de veritat        |                         |                         | Circuit elèctric equivalent                                                           |
|-----------------------------------------|--------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------|-------------------------|-------------------------|---------------------------------------------------------------------------------------|
|                                         |                                                  | DIN                                                                                 | ASA                                                                                 |                         |                         |                         |                                                                                       |
| Suma Exclusiva<br>O EXCLUSIVA<br>(EXOR) | $F = a \oplus b = \overline{a}b + a\overline{b}$ |  |  | $a$<br>0<br>0<br>1<br>1 | $b$<br>0<br>1<br>0<br>1 | $F$<br>0<br>1<br>1<br>0 |  |

| Denominació                   | Funció                     | Símbol                                                                            |                                                                                   | Taula de veritat        |                         |                         | Circuit elèctric equivalent                                                         |
|-------------------------------|----------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------|-------------------------|-------------------------|-------------------------------------------------------------------------------------|
|                               |                            | DIN                                                                               | ASA                                                                               |                         |                         |                         |                                                                                     |
| Producte negat<br>NO I (NAND) | $F = \overline{a \cdot b}$ |  |  | $a$<br>0<br>0<br>1<br>1 | $b$<br>0<br>1<br>0<br>1 | $F$<br>1<br>1<br>1<br>0 |  |

| Denominació               | Funció                 | Símbol                                                                            |                                                                                   | Taula de veritat                                                                                                                                                                                                                        |          |          | Circuit elèctric equivalent |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                     |
|---------------------------|------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------|-----------------------------|---|---|---|---|---|---|---|---|---|---|---|---|-------------------------------------------------------------------------------------|
|                           |                        | DIN                                                                               | ASA                                                                               |                                                                                                                                                                                                                                         |          |          |                             |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                     |
| Suma negada<br>NO O (NOR) | $F = \overline{a + b}$ |  |  | <table><tr><td><i>a</i></td><td><i>b</i></td><td><i>F</i></td></tr><tr><td>0</td><td>0</td><td>1</td></tr><tr><td>0</td><td>1</td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td></tr><tr><td>1</td><td>1</td><td>0</td></tr></table> | <i>a</i> | <i>b</i> | <i>F</i>                    | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 |  |
| <i>a</i>                  | <i>b</i>               | <i>F</i>                                                                          |                                                                                   |                                                                                                                                                                                                                                         |          |          |                             |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                     |
| 0                         | 0                      | 1                                                                                 |                                                                                   |                                                                                                                                                                                                                                         |          |          |                             |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                     |
| 0                         | 1                      | 0                                                                                 |                                                                                   |                                                                                                                                                                                                                                         |          |          |                             |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                     |
| 1                         | 0                      | 0                                                                                 |                                                                                   |                                                                                                                                                                                                                                         |          |          |                             |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                     |
| 1                         | 1                      | 0                                                                                 |                                                                                   |                                                                                                                                                                                                                                         |          |          |                             |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                     |

| Denominació                                              | Funció                                                                                  | Símbol                                                                              |                                                                                     | Taula de veritat        |                         |                         | Circuit elèctric equivalent                                                           |
|----------------------------------------------------------|-----------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------|-------------------------|-------------------------|---------------------------------------------------------------------------------------|
|                                                          |                                                                                         | DIN                                                                                 | ASA                                                                                 |                         |                         |                         |                                                                                       |
| Suma Exclusiva<br>negada<br>NO O<br>EXCLUSIVA<br>(EXNOR) | $F = \overline{a \oplus b} = \overline{a \oplus b}$ $= a b + \overline{a} \overline{b}$ |  |  | $a$<br>0<br>0<br>1<br>1 | $b$<br>0<br>1<br>0<br>1 | $F$<br>1<br>0<br>0<br>1 |  |

### Funció Lògica d'un Circuit

Minterms : Suma de productes

$$F = \overline{a} \cdot \overline{b} \cdot c + \overline{a} \cdot b \cdot \overline{c} + a \cdot \overline{b} \cdot \overline{c} + a \cdot \overline{b} \cdot c + a \cdot b \cdot c$$

Maxterms : Producte de Sumes

$$F = (a + b + c) \cdot (a + \overline{b} + \overline{c}) \cdot (\overline{a} + \overline{b} + c)$$

| a | b | c | F |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 1 |
| 0 | 1 | 0 | 1 |
| 0 | 1 | 1 | 0 |
| 1 | 0 | 0 | 1 |
| 1 | 0 | 1 | 1 |
| 1 | 1 | 0 | 0 |
| 1 | 1 | 1 | 1 |

## Exercicis :

Obtenció de la funció lògica ( minterms i maxterms ) a partir de les taules :

| a | b | c | F |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 1 |
| 0 | 1 | 0 | 0 |
| 0 | 1 | 1 | 0 |
| 1 | 0 | 0 | 1 |
| 1 | 0 | 1 | 1 |
| 1 | 1 | 0 | 1 |
| 1 | 1 | 1 | 0 |

| a | b | c | F |
|---|---|---|---|
| 0 | 0 | 0 | 1 |
| 0 | 0 | 1 | 0 |
| 0 | 1 | 0 | 0 |
| 0 | 1 | 1 | 0 |
| 1 | 0 | 0 | 1 |
| 1 | 0 | 1 | 1 |
| 1 | 1 | 0 | 0 |
| 1 | 1 | 1 | 0 |

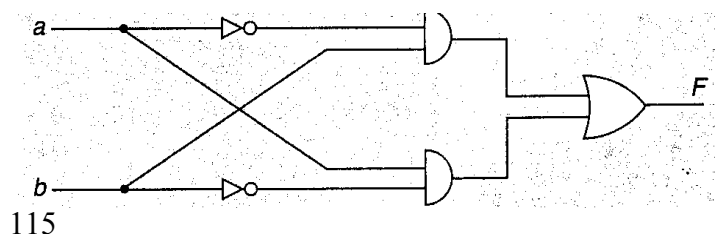
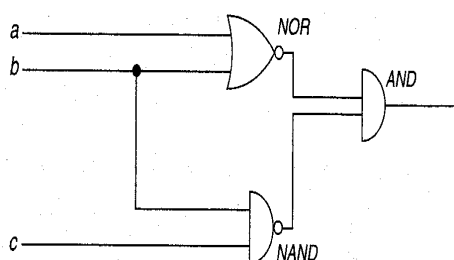
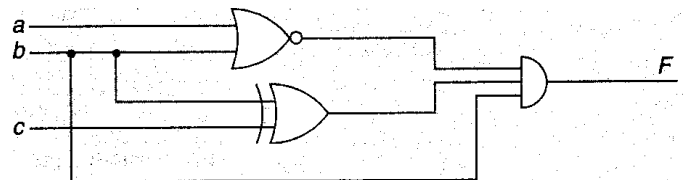
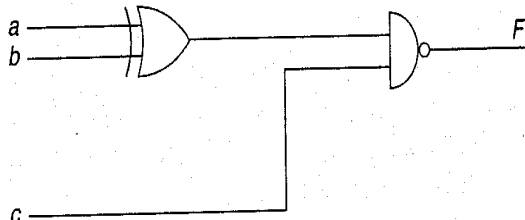
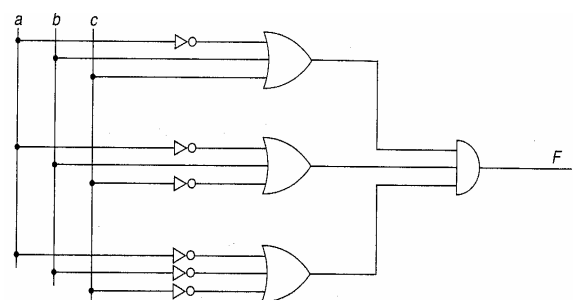
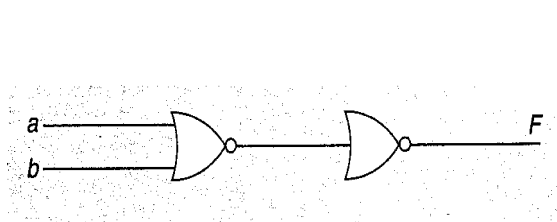
Obtenció de la taula de veritat a partir de les expressions :

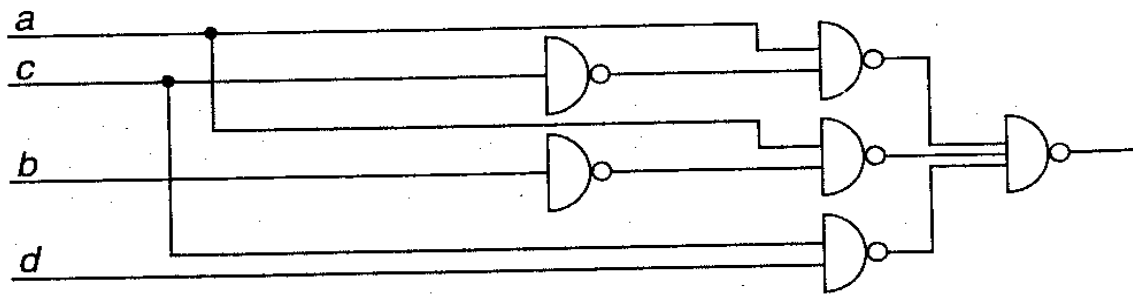
a)  $F = \overline{a + (b \cdot a)}$       b)  $F = \overline{a \cdot (b + c)}$       c)  $F = \overline{(b + a) \cdot (a \cdot c)}$

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

Obtenció del circuit a partir de les funcions lògiques d'abans :

Obtenció de la funció lògica a partir del circuit





### Implementació amb portes NAND o NOR

Exemple :  $F = a \cdot b + a \cdot c$

NAND  $\overline{a \cdot b}$  ;  $F = \overline{\overline{ab + ac}} = \overline{\overline{ab} \cdot \overline{ac}}$

NOR  $\overline{a + b}$  ;  $F = \overline{\overline{ab + ac}} = \overline{\overline{a + b} \cdot \overline{a + c}} = \overline{\overline{a + b} + \overline{a + c}}$

### Exercicis :

$F = (\overline{a} + b) \cdot c$  ;  $F = \overline{a} \cdot b + a \cdot \overline{c}$  ;  $F = a (b + \overline{c})$

$F = \overline{a} \cdot b + a \cdot (b + c)$  ;  $F = a \cdot c (a + b)$

### Karnaugh : Simplificació de Funcions

Posibles Agrupacions per simplificar

| a \ bc | 00 | 01 | 11 | 10 |
|--------|----|----|----|----|
| 0      |    |    |    |    |
| 1      |    |    |    |    |

| a \ bc | 00 | 01 | 11 | 10 |
|--------|----|----|----|----|
| 0      |    |    |    |    |
| 1      |    |    |    |    |

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

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

### Minterms

Exemple :  $F = \bar{a} \cdot \bar{b} \cdot c + a \cdot \bar{b} \cdot \bar{c} + a \cdot \bar{b} \cdot c$

| a \ bc | 00 | 01 | 11 | 10 |
|--------|----|----|----|----|
| 0      |    | 1  |    |    |
| 1      | 1  | 1  |    |    |

$$F = \bar{b} \cdot c + a \cdot \bar{b}$$

### Maxterms

$$F = (a+b+c) (a+\bar{b}+c) (a+\bar{b}+\bar{c}) (\bar{a}+\bar{b}+c) (\bar{a}+\bar{b}+\bar{c})$$

| a \ bc | 00 | 01 | 11 | 10 |
|--------|----|----|----|----|
| 0      | 0  |    | 0  | 0  |
| 1      |    |    | 0  | 0  |

$$F = \bar{b} \cdot (a+c)$$

### Exercicis

Simplifica

1.

a)  $F = \bar{a} + \bar{b} + \bar{c} + \overline{abc}$

b)  $F = a + c \cdot \bar{c} + b + \bar{b}$

c)  $F = \bar{a} \cdot \bar{b} \cdot c + \bar{a} \cdot b \cdot \bar{c} + \bar{a} \cdot b \cdot c$

2. Demuestra :  $ad + \bar{c} = (a + \bar{c})(\bar{c} + d)$

### 3. Simplifica amb Karnaugh :

$$a) F = (a + \bar{b} + \bar{c}) \cdot (\bar{a} + b + c) \cdot (a + \bar{b} + c)$$

$$b) F = \bar{a} \cdot \bar{b} \cdot \bar{c} + \bar{a} \cdot \bar{b} \cdot c + \bar{a} \cdot b \cdot c + a \cdot \bar{b} \cdot \bar{c} + a \cdot b \cdot \bar{c}$$

$$c) F = \bar{a} \cdot \bar{b} \cdot \bar{c} + a \cdot \bar{b} \cdot \bar{c} + \bar{a} \cdot b \cdot c + abc + \bar{a} \cdot b \cdot \bar{c} + a \cdot b \cdot \bar{c}$$

$$(a + b + c + d)(a + b + c + d)(a + b + c + d)(a + b + c + d)(a + b + c + d)(a + b + c + d)(a + b + c + d)(a + b + c + d)$$

### 4. A partir d'aquesta taules obtenir la forma més simplificada i la seva implementació

a) en minterms i en maxterms

| a | b | c | F |
|---|---|---|---|
| 0 | 0 | 0 | 1 |
| 0 | 0 | 1 | 1 |
| 0 | 1 | 0 | 0 |
| 0 | 1 | 1 | 0 |
| 1 | 0 | 0 | 1 |
| 1 | 0 | 1 | 1 |
| 1 | 1 | 0 | 0 |
| 1 | 1 | 1 | 0 |

| a | b | c | F |
|---|---|---|---|
| 0 | 0 | 0 | 1 |
| 0 | 0 | 1 | 0 |
| 0 | 1 | 0 | 1 |
| 0 | 1 | 1 | 0 |
| 1 | 0 | 0 | 0 |
| 1 | 0 | 1 | 1 |
| 1 | 1 | 0 | 0 |
| 1 | 1 | 1 | 1 |

5. En un local hi ha una alarma que sona quan es tanca la porta amb clau si la finestra, el llum o ambdós elements queden oberts. Utilitzant les variables d'estat :

$$porta \ p = \begin{cases} 1 \text{ tan cada} \\ 0 \text{ oberta} \end{cases}$$

$$finestra \ f = \begin{cases} 1 \text{ tan cada} \\ 0 \text{ oberta} \end{cases}$$

$$llum \ l = \begin{cases} 1 \text{ apagat} \\ 0 \text{ encés} \end{cases}$$

$$alarma \ a = \begin{cases} 1 \text{ sona} \\ 0 \text{ no sona} \end{cases}$$

- Escriu la taula de veritat del sistema
- Determineu la funció lògica entre aquestes variables i simplifiqueu-la ( us poden ser útils les igualtats  $a + \bar{a} = 1$  ;  $a + \bar{a} \cdot b = a + b$  )
- Dibuixeu el circuit lògic amb portes NOR i NAND .

6. Per obrir una porta que dona accés a un recinte controlat cal , en horari laboral , introduir una targeta magnètica vàlida i/o teclejar una clau numérica correcta i fer les dues coses fora d'aquest horari . Utilitzant les variables d'estat

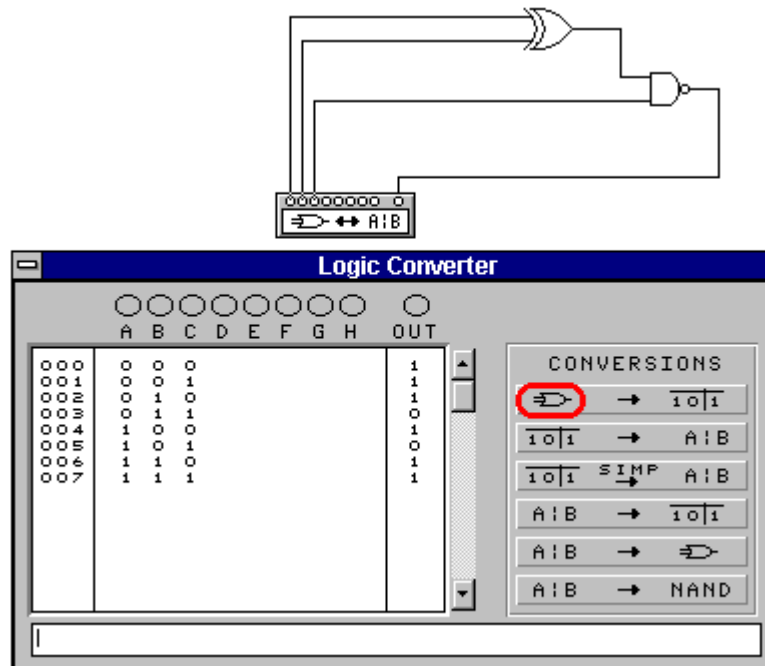
$$horari \ h = \begin{cases} 1 \text{ laboral} \\ 0 \text{ no laboral} \end{cases} ; \quad targeta \ t = \begin{cases} 1 \text{ vàlida} \\ 0 \text{ no vàlida} \end{cases}$$

$$clau \ c = \begin{cases} 1 \text{ correcta} \\ 0 \text{ no correcta} \end{cases} ; \quad accés \ a = \begin{cases} 1 \text{ permès} \\ 0 \text{ denegat} \end{cases}$$

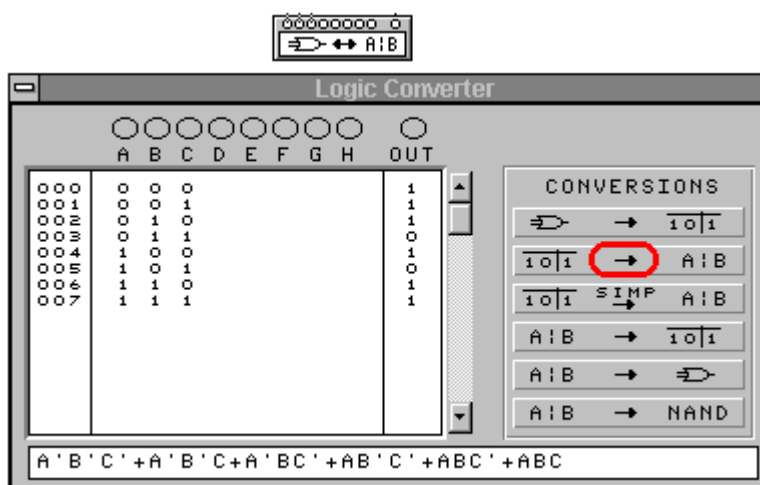
- Escriu la taula de veritat del sistema
- Determineu la funció lògica entre aquestes variables i simplifiqueu-la . ( Us poden ser útils les igualtats  $a + \bar{a} = 1$  ;  $a + \bar{a}b = a + b$  )
- Dibuixa l'esquema de portes lògiques i l'esquema de contactes equivalents .

## Pràctica

1. A partir del circuit obtenir la taula de veritat



2. A partir de la taula de veritat obtenir la funció lògica sense simplificar



3. A partir de la taula obtenir l'expressió simplificada de la funció Lògica :

00000000 0  
A B

**Logic Converter**

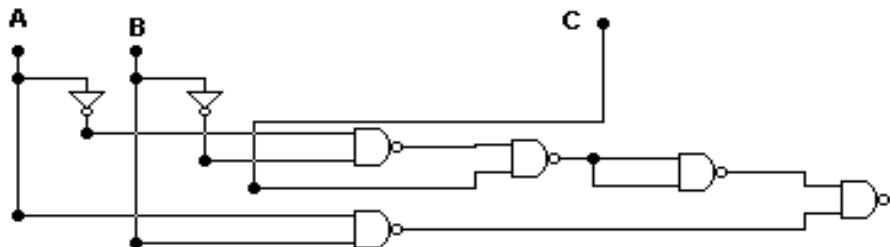
|     | A | B | C | D | E | F | G | H | OUT |
|-----|---|---|---|---|---|---|---|---|-----|
| 000 | 0 | 0 | 0 |   |   |   |   |   | 1   |
| 001 | 0 | 0 | 1 |   |   |   |   |   | 1   |
| 002 | 0 | 1 | 0 |   |   |   |   |   | 1   |
| 003 | 0 | 1 | 1 |   |   |   |   |   | 0   |
| 004 | 1 | 0 | 0 |   |   |   |   |   | 1   |
| 005 | 1 | 0 | 1 |   |   |   |   |   | 0   |
| 006 | 1 | 1 | 0 |   |   |   |   |   | 1   |
| 007 | 1 | 1 | 1 |   |   |   |   |   | 1   |

CONVERSIONS

$\Rightarrow$   $\rightarrow$   $\overline{101}$   
 $\overline{101}$   $\rightarrow$   $A \mid B$   
 $\overline{101}$  **SIMP**  $\rightarrow$   $A \mid B$   
 $A \mid B$   $\rightarrow$   $\overline{101}$   
 $A \mid B$   $\rightarrow$   $\Rightarrow$   
 $A \mid B$   $\rightarrow$  NAND

$A' B' + C' + AB$

4. Obtenir a partir de la funció lògica el circuit en portes NAND



**Logic Converter**

|  | A | B | C | D | E | F | G | H | OUT |
|--|---|---|---|---|---|---|---|---|-----|
|  |   |   |   |   |   |   |   |   |     |
|  |   |   |   |   |   |   |   |   |     |
|  |   |   |   |   |   |   |   |   |     |
|  |   |   |   |   |   |   |   |   |     |
|  |   |   |   |   |   |   |   |   |     |
|  |   |   |   |   |   |   |   |   |     |
|  |   |   |   |   |   |   |   |   |     |
|  |   |   |   |   |   |   |   |   |     |

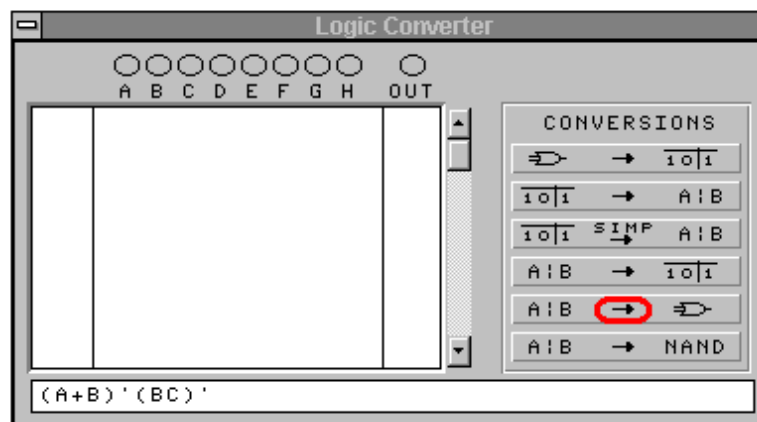
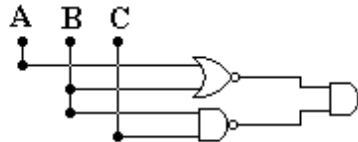
CONVERSIONS

$\Rightarrow$   $\rightarrow$   $\overline{101}$   
 $\overline{101}$   $\rightarrow$   $A \mid B$   
 $\overline{101}$  **SIMP**  $\rightarrow$   $A \mid B$   
 $A \mid B$   $\rightarrow$   $\overline{101}$   
 $A \mid B$   $\rightarrow$   $\Rightarrow$   
 **$A \mid B$**   $\rightarrow$  NAND

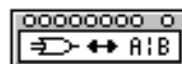
$A' B' + C' + AB$



5. A partir de la funció lògica obtenir el circuit



6. A partir de la funció obtenir la taula



|     | A | B | C | D | E | F | G | H | OUT |
|-----|---|---|---|---|---|---|---|---|-----|
| 000 | 0 | 0 | 0 |   |   |   |   |   | 1   |
| 001 | 0 | 0 | 1 |   |   |   |   |   | 1   |
| 002 | 0 | 1 | 0 |   |   |   |   |   | 0   |
| 003 | 0 | 1 | 1 |   |   |   |   |   | 0   |
| 004 | 1 | 0 | 0 |   |   |   |   |   | 0   |
| 005 | 1 | 0 | 1 |   |   |   |   |   | 0   |
| 006 | 1 | 1 | 0 |   |   |   |   |   | 0   |
| 007 | 1 | 1 | 1 |   |   |   |   |   | 0   |