
Mappe di *Karnaugh* (*Esempi*)

Maurizio Palesi

Comparatore a 1 bit

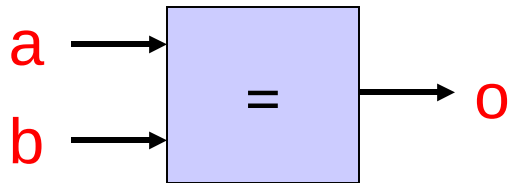


Tavola della verità

a	b	o
0	0	1
0	1	0
1	0	0
1	1	1

Mappa di Karnaugh

		a	
		0	1
b	0	1	
	1		1

E' già in forma minima
 $o(a,b) = \underline{a}b + ab$

Comparatore a 1 bit

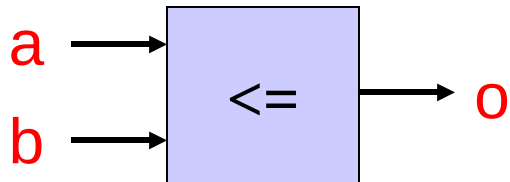


Tavola della verità

a	b	o
0	0	1
0	1	1
1	0	0
1	1	1

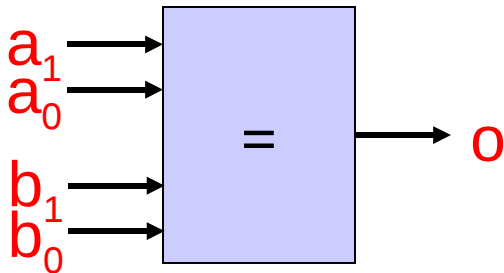
Mappa di Karnaugh

A Karnaugh map for the 1-bit comparator. The map is a 2x2 grid with 'a' as the horizontal axis and 'b' as the vertical axis. The cells contain values: (a=0, b=0) is 1, (a=0, b=1) is 1, (a=1, b=0) is 0, and (a=1, b=1) is 1. A red circle highlights the '1' in the (a=0, b=0) cell, and a blue circle highlights the '1's in the (a=0, b=1) and (a=1, b=1) cells.

L'espressione minima è:

$$o(a,b) = \underline{a} + b$$

Comparatore a 2 bit



Descrizione

```

if (a1==b1 && a0==b0)
    o = 1;
else
    o = 0;
  
```

Mappa di Karnaugh

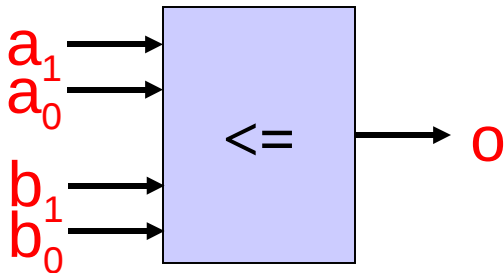
		a ₁ a ₀			
		00	01	11	10
b ₁ b ₀	00	1			
	01		1		
	11			1	
	10				1

Tavola della verità

a ₁	a ₀	b ₁	b ₀	o
0	0	0	0	1
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	1
0	1	1	0	0
0	1	1	1	0
1	0	0	0	0
1	0	0	1	0
1	0	1	0	1
1	0	1	1	0
1	1	0	0	0
1	1	0	1	0
1	1	1	0	0
1	1	1	1	1

$$o(a_1, a_0, b_1, b_0) = \underline{a_1} \underline{a_0} \underline{b_1} \underline{b_0} + \underline{a_1} \underline{a_0} \underline{b_1} b_0 + a_1 \underline{a_0} b_1 \underline{b_0} + a_1 \underline{a_0} b_1 b_0$$

Comparatore a 2 bit



Descrizione

```

if ((a1==b1 && a0<=b0) ||
    (a1<=b1))
    o = 1;
else
    o = 0;

```

Mappa di
Karnaugh

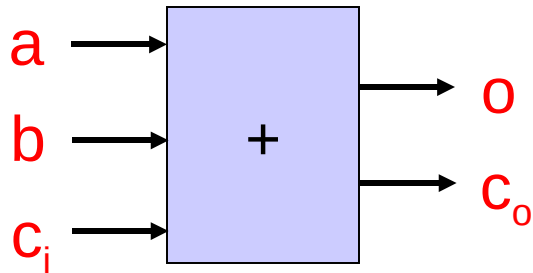
		<i>a1a0</i>			
		00	01	11	10
<i>b1b0</i>	00	1			
	01	1	1		
	11	1	1	1	1
	10	1	1		1

Tavola della verità

a1	a0	b1	b0	o
0	0	0	0	1
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	0
0	1	0	1	1
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	0
1	1	1	1	1

$$o(a_1, a_0, b_1, b_0) = \underline{a_1} \underline{a_0} + \underline{b_1} \underline{b_0} + \underline{a_0} \underline{b_1} + \underline{a_1} \underline{b_0} + \underline{a_1} \underline{b_1}$$

Sommatore a 1 bit



a	b	c _i	c _o	o
0	0	0	0	0
0	0	1	0	1
0	1	0	0	1
0	1	1	1	0
1	0	0	0	1
1	0	1	1	0
1	1	0	1	0
1	1	1	1	1

Mappa di Karnaugh (c_o)

		ab			
		00	01	11	10
c _i	0			1	
	1		1	1	1

$$c_o(a,b,c_i) = ab + bc_i + ac_i$$

Mappa di Karnaugh (o)

		ab			
		00	01	11	10
c _i	0		1		1
	1	1		1	

$$o(a,b,c_i) = \underline{a}b\underline{c}_i + a\underline{b}c_i + \underline{a}bc_i + abc_i$$

Esercizio

Mappa di Karnaugh

		<i>ab</i>			
		00	01	11	10
<i>cd</i>	00		1		
	01	1	1		1
	11		1	1	1
	10		1	1	

L'espressione minima è:

$$f(a,b,c,d) = \underline{a}b + bc + acd + \underline{b}cd$$

- $1 + 1 + 2 + 2 = 6$ porte AND a due ingressi
 - 3 porte OR a 2 ingressi
 - Cammino critico $2+3=5$ porte
- } Area: 9 porte logiche