OR 

→ B is const 1, so this group only depends on B

$C \backslash AB$	00	01	11	10
0	0	1	1	0
1	0	1	1	1

A is always 1

C is also always 1

connect into

=> both A and C have to be true

=> AC

in conclusion we have either AC or B

$$\Rightarrow AC + B$$

or mathematically $(A \land C) \lor B$

when we group by 1s we always use and (·) for same group and or (+) to connect different groups

C \ AB	00	01	11	10
0	0	1	1	0
1	0	1	1	1

We can also group by 0s if that is more convenient, but now use opposite signs

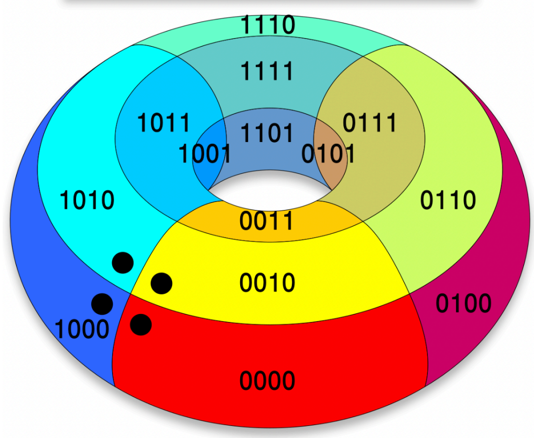
A and B have to be 0

$A + B$

maps can loop around, B and C have to be 0

$B + C$

0000	0100	1100	1000
0001	0101	1101	1001
0011	0111	1111	1011
0010	0110	1110	1010



Now put together

$$(A + B) \cdot (B + C)$$

use distributive laws:

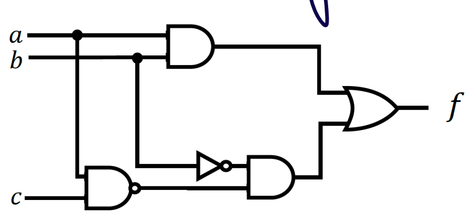
$$B + (A \cdot C)$$

So we get equivalent circuit

Laws of Boolean algebra

- **Identity :** $A + 0 = A$ $\quad$ $A \cdot 1 = A$
- **Zero & One:** $A + 1 = 1$ $\quad$ $A \cdot 0 = 0$
- **Inverse :** $A + \overline{A} = 1$ $\quad$ $A \cdot \overline{A} = 0$
- **Commutative :** $A + B = B + A$ $\quad$ $A \cdot B = B \cdot A$
- **Associative :** $A + (B + C) = (A + B) + C$
  $A \cdot (B \cdot C) = (A \cdot B) \cdot C$
- **Distributive :** $A \cdot (B + C) = (A \cdot B) + (A \cdot C)$
  $A + (B \cdot C) = (A + B) \cdot (A + C)$
- **Demorgan's** $\overline{A + B} = \overline{A} \cdot \overline{B}$
  $\overline{A \cdot B} = \overline{A} + \overline{B}$

example with negative inputs



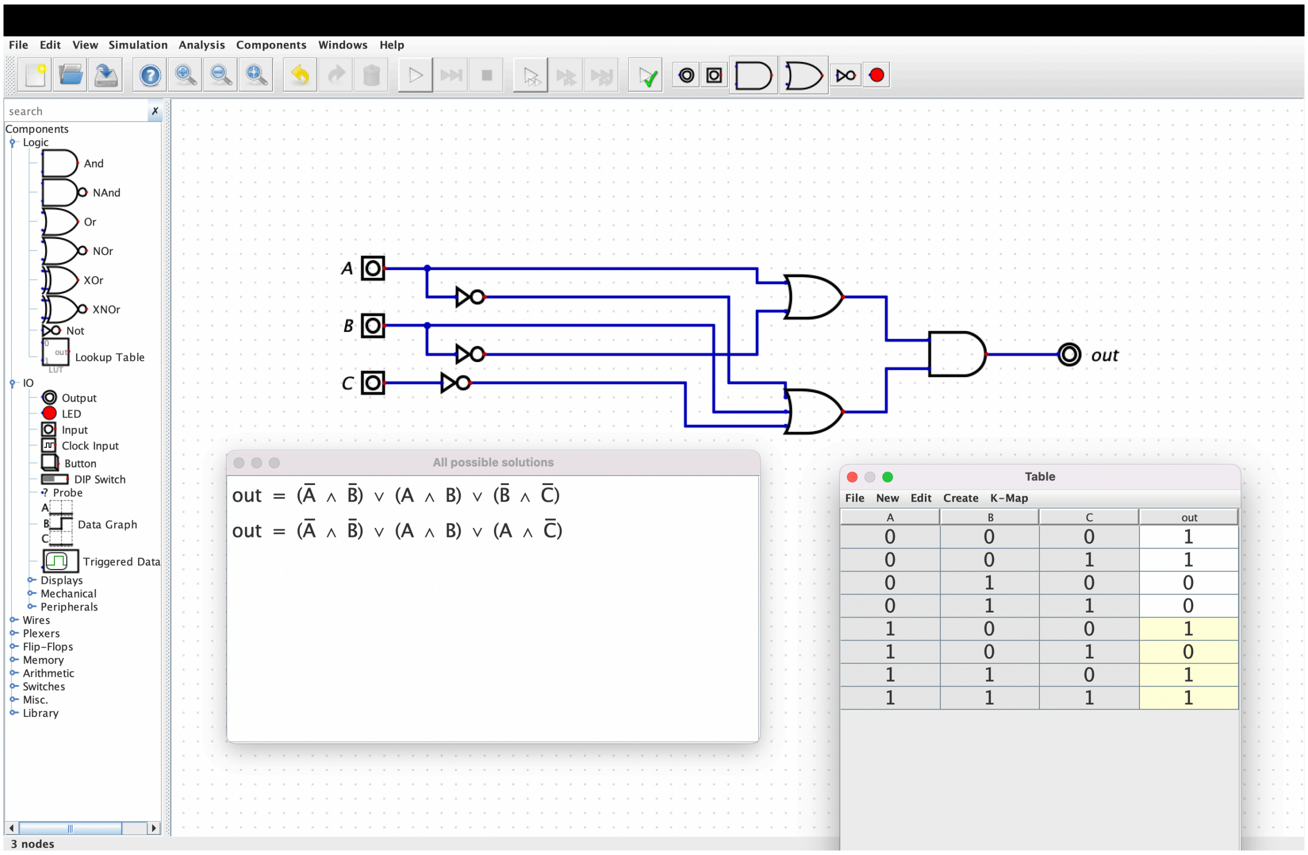
a	b	c	ab	ac	$\overline{a.c}$	$\overline{b}$	$\overline{a \cdot c} \cdot \overline{b}$	f
0	0	0	0	0	1	1	1	1
0	0	1	0	0	1	1	1	1
0	1	0	0	0	1	0	0	0
0	1	1	0	0	1	0	0	0
1	0	0	0	0	1	1	1	1
1	0	1	0	1	0	1	0	0
1	1	0	1	0	1	0	0	1
1	1	1	1	1	0	0	0	1

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

zeros more convenient

$$(A + \overline{B}) \cdot (\overline{A} + B + \overline{C})$$

We got the same result



example with 4 inputs

a	b	c	d	w	x	y	z
0	0	0	0	0	0	0	0
0	0	0	1	1	1	1	1
0	0	1	0	1	1	1	0
0	0	1	1	1	1	0	1
0	1	0	0	1	1	0	0
0	1	0	1	1	0	1	1
0	1	1	0	1	0	1	0
0	1	1	1	1	0	0	1
1	0	0	0	1	0	0	0
1	0	0	1	0	1	1	1
1	0	1	0	0	1	1	0
1	0	1	1	0	1	0	1
1	1	0	0	0	1	0	0
1	1	0	1	0	0	1	1
1	1	1	0	0	0	1	0
1	1	1	1	0	0	0	1

CD \ AB	00	01	11	10
00	0	1	0	1
01	1	1	0	0
11	1	1	0	0
10	1	1	0	0

for W

$$\bar{A}C + \bar{A}D + \bar{A}B + A\bar{B}\bar{C}\bar{D}$$

simplify:

$$\bar{A}\cdot(C + D + B) + A\bar{B}\bar{C}\bar{D}$$