

Complete the following truth tables:

a b	a + b
00	
01	
10	
11	

a b	b + a
00	
01	
10	
11	

a b	a * b
00	
01	
10	
11	

a b	b * a
00	
01	
10	
11	

Complete the following truth tables:

a b c	$a + (b * c)$
0 0 0	
0 0 1	
0 1 0	
0 1 1	
1 0 0	
1 0 1	
1 1 0	
1 1 1	

a b c	$(a + b) * (a + c)$
0 0 0	
0 0 1	
0 1 0	
0 1 1	
1 0 0	
1 0 1	
1 1 0	
1 1 1	

Complete the following truth tables:

a b c	$a * (b + c)$
0 0 0	
0 0 1	
0 1 0	
0 1 1	
1 0 0	
1 0 1	
1 1 0	
1 1 1	

a b c	$(a * b) + (a * c)$
0 0 0	
0 0 1	
0 1 0	
0 1 1	
1 0 0	
1 0 1	
1 1 0	
1 1 1	

Complete the following truth tables:

a	$a + 0$
0	
1	

a	$a * 1$
0	
1	

a	$a + \bar{a}$
0	
1	

a	$a * \bar{a}$
0	
1	

Boolean Sum, Product, and Complement operations:

$$a + b * c = a + b * c$$

$$a * \bar{b} = a * \bar{b}$$

Precedence:

Additional Laws

Idempotent Laws

$$a + a = a$$

$$a * a = a$$

Boundless Laws

$$a + 1 = a$$

$$a * 0 = 0$$

Absorption Laws

$$a + (a * b) = a$$

$$a * (a + b) = a$$

Associative Laws

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

$$(a * b) * c = a * (b * c)$$

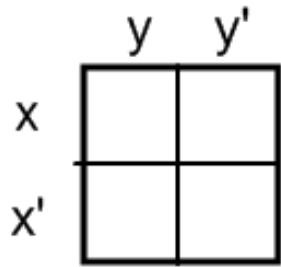
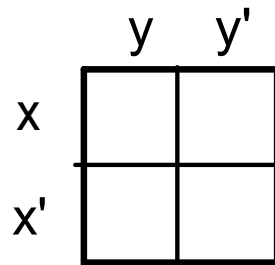
Additional Notes

For circuits, we use \vee to represent OR gates
use \wedge to represent AND gates
use ' to represent NOT

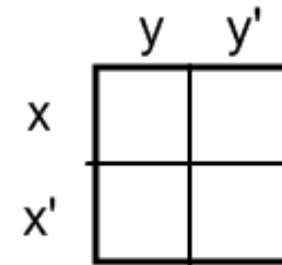
We also use these for truth tables that represent circuits:

A	B	$A \vee B$
1	1	1
1	0	1
0	1	1
0	0	0

Karnaugh Maps

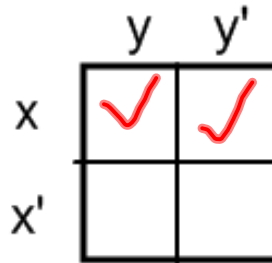
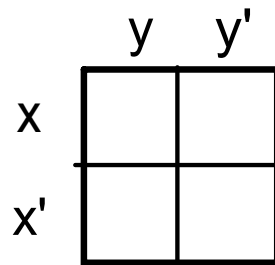


$$E_1 = xy + xy'$$



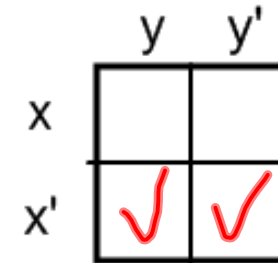
$$E_2 = xy + x'y + x'y'$$

Karnaugh Maps



$$E_1 = xy + xy'$$

$$E_1 = x$$

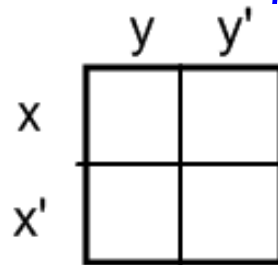


$$E_2 = xy + x'y + x'y'$$

$$E_1 = x' + y$$

Adjacent squares

isolated squares



$$E_3 = xy + x'y'$$

minimum disjunctive normal forms

Karnaugh Maps

Three variables x, y, z

	yz	yz'	$y'z'$	$y'z$
x				
x'				

Three variables x, y, z

yz yz' $y'z'$ $y'z$

Karnaugh Maps

Four variables x, y, z, t

	zt	zt'	$z't'$	$z't$
xy				
xy'				
$x'y'$				
$x'y$				

Examples:

	zt	zt'	z't'	z't
xy				
xy'				
x'y'				
x'y				

E_1

$$y'z + xyz' + yz't'$$

	zt	zt'	z't'	z't
xy				
xy'				
x'y'				
x'y				

E_2

$$y' + xzt'$$