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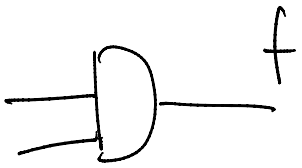
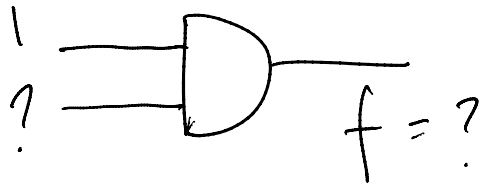
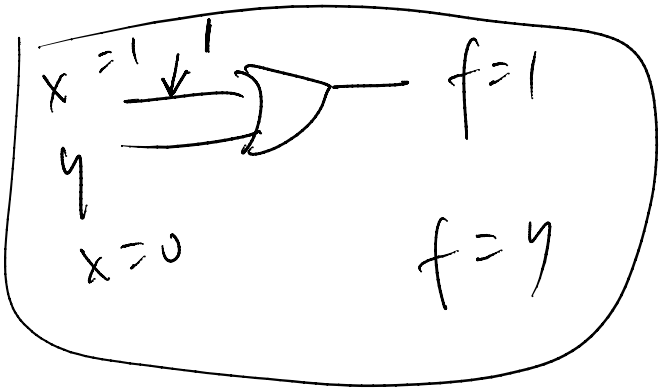


$f = xy$

$x = 0$, $f = 0$

$x = 1$ $f = 1 \cdot y = y$





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SOP Sum of product logic equation

x_1	x_2	x_3	f
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1 ←
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

$f = \bar{x}_1 x_2 x_3 + x_1 \bar{x}_2 x_3 + x_1 x_2 \bar{x}_3 +$

$x_1 x_2 x_3$

3 not gates

4 3-input AND gates

1 4-input OR gate

Algebraic manipulation

$f = (\bar{x}_1 + x_1) x_2 x_3 + x_1 (x_2 + \bar{x}_2) x_3 + x_1 x_2 (x_3 + \bar{x}_3)$

$= x_2 x_3 + x_1 x_3 + x_1 x_2$

3 2-input AND gates

1 3-input OR gate

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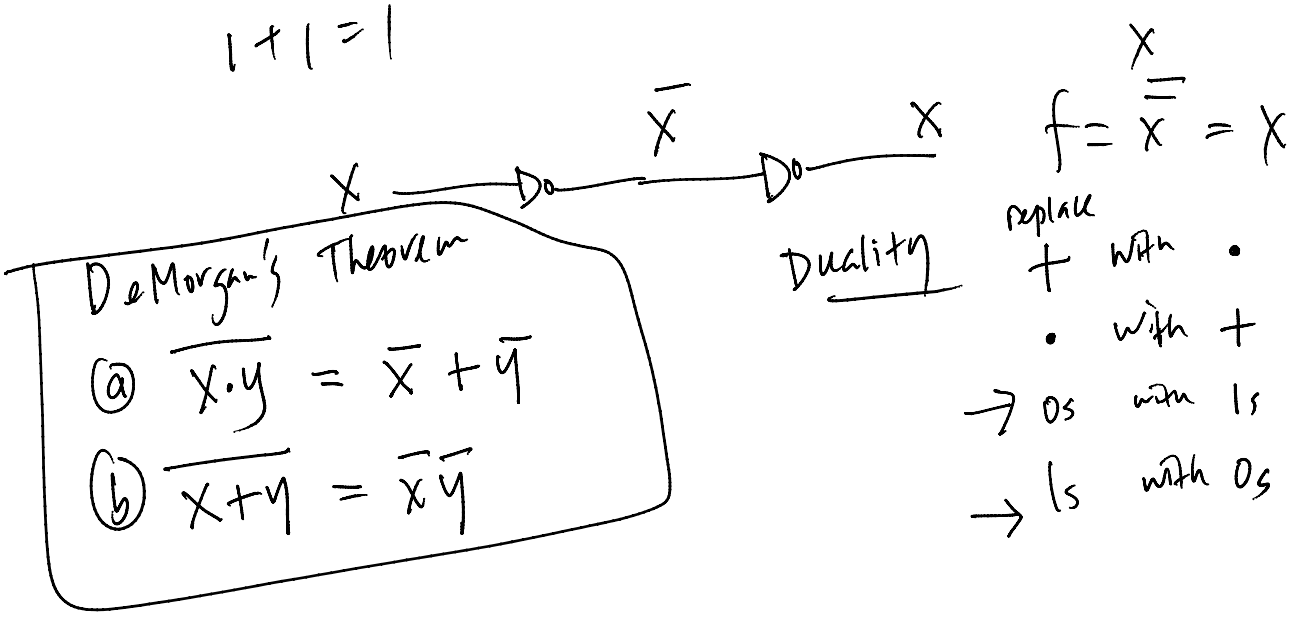
from pgs 29, 30, 31

$0 \cdot 0 = 0$

$1 + 1 = 1$

$\bar{X}$



DeMorgan's Theorem

(a) $\overline{X \cdot Y} = \bar{X} + \bar{Y}$

(b) $\overline{X + Y} = \bar{X}\bar{Y}$

Duality

replace
+ with ·
· with +
→ 0s with 1s
→ 1s with 0s

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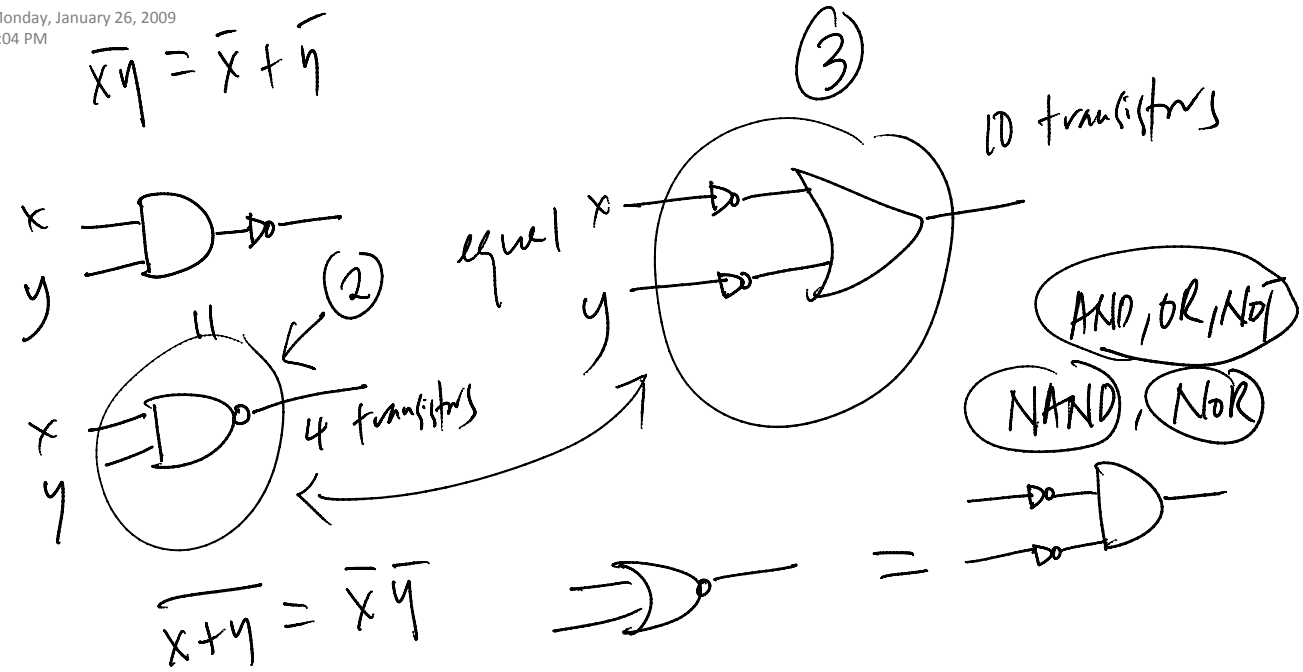
$\overline{xy} = \bar{x} + \bar{y}$



$\overline{x+y} = \bar{x}\bar{y}$

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$x \cdot y = y \cdot x$

$x + y = y + x$

$x \cdot (y \cdot z) = (x \cdot y) \cdot z$

$x + yz = (x+y)(x+z)$

LHS RHS

$RHS = (x+y)(x+z)$

$= xx + xz + xy + yz$

$= x + xz + xy + yz$

$= x(1 + z + y) + yz$

$= x \cdot 1 + yz$

$= x + yz$

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$X + XY = X$

LHS RHS

$LHS = X + XY$

$= X(1 + Y)$

$= X$

14b

$(X+Y)(X+\bar{Y}) = X$

$LHS = X\bar{X} + X\bar{Y} + XY + Y\bar{Y}$ (always 0)

$= X + X\bar{Y} + XY$

$= X(1 + \bar{Y} + Y) = X$

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(16a) $x + \bar{x}y = x + y$

LHS RHS

$$(x + \bar{x}y)y' = (x+y)y'$$

$$xy' + \bar{x}yy' = xy' + yy'$$

$$xy' = xy'$$

$$RHS = (x+y)(x+x')$$

$$= xx + xx' + xy + \bar{x}y$$

$$= x + xy + \bar{x}y$$

$$= x(1+y) + \bar{x}y$$

$$= x + \bar{x}y$$

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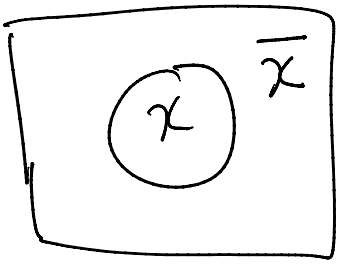
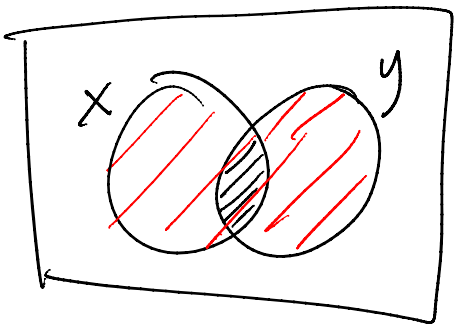
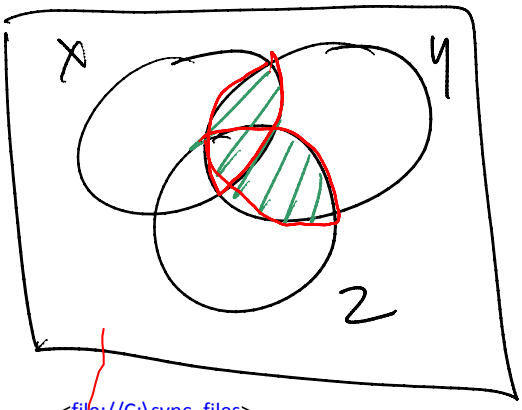
Venn Diagram





xy



x+y

~~x+z+xyz~~

xy + yz

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