DeMorgan's Law for **NAND**:

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

Intuition from English:

It's not true that x and y are both true = either x is false or y is false

DeMorgan's Law for **NOR**:

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

Intuition from English:

It's not true that x or y (or both) are true = both x and y are false

"Neither x nor y."

 ${f egin{array}{c} {
m not} {
m OR}^{
m not} = {
m AND} {
m I} \end{array}}$ 

since

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

by inverting both sides

we have

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

 ${}^{
m not}_{
m not}{
m AND}^{
m not}={
m OR}$ 

since

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

by inverting both sides

we have

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

XOR:

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

This or that but not both (i.e. exactly one is true).

Inverted XOR (aka NXOR or XNOR):

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

Neither are true, or both are true.

source: github.com/mathandy/logic-notes