De Morgan's Laws

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And Gate

For any two given inputs A and B,output X is given as X=AB

Figure : AND gate

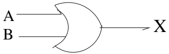
Truth table for AND gate [2]

A	B	X
1	1	1
1	0	0
0	1	0
0	0	0

Or Gate

For any two given inputs A and B,output X is given as
X=A+B

Figure : Or gate



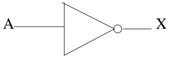
Truth table for Or gate [4]

A	B	X
1	1	1
1	0	1
0	1	1
0	0	0

Not Gate

For given input A,output X is given as
X=$\overline{A}$

Figure : Not gate



Truth table for not gate [1]

A	X
1	0
0	1

De morgan's laws for two variables

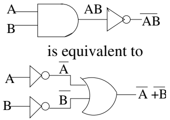
Let A and B be two inputs.Then by De Morgan's laws [3],

- $\overline{A+B}$ =$\overline{A}$ $\overline{B}$
- $\overline{AB} = \overline{A} + \overline{B}$

Prove of First Law

According to first law,an OR gate with all inputs inverted (a Negative-OR gate) behaves the same as a NAND gate that is, $\overline{AB} = \overline{A} + \overline{B}$

Figure : First Law



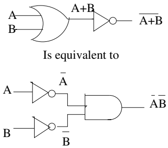
This can be proved by truth table

A	B	$\overline{AB}$	$\overline{A}$	$\overline{B}$	$\overline{A}+\overline{B}$
1	1	0	0	0	0
1	0	1	0	1	1
0	1	1	1	0	1
0	0	1	1	1	1

Proof of Second Law

According to first law,an AND gate with all inputs inverted (a Negative-AND gate) behaves the same as a NOR gate that is, $\overline{A+B}=\overline{A}\,\overline{B}$

Figure : Second Law



This can be proved by truth table

A	B	$\overline{A+B}$	$\overline{A}$	$\overline{B}$	$\overline{A}\,\overline{B}$
1	1	0	0	0	0
1	0	0	0	1	0
0	1	0	1	0	0
0	0	1	1	1	1

De morgan's laws for n variables

Let $x_1, x_2, ..., x_n$ be two inputs.Then,

- $\overline{x_1 + x_2 + .. + x_n} = \overline{x_1}\,\overline{x_2}...\overline{x_n}$
- $\overline{x_1 x_2 ... x_n} = \overline{x_1} + \overline{x_2} + ... + \overline{x_n}$

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