

# Section 2.4: Logic Circuits and Boolean Algebra

Monday, January 29, 2024 10:43 AM

logic circuit: an electrical circuit with only two levels

- one voltage is set at zero volts (grounded)

- the other voltage is set to some other value (such as five volts)

two values: 5 volts / zero volts  
on / off  
1 / 0

a little bit of background (will not be tested)

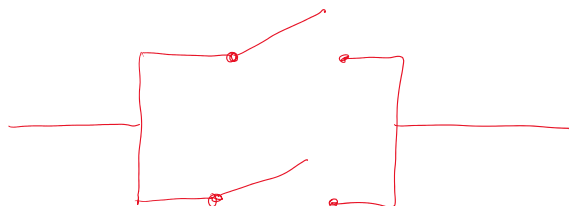
the circuit behaves like a switch



consider the two circuits below:



behaves like "and" - both switches must be closed for current to flow

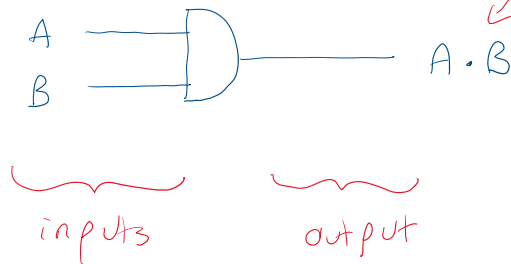


behaves like "or" - at least one switch must

behaves like "or" - at least one switch must be closed for current to flow

gate representation (this I will test)

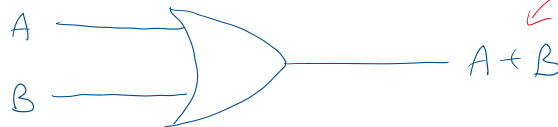
"and"



the dot means "and"

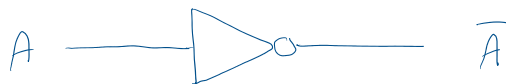
ok to write just AB without the dot

"or"



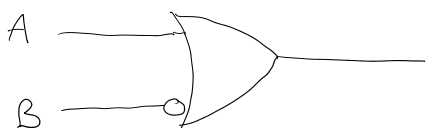
plus mean "or"

"not"

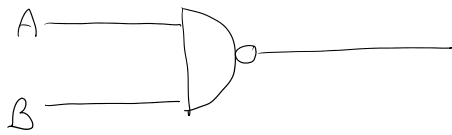


actually we often omit the triangle entirely and just use the open circle to show negation

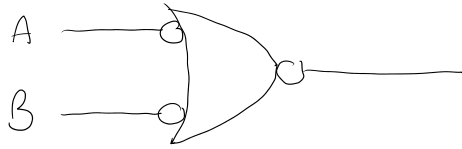
examples: give the output for the following circuits:



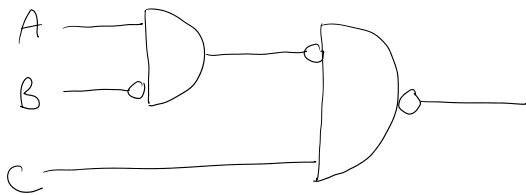
$A + \bar{B}$



$$\overline{AB}$$



$$\overline{\overline{A + B}}$$

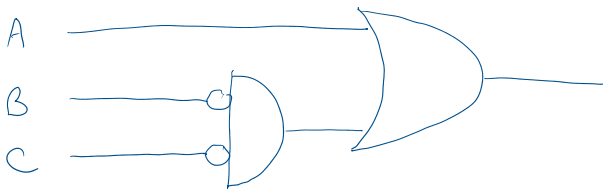


$$\overline{\overline{ABC}}$$

example : draw the gate representation for

$$A + \overline{BC}$$

note: do "and" before the "or"



## Boolean Algebra:

algebra in which the variables can only take on one of two possible values:

0 or 1

"and" symbol is a dot (or implied multiplication with no symbol)

$$A \cdot B, AB, A \cdot 0$$

"or" symbol is a plus sign (+)

"not" symbol is an overbar —

$$\bar{A}, \overline{AB}$$

Section 2.4: cont'd 2024/01/30

order of operations:

"and" before "or"

"not" (negation bar) behaves like brackets

brackets can be used to force the order that you want

examples: what is the order of operations?

a)  $A + BC$

"and" before "or"

b)  $A + \overline{BC}$

"and" before "not" then "or"

c)  $\overline{A + BC}$

"or", then "not", then "and"

d)  $(A + \bar{B})C$

"not", then "or", then "and"

e)  $\overline{A + BC}$

"and", then "or", then "not"

example: write the truth table for  $A + \bar{B}\bar{C}$

A	B	C	$\bar{B}$	$\bar{C}$	$\bar{B}\bar{C}$	$A + \bar{B}\bar{C}$
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0	0	0	1	1	1	1
0	0	1	1	0	0	0
0	1	0	0	1	0	0
0	1	1	0	0	0	0
1	0	0	1	1	1	1
1	0	1	1	0	0	1
1	1	0	0	1	0	1
1	1	1	0	0	0	1