

# Section 2.4: Logic Circuits and Boolean Algebra

Monday, September 16, 2019 10:21 AM

## Algebra

logic circuit - an electrical circuit with only two levels

- one voltage is set at zero volts (grounded)

- the other is set to some other value, such as 5 volts

two values:

5 volts	/	zero volts
on	/	off
1	/	0

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a little bit of background (will not be tested):

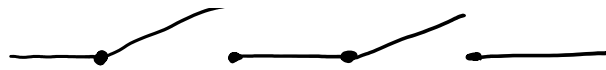
the circuit behaves like a switch:



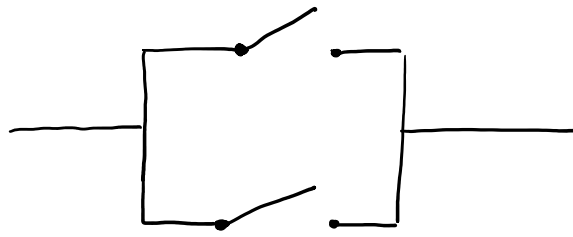
consider the two circuits below:



← behaves like an "and" - both



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

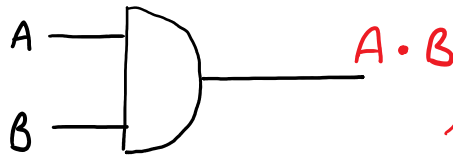


↑ behaves like "or" - at least one switch must be closed for current to flow

gate representation

(this I will test)

"and"



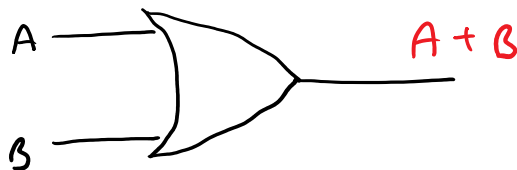
← the dot means "and"

↑ also okay to write just AB without the dot

inputs

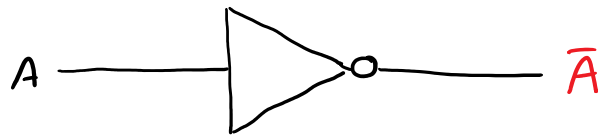
output

"or"



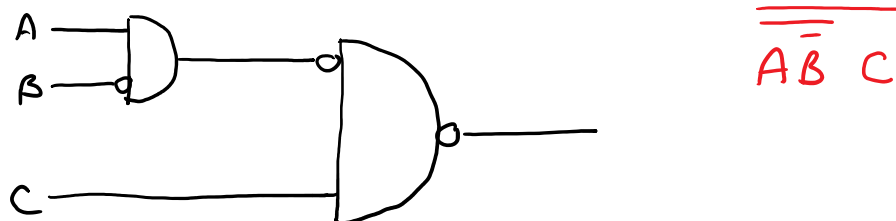
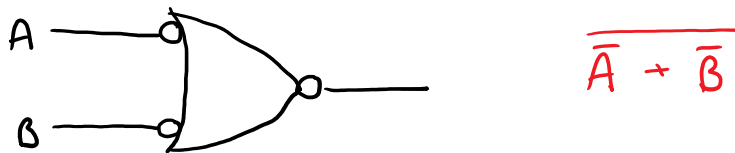
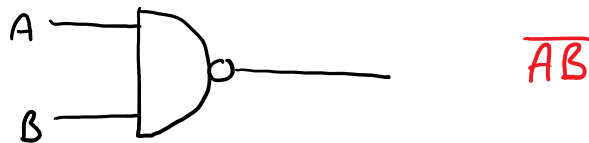
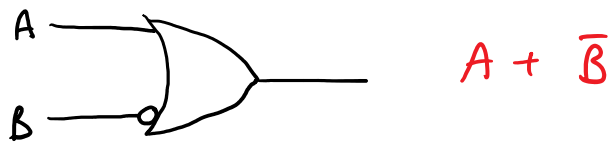
← plus means "or"

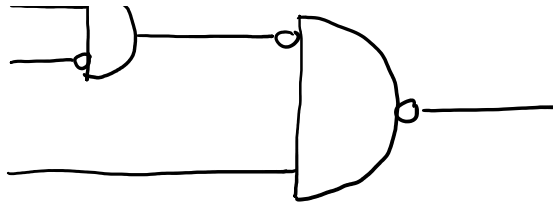
"not"



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

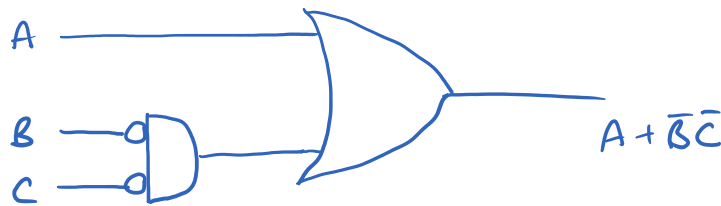
examples: give the output for the following circuits





$A\bar{B}C$

draw the gate representation for  $A + \bar{B}\bar{C}$   
 note: do "and" before "or"



Boolean Algebra: algebra in which the variables can only take on one of two possible values: 0 or 1

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

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

"or" symbol is a  $+$  (plus sign)

"not" symbol is a  $-$  (bar)

$\bar{A}$  is "not - A"

## Order of Operations

"and" before "or"

the negation bar behaves like brackets

you can use brackets to force the order that you want

example: which operation comes first?

①  $A + \underbrace{BC}$   
and first, then or

②  $A + \overline{BC}$   
↑  
not, then and, then or

③  $(A + B)C$   
↑  
or first, then and

④  $\overline{AC}$   
↑  
and, then not

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

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

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