Math 8c

11/22/2020

Antonenko

⑤ NAND

(a) (A NAND B) ⇔ NOT (A AND B)

A	B	A NAND B
T	T	F
T	F	T
F	T	T
F	F	T

(b) A NAND A = NOT (A)

A	A NAND A
T	F
F	T

(c) ¬A = A NAND A

A AND B = NOT (NOT (A AND B))

= NOT (A NAND B)

= (A NAND B) NAND (A NAND B)

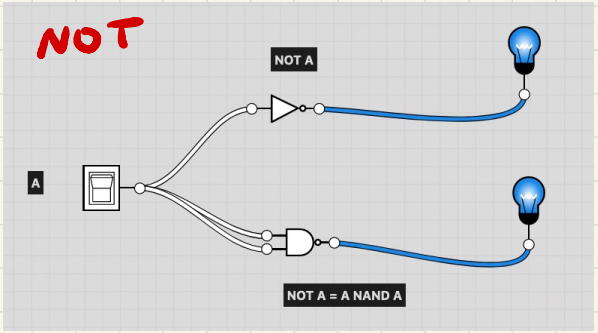
A OR B = ¬(¬A AND ¬B)

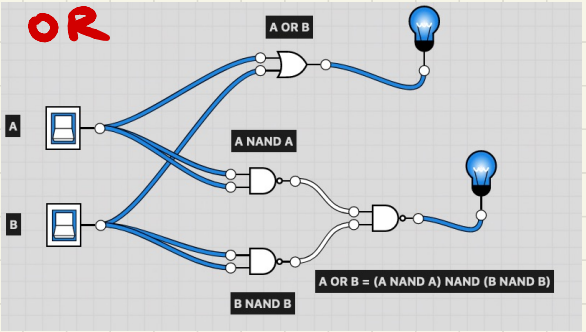
= ¬((A NAND A) AND (B NAND B))

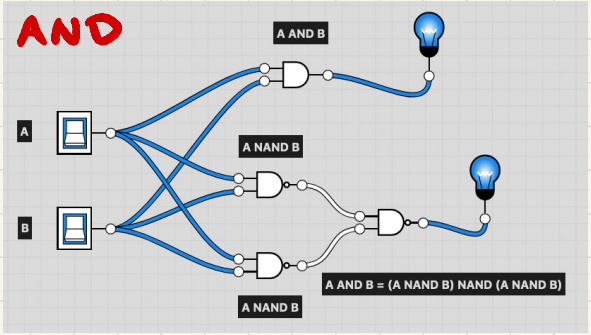
= (A NAND A) NAND (B NAND B)

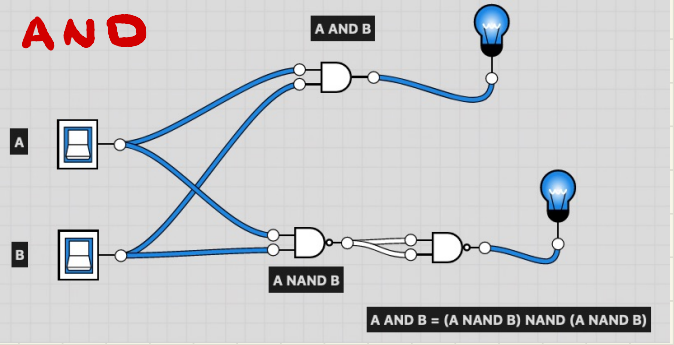
¬(A OR B) = (¬A) AND (¬B)

(A OR B) = ¬((¬A) AND (¬B))


NOT
NOT A
A
NOT A = A NAND A


OR
A OR B
A
A NAND A
B
A OR B = (A NAND A) NAND (B NAND B)
B NAND B


AND
A AND B
A
A NAND B
B
A AND B = (A NAND B) NAND (A NAND B)
A NAND B


AND
A AND B
A
B
A NAND B
A AND B = (A NAND B) NAND (A NAND B)

① NOR:

A NOR B = NOT (A OR B)

A	B	A NOR B
T	T	F
T	F	F
F	T	F
F	F	T

NOT A = A NOR A

A OR B = NOT (NOT (A OR B))

A NOR B

= NOT (A NOR B) =

= (A NOR B) NOR (A NOR B)

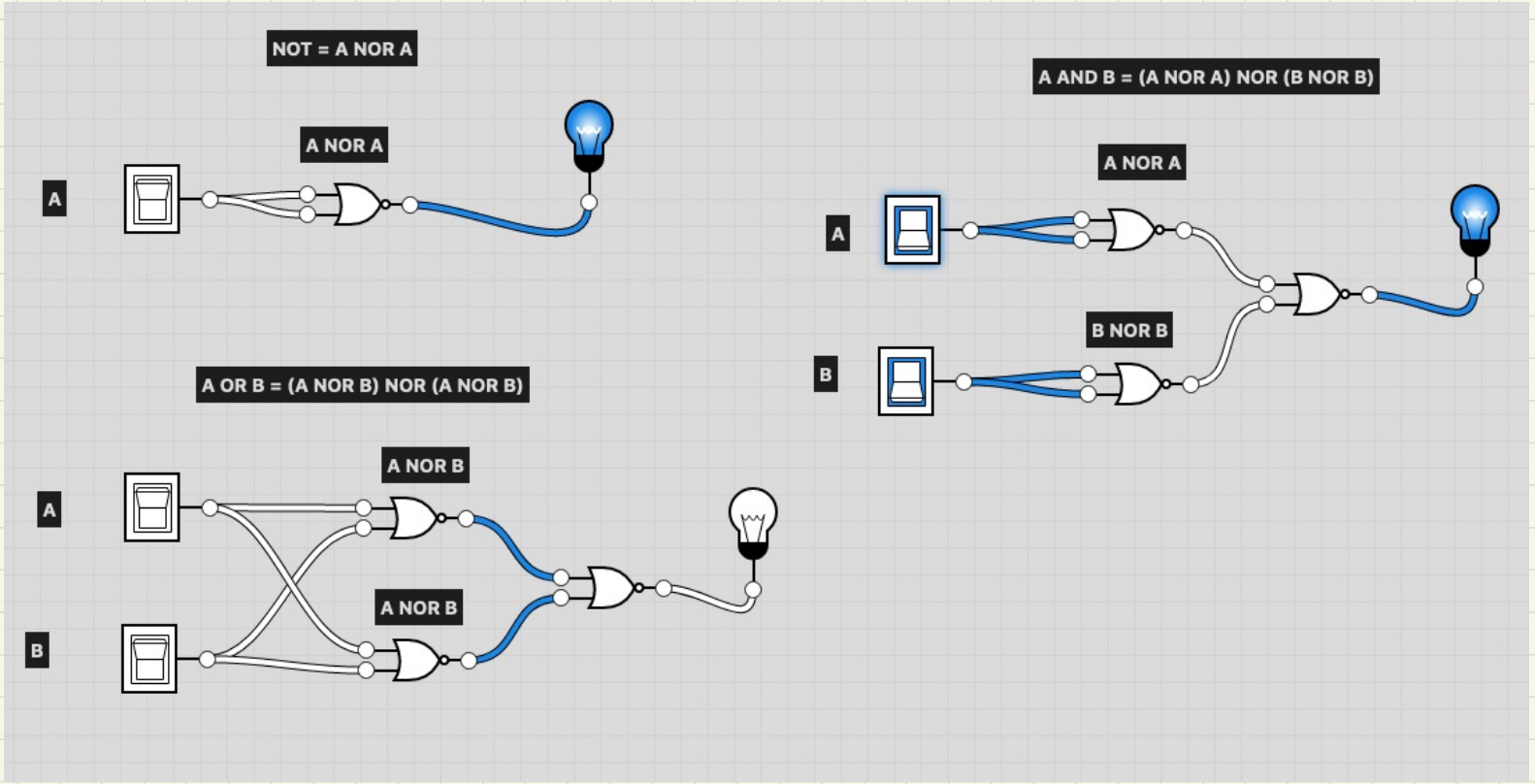
A AND B = NOT ((NOT A) OR (NOT B))

= (NOT A) NOR (NOT B) = (A NOR A) NOR (B NOR B)

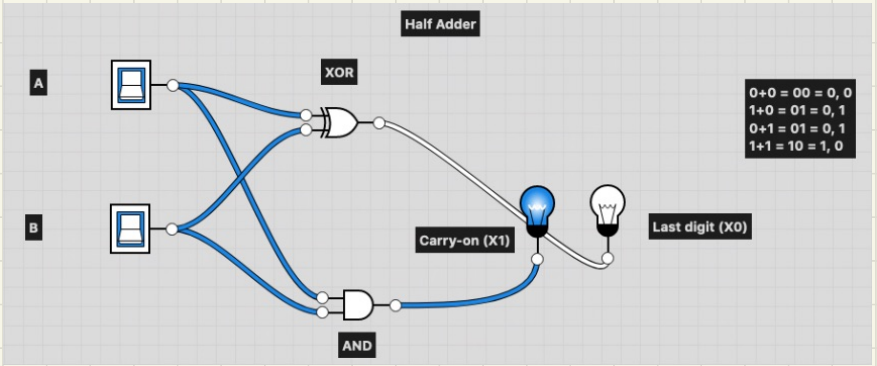
A NAND A

(A NAND A) NAND (B NAND B)

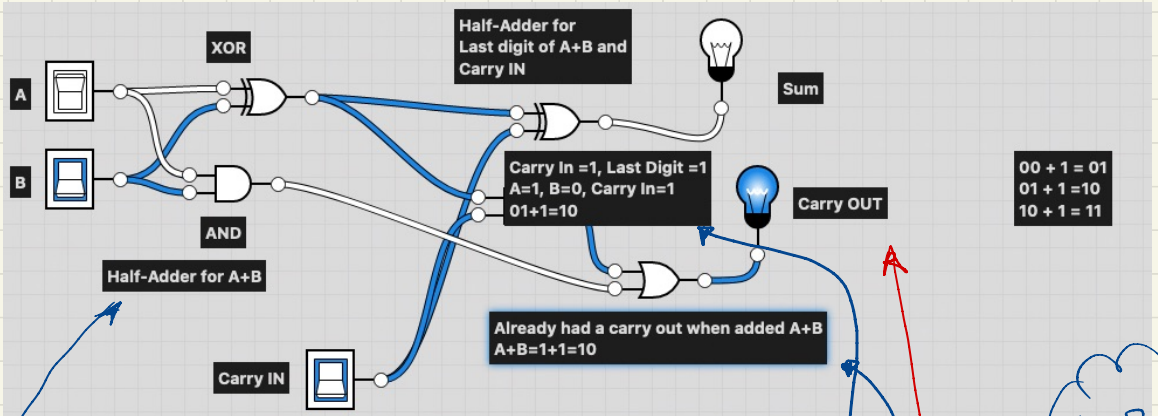
(A NAND B) NAND (A NAND B)


NOT = A NOR A
A
A NOR A
A AND B = (A NOR A) NOR (B NOR B)
A
A NOR A
B
B NOR B
A OR B = (A NOR B) NOR (A NOR B)
A
A NOR B
B
A NOR B

Half Adder


Half Adder
A
B
XOR
AND
Carry-on (X1)
Last digit (X0)
0+0 = 00 = 0, 0
1+0 = 01 = 0, 1
0+1 = 01 = 0, 1
1+1 = 10 = 1, 0

Full Adder



Outputs A+B
(same as in half-adder)

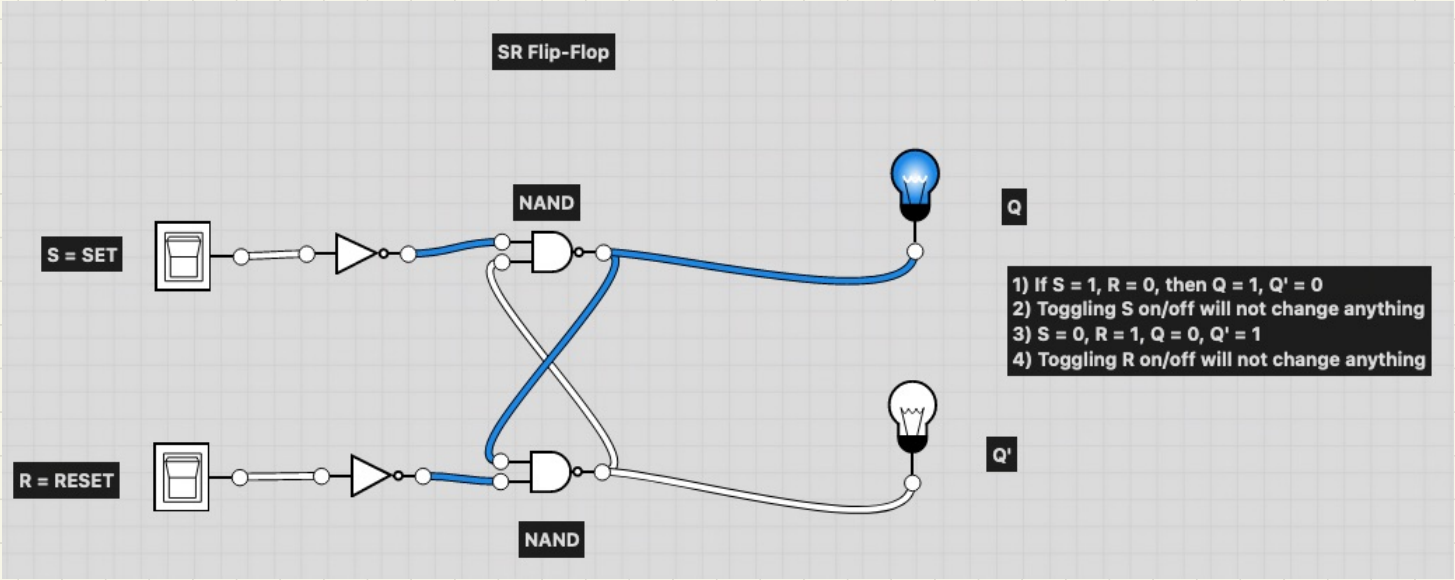
A+B = 1+1 = 10
Carry In = 0/1:
1+1+1 = 11
1+1+0 = 10

there are 2 cases when carry out is ON:

1) Either we already had carry out when adding A+B
2) Or A+B ends in 1 and carry in is also 1

A=1, B=0
A+B = 01
Carry In = 1
01+1 = 10

SR Flip-Flop.



① Start with $S = 1$, $R = 0$ $\Rightarrow$ $Q = 1$, $Q' = 0$
Now, flipping S on or off won't change the bulbs.
— we are in S-state (the flip-flop is SET)

② Now, turn $S = 0$, and turn $R = 1$ $\Rightarrow$ light bulbs flip:
$Q = 0$, $Q' = 1$.
Now, flipping R on or off won't change the bulbs.
- we are in R-state (the flip-flop is RESET)

implication

NOT ($\neg$), OR ($\vee$), AND ($\wedge$), XOR, NAND, NOR

IF / IMPLIES ($\Rightarrow$) ~ conditional / implication

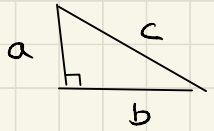
$A \Rightarrow B$ If A then B
A implies B

A	B	$A \Rightarrow B$
T	T	T
T	F	F
F	T	T
F	F	T

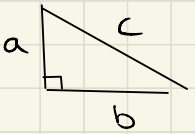
If $2 \times 2 = 5$ then
2 is an even number ✓

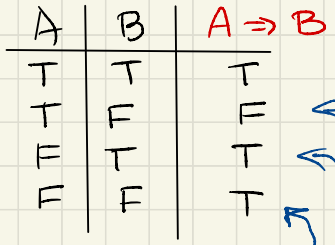
If $2 \times 2 = 5$ then
2 is an odd number ✓

Pythagoras th:
If Δ is right-angled, then
$a^2 + b^2 = c^2$



Pythagoras non_theorem
If Δ is right-angled then
$a^2 - b^2 = c^2$





If it's sunny, I wear sunglesses

✓ ① It's sunny (T), I have sunglesses on (T)

✗ ② It's sunny (T), I have NO sunglesses on (F)

{ "You're lying!!!" – the only situation when you can accuse me of lying!

✓ ③ It's cloudy (F), I have sunglesses on (T)

✓ ④ It's cloudy (F), I have NO sunglesses on (F)