· SECTION 1 ·

SIMPLIFYING EQUATIONS

- ALWAYS SIMPLIFY BEFORE MAKING A CIRCUIT

- USE PROPERTIES TO SIMPLIFY

$$r = ab c' + ab' c'$$

$$r = a c' (b + b')$$

$$r = a c' (1)$$

$$r = a c'$$

KMAPS

- KARNAUGH MAP
- A MAP OF A FUNCTION

a\b	0	1
0	$a'b'$	$a'b$
1	ab'	ab

$$y = a'b' + ab'$$

a\b	0	1
0	$a'b'$	0
1	ab'	0

$\Rightarrow$

a\b	0	1
0	1	0
1	1	0

- Each box is a minterm

- You can simplify an eq using circles in a kmap

$$x = a'b' + ab'$$
$$x = (a' + a)b'$$
$$x = (1)b'$$
$$x = b'$$

RULES REGARDING CIRCLES
- Cover every **1** at least once
  ↳ Add term to expression
- Use fewest + largest circles possible

MORE VARIABLES : MORE FUN

a \ bc	00	01	11	10
0	$a'b'c'$	$a'b'c$	$a'bc$	$a'bc'$
1	$ab'c'$	$ab'c$	abc	abc'

$a'b$

b'

$a'c'd$

ab \ cd	00	01	11	10
00	0	1	0	0
01	0	1	0	0
11	1	1	1	1
10	0	0	1	1

ab

bc

- THE LARGER THE CIRCLE - THE FEWER TERMS

De Morgan's Laws

$$OR \mid (a \lor b)' = a' \land b'$$

$$AND \mid (a \land b)' = a' \lor b'$$

When an operation is 'not', flip the sign + not each item

XOR / XNOR

$$y = a \oplus b$$

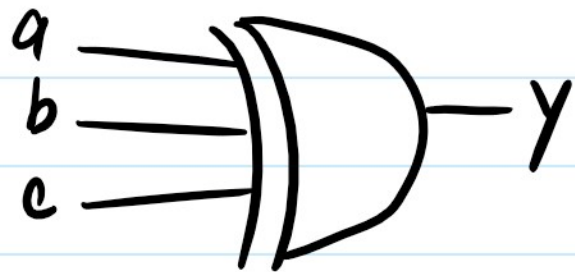| a	b	y
0	0	0
0	1	1
1	0	1
1	1	0

$$a \oplus b = a'b + ab'$$

MORE GATES? NO PROBLEM

a	b	c	y
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	b	1	0
1	1	0	0
1	1	1	1

• ODD # OF 1^s

NAND

NAND is NOT AND :0
"Gasps in Spanish"

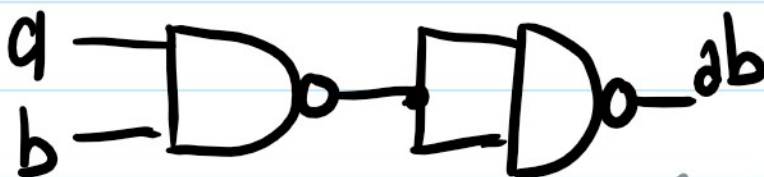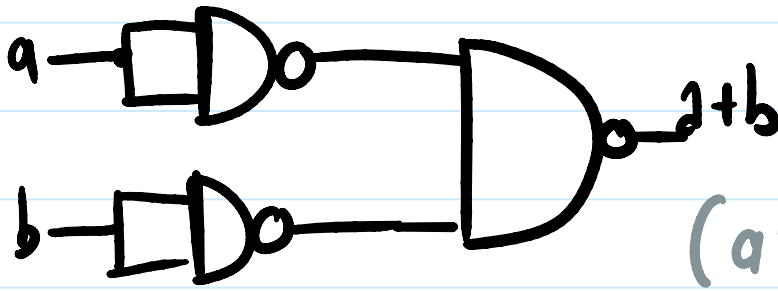| a	b	y
0	0	1
0	1	1
1	0	1
1	1	0
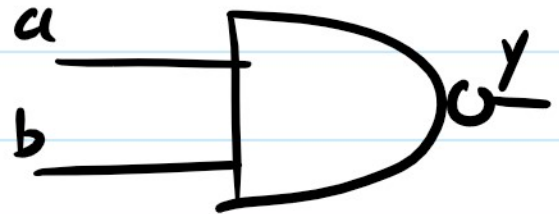
- Is a universal gate: Can make any gate from these
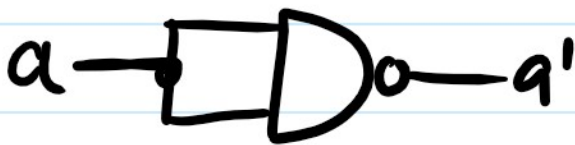
NOT

$(aa)' = a' + a' = a'$

AND

$((ab)')' = (ab)'' = ab$

OR

$(a'b')' = a'' + b'' = a + b$

NOR

- NOR IS NOT OR :O
  "CLASPS IN SPANISH"

- UNIVERSAL GATE

a	b	y
0	0	1
0	1	0
1	0	0
1	1	0

NOT

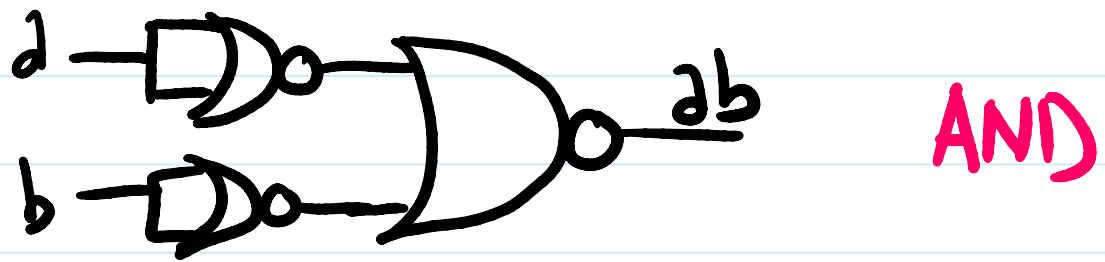$$(a+a)' = a'a' = a'$$

OR

$$((a+b)')' = (a+b)'' = a+b$$

AND

$$(a' + b')' = a''b'' = ab$$