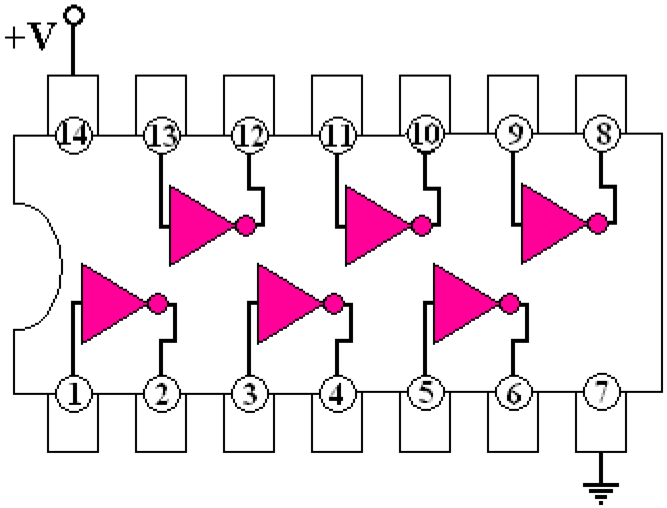
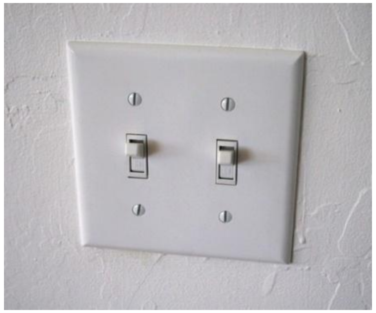
Logic Gates



What are logic gates?

- In the binary lesson, we discussed the switches inside a computer
- Logic gates are the switches that turn ON or OFF depending on what the user is doing!
- They are the building blocks for how computers work.

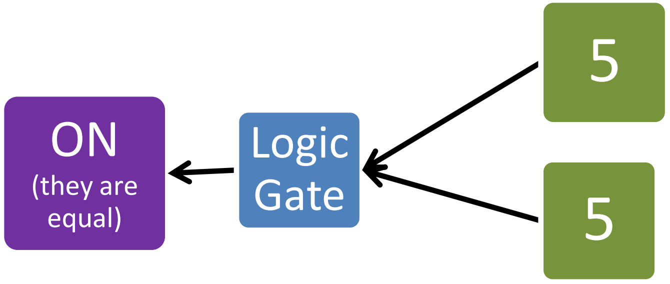


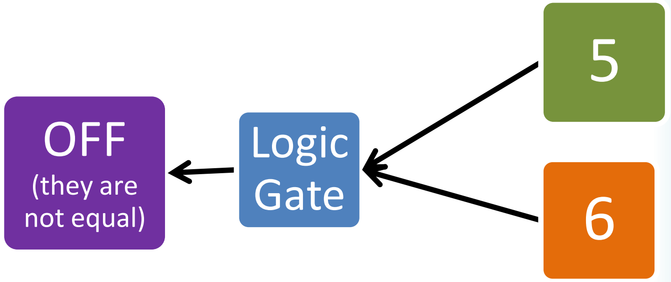
What are logic gates?

- Logic gates turn ON when a certain condition is true, and OFF when the condition is false
  - They check whether or not the information they get follows a certain rule
- They either spit out the answer true (ON) or false (OFF)
- Remember:
  - True= ON = 1
  - False = OFF=0

Let's do an example!

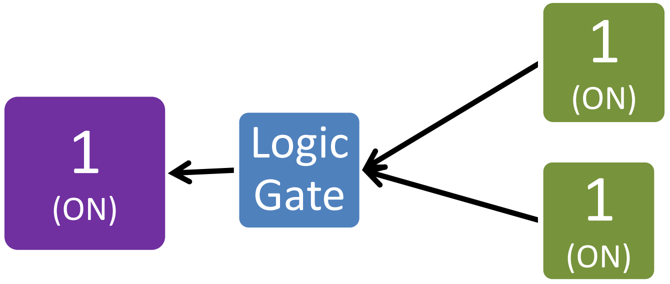
- Let's say a certain logic gate needs to determine if two numbers are equal
- The rule would be "is equal"
- If the two input numbers are equal, it will go into its ON position, indicating true
- If they are not equal, it will go into its OFF position, indicating false

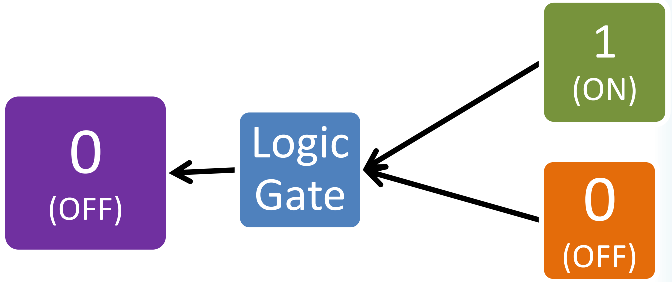




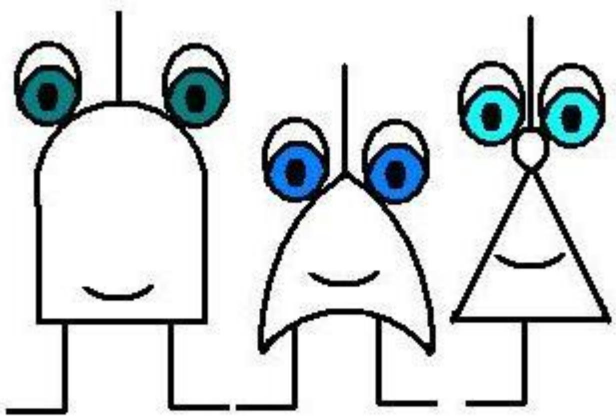
Let’s do an example!

- But we learned before that computers only think of things in terms of ON and OFF, which to them is 1 and 0
- So a computer wouldn’t take an input of 5 or 6 – all of the information need to be 0s and 1s
- *Reminder*: Input refers to the information you give the logic gate, and output refers to what it spits out!
- Let’s try this example again, keeping this rule in mind!

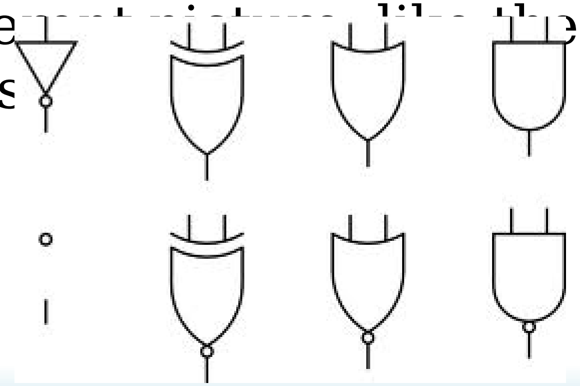




Types of Logic Gates!

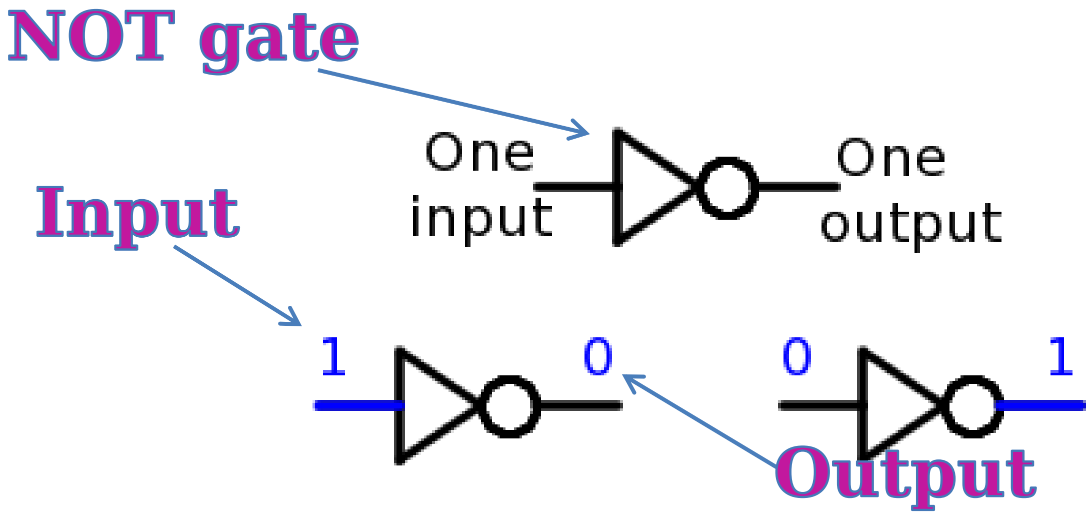


- Major logic gates: NOT, AND, OR, and XOR
- There are also other ones, such as NAND, NOR, and XNOR that we're not going to cover.
- This is called Boolean logic
- In a circuit schematic each logic gate is represented by a different picture, like the ones



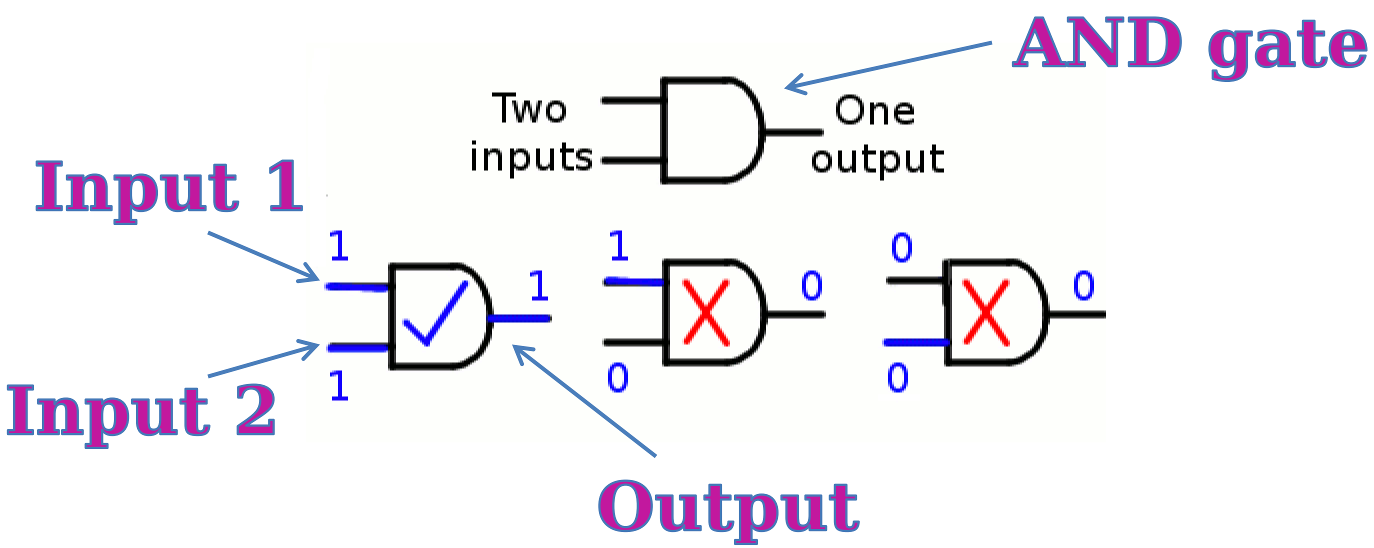
NOT

- NOT is the most simple logic gate.
- All it does is take in an input that is either ON or OFF and spits out the opposite.
- So for a 1 it will give a 0, and for a 0 it will give a 1.
- Another name for a NOT gate is inverter, because it inverts (makes opposite) the input



AND

- Unlike NOT, AND needs two inputs
- It only turns on when both inputs are ON
- If only one input is on, it spits out OFF
- If both inputs are off, it spits out OFF



AND Truth Table

- A convenient way to visualize the outputs for the logic gates is through a truth table
- The truth table depicts the gate's response to each possible set of inputs

Input 1

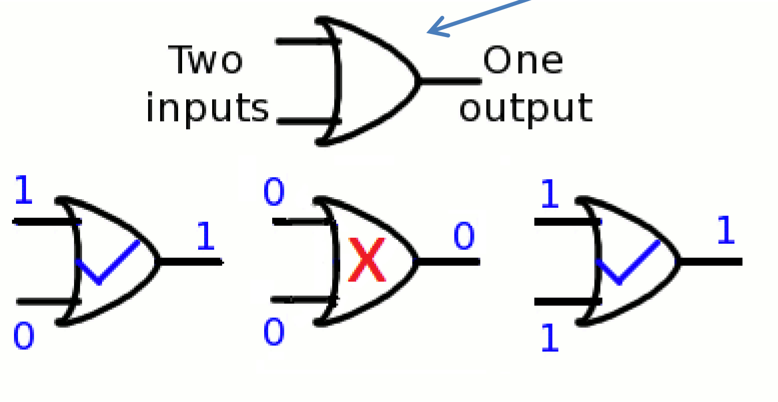
Input 2	0	1
0	0	0
1	0	1

Output

OR

- OR also needs two inputs
- OR needs one input to be ON for it to spit out ON
- It is also ON when both inputs are ON
- It is OFF when both inputs are OFF

OR gate



OR Truth Table

Input 1

Input 2

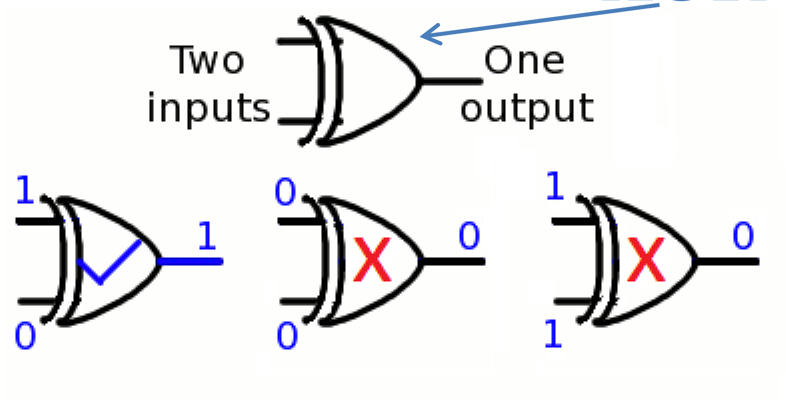
	0	1
0	0	1
1	1	1

Output

XOR

- XOR is the short way to say "Exclusive OR"
- Like OR, XOR also only needs one input to be ON for it to spit out ON
- But unlike OR, when both inputs are ON, XOR spits out OFF
- It is also OFF when both inputs are OFF

XOR gate



XOR Truth Table

Input 1

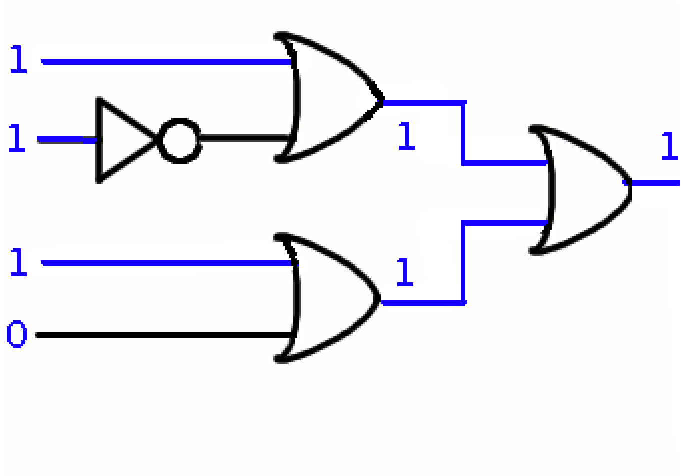
Input 2

	0	1
0	0	1
1	1	0

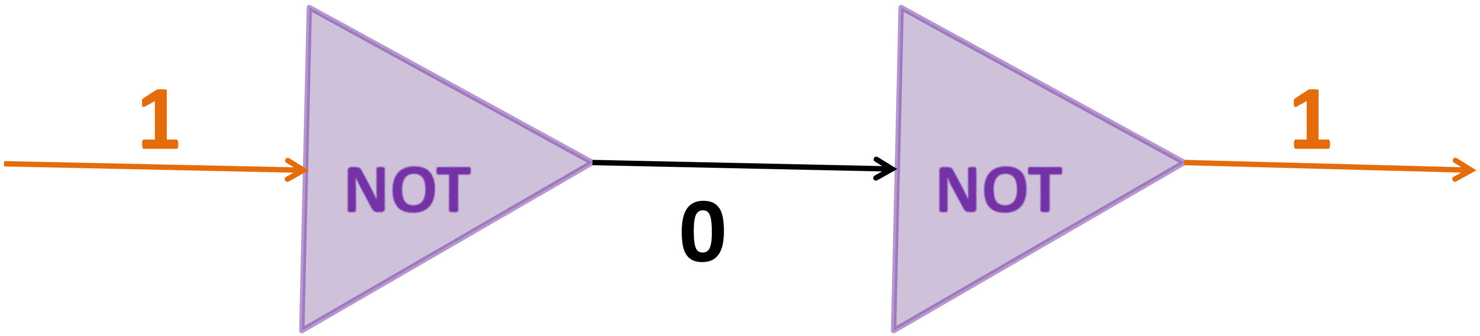
Output

Stacking Logic Gates!

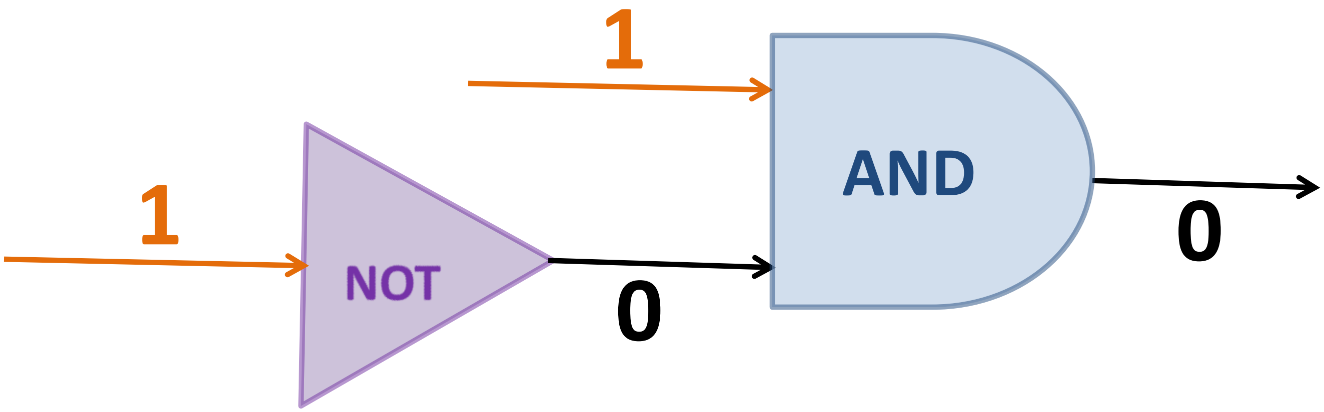
- An output of one logic gate can be an input to another logic gate.
- This creates trees of gates that depend on each other.



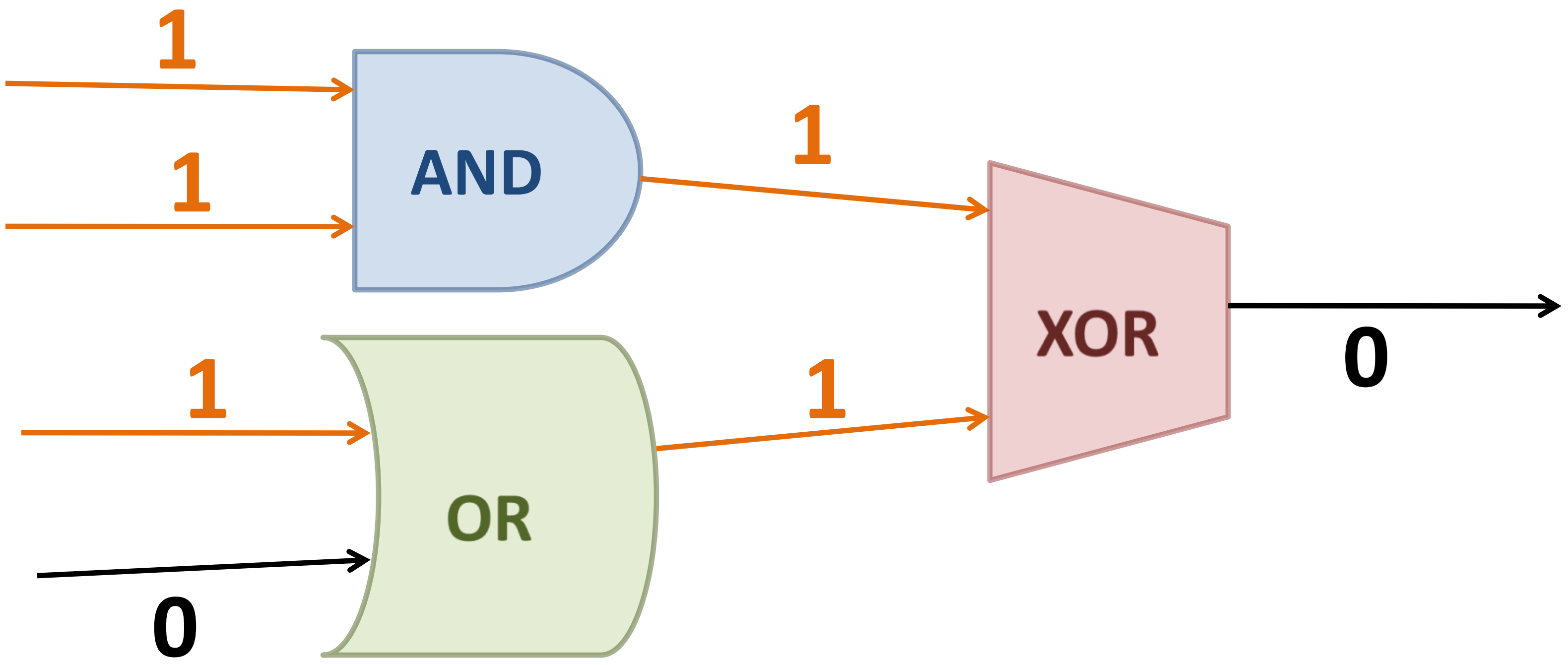
Let’s Do an Example!



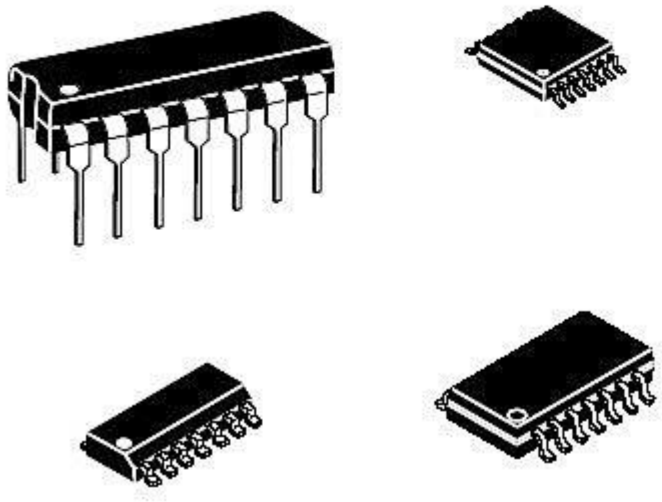
Example 2!



Example 3!



Logic gates actually look like weird bugs in real life!



However, the diagrams we use are easier to understand

Any Questions??