

Breadboard logic

January 13th, 2020

Outline

Boolean logic

What can we do with logic gates

Latches and Flip-Flops

Basic logic operation

- Two states **TRUE** and **FALSE** (also written as **1** and **0**)
- Boolean logic describes logical operations

- **NOT**

A	Y
0	1
1	0

- **AND**

A	B	Y
0	0	0
1	0	0
0	1	0
1	1	1

- **OR**

A	B	Y
0	0	0
1	0	1
0	1	1
1	1	1

- In electronics boolean states are represented by different voltage levels, e.g. **FALSE** = 0 V, **TRUE** = 5 V

- **XOR**

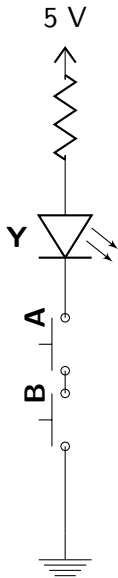
A	B	Y
0	0	0
1	0	1
0	1	1
1	1	0

- **NAND**

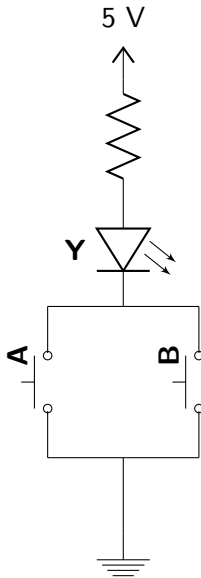
A	B	Y
0	0	1
1	0	1
0	1	1
1	1	0

Basic gate functionality with push buttons

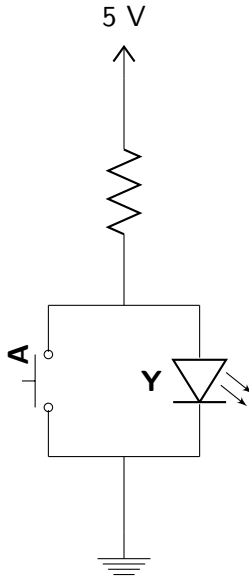
AND gate



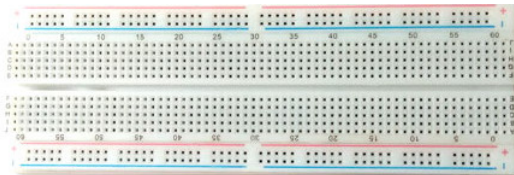
OR gate



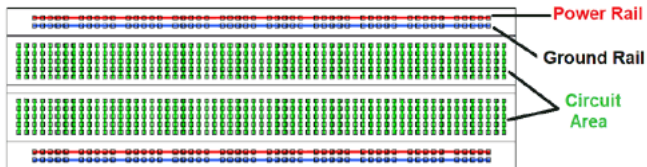
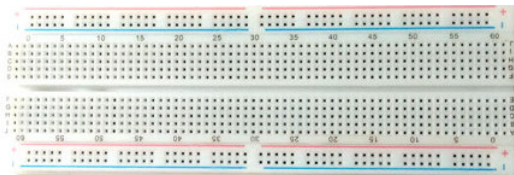
NOT gate
(inverter)



Breadboard

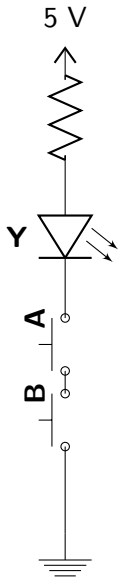


Breadboard



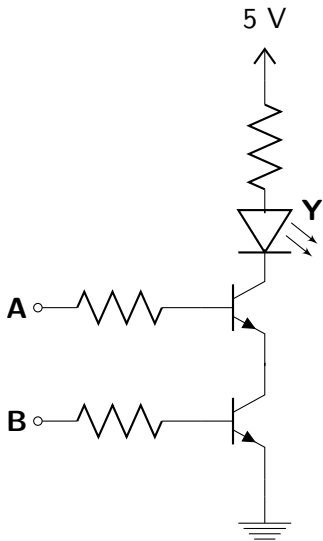
Basic gates with transistors

AND gate



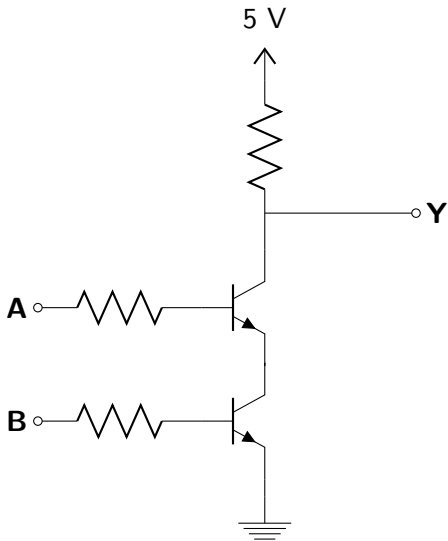
Basic gates with transistors

AND gate



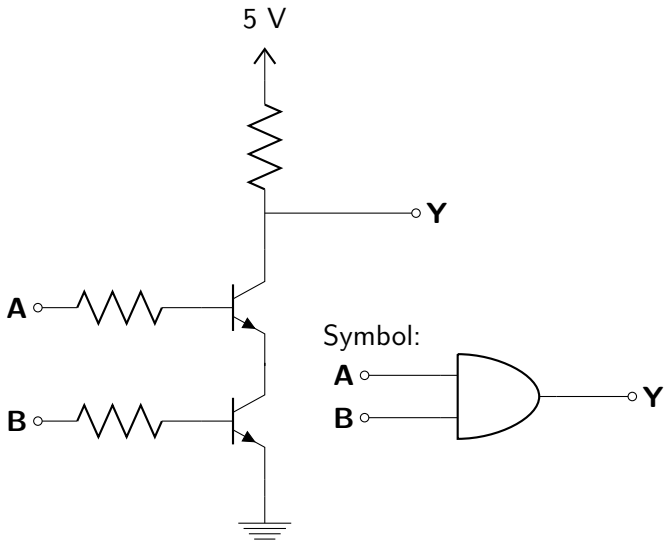
Basic gates with transistors

AND gate



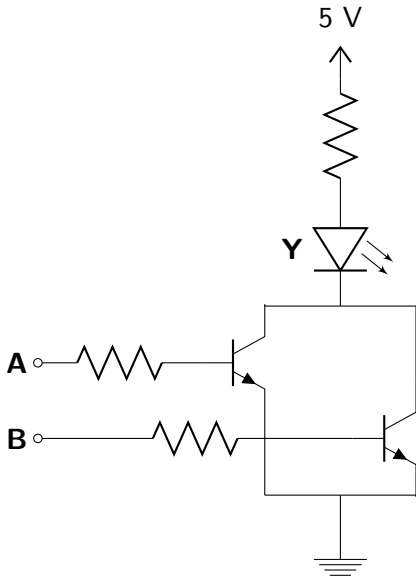
Basic gates with transistors

AND gate

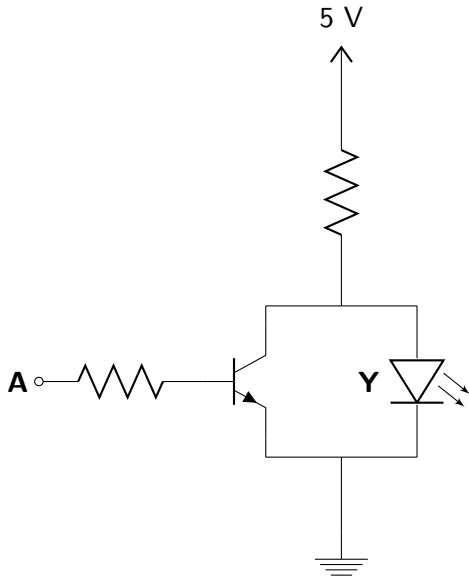


Basic gates with transistors

OR gate



NOT gate (inverter)



Building some gates with other gates

content...

Binary addition

Adding two bits
can be implemented with one AND gate and one XOR gate

Full Adder

content...

Building a N-bit adder

Ripple carry adder

Memory

S-R-Latch

Gated latch

content...

D latch

content...

Building a N-bit shift register

content...