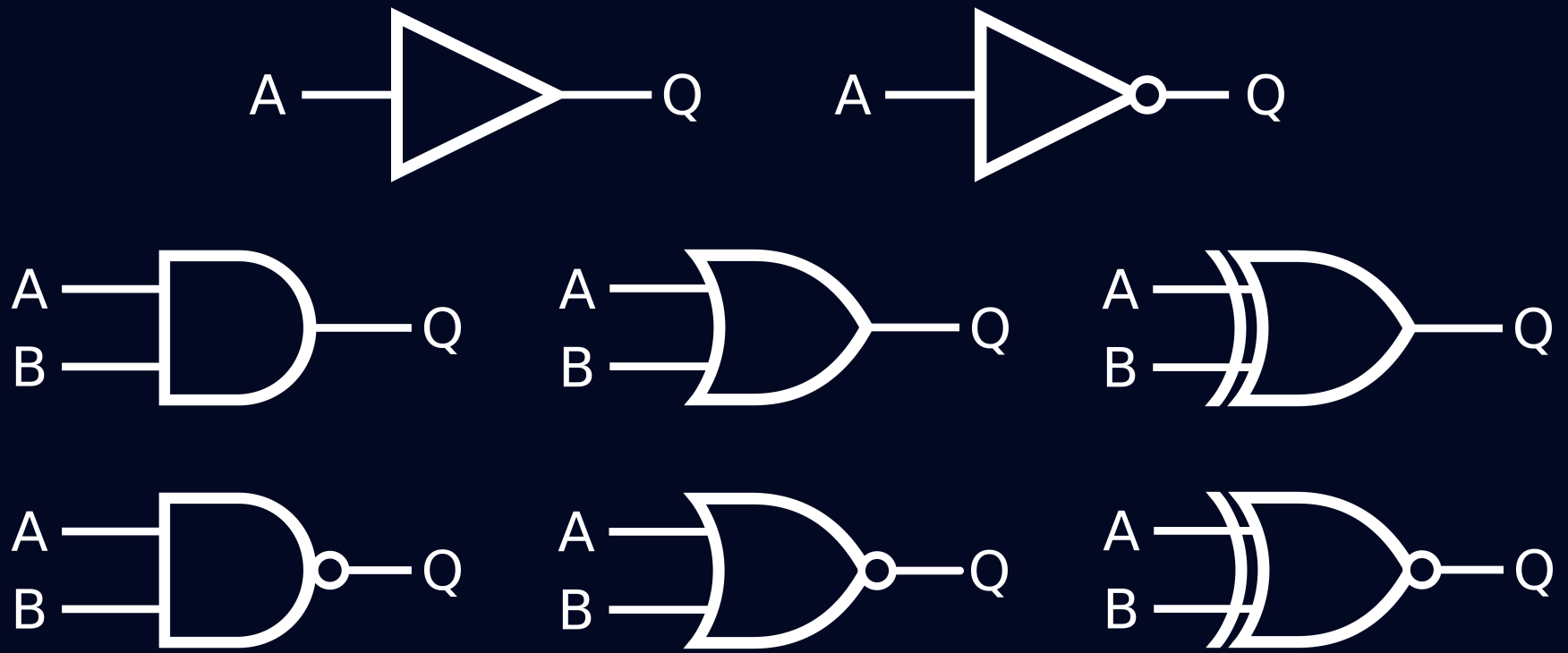
LOGIC GATES

Zoldan Carlo 5^alm



[Falstad's Circuit Simulator Premade Circuit File]

Introduction: Boolean Values

Boolean data are a type of variables that defines truth, and can only have the value of **False (0)** or **True (1)**.

Booleans are widely used in informatic and mathematical logic.

FALSE = 0
TRUE = 1

Introduction: Boolean Values

In informatic Boolean values are mainly used to define and check the truth of given prompts:

User Input:

Machine response:

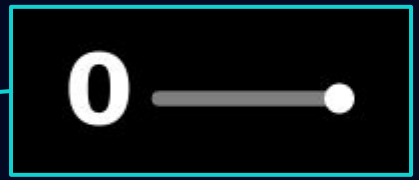
```
>>> 1 + 1 == 2
True
>>> 1 + 1 == 1
False
```

example made using python3 console

Main Elements: inputs, outputs, gates

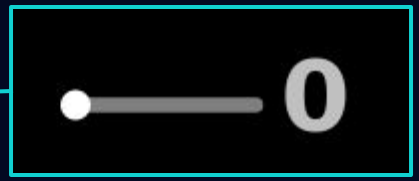
Input:

Send a boolean value



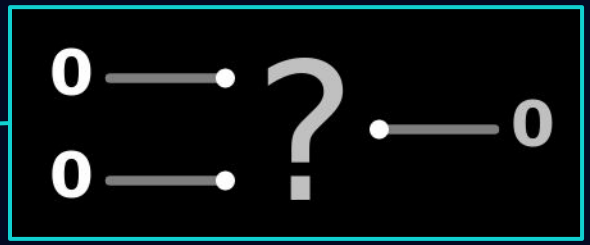
Output:

Display a boolean value



Gate:

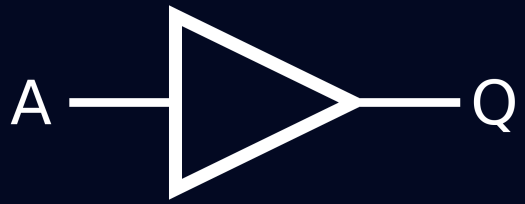
Process two or more inputs to a single output



Basic Gates: BUFFER, NOT

BUFFER Gate:

The output (Q) is equal to the input (A).

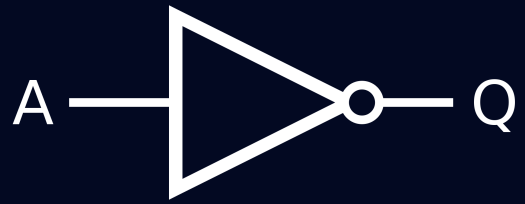


A	Q
0	0
1	1

NOT Gate:

The output is the opposite of the input.

This gate is also known as *“Inverter”*.

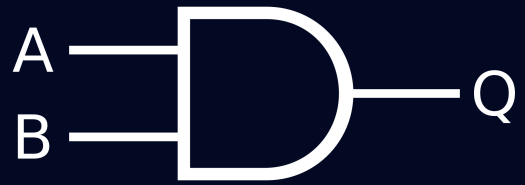


A	Q
0	1
1	0

Conjunction Gates: AND, NAND

AND Gate:

If both inputs are 1, outputs 1, otherwise outputs 0.

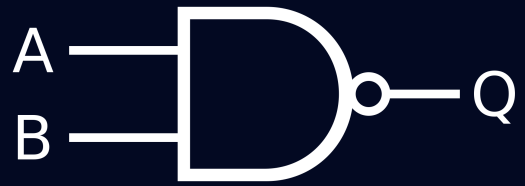


A	B	Q
0	0	0
0	1	0
1	0	0
1	1	1

NAND Gate:

If both inputs are 1, outputs 0, otherwise outputs 1.

(Inversion of AND outputs)

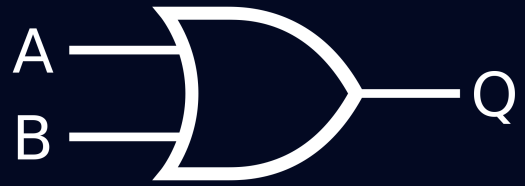


A	B	Q
0	0	1
0	1	1
1	0	1
1	1	0

Disjunction Gates: OR, NOR

OR Gate:

If at least one of the inputs is 1, outputs 1, otherwise outputs 0.

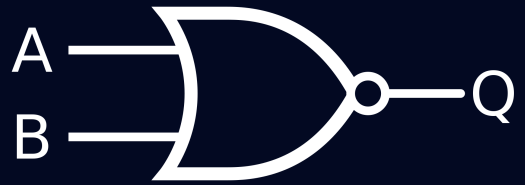


A	B	Q
0	0	0
0	1	1
1	0	1
1	1	1

NOR Gate:

If at least one of the inputs is 1, outputs 0, otherwise outputs 1.

(Inversion of OR outputs)

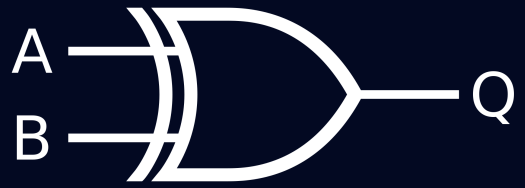


A	B	Q
0	0	1
0	1	0
1	0	0
1	1	0

Biconditional Gates: XOR, XNOR

XOR Gate:

If one (and one only!) of the inputs is 1, outputs 1, otherwise outputs 0.

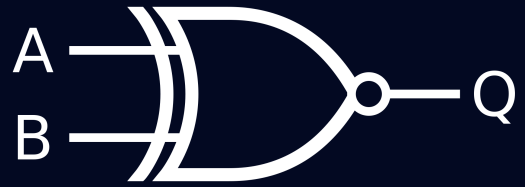


A	B	Q
0	0	0
0	1	1
1	0	1
1	1	0

XNOR Gate:

If one (and one only!) of the inputs is 1, outputs 0, otherwise outputs 1.

(Inversion of XNOR outputs)



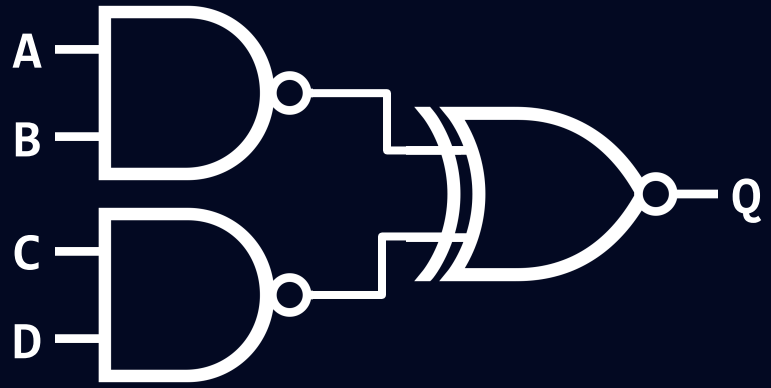
A	B	Q
0	0	1
0	1	0
1	0	0
1	1	1

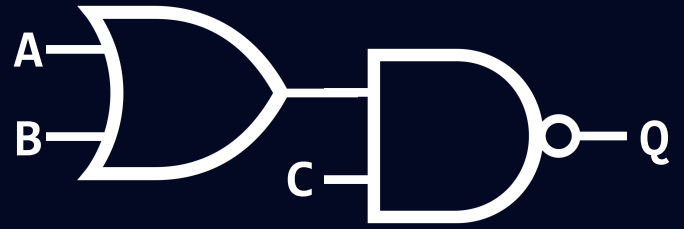
TRUTH TABLE OF ALL LOGIC GATES

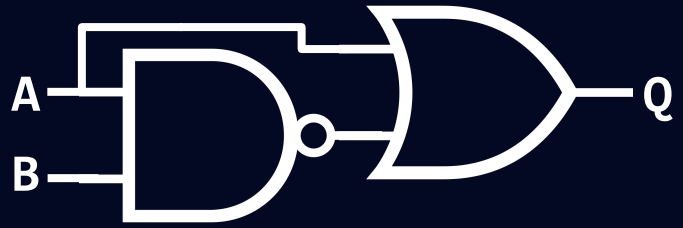
INPUT		OUTPUT					
A	B	AND	NAND	OR	NOR	XOR	XNOR
0	0	0	1	0	1	0	1
0	1			1	0	1	0
1	0						
1	1	1	0			0	1

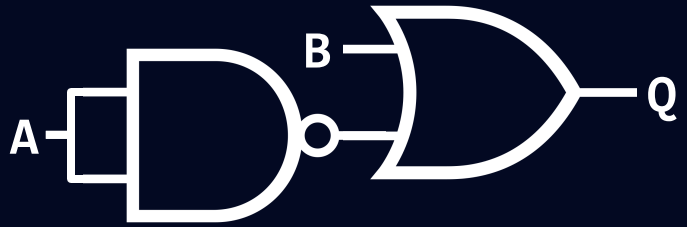
Logic Circuits

Several logic gates can be connected together to form what is called a logic circuit.



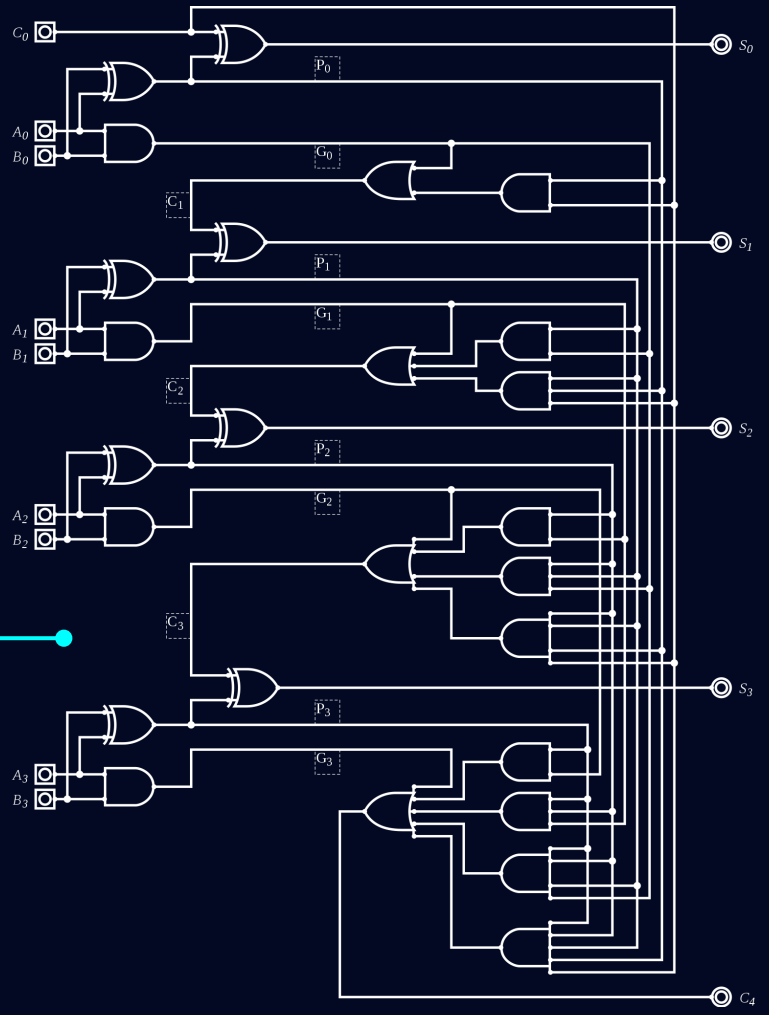






Logic Circuits

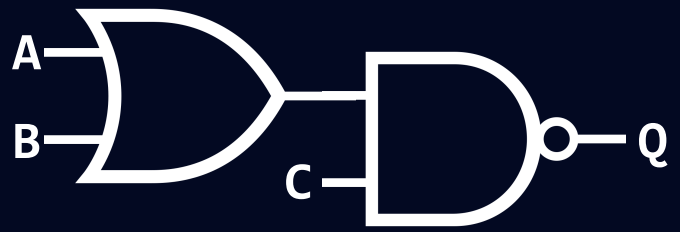
Some of the microchips and components used in our digital devices are simply very complex logic circuits.



A 4-bit Carry Lookahead Adder

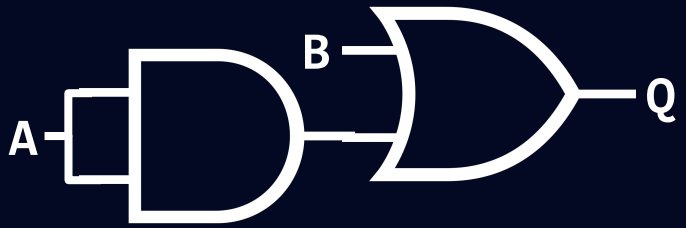
Find the value of Q using the given inputs.

A = 1 B = 0 C = 1 Q = ?	A = 0 B = 0 C = 0 Q = ?	A = 1 B = 1 C = 0 Q = ?

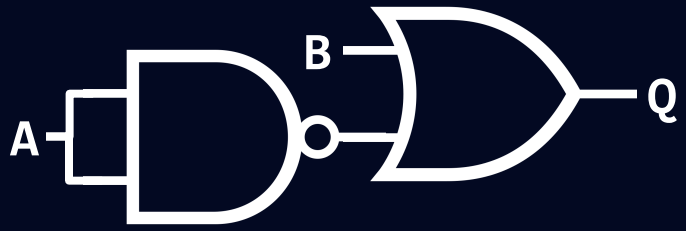


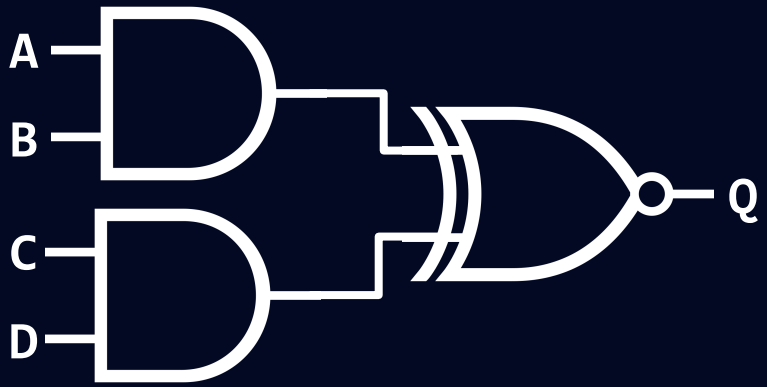
Find the value of Q using the given inputs.

A = 0 B = 0 Q = ?	A = 1 B = 1 Q = ?	A = 1 B = 0 Q = ?	A = 0 B = 1 Q = ?



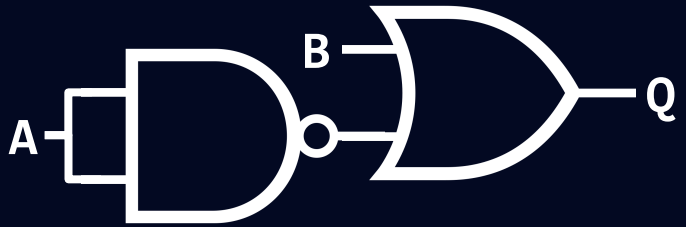
Which values of A, B, C, D makes Q = 1?





Find the value of Q using the given inputs.

A = 0 B = 0 Q = ?	A = 1 B = 1 Q = ?	A = 1 B = 0 Q = ?	A = 0 B = 1 Q = ?



RANDOM MEMES

(because you haven't suffered enough)