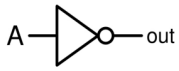
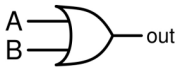
CS1800
Fall 2026
Circuits and Truth Tables

In this handout

Basic Logic Gates
Gates and Truth Tables
Circuits

Basic Logic Gates

	NOT gate. 0 if *A* is 1, 1 if *A* is 0
	AND gate. 1 if *A* and *B* are both 1, 0 otherwise.
	OR gate. 0 if *A* and *B* are both 0, 1 otherwise.

Gates and Truth Tables

Every logic gate can be represented by a truth table. Every row in a truth table corresponds to specific input values, so that all possible inputs are represented. Below are the truth tables representing the gates given above.

A	**NOT A**
0	1
1	0

A	**B**	**A AND B**
0	0	0
0	1	0
1	0	0
1	1	1

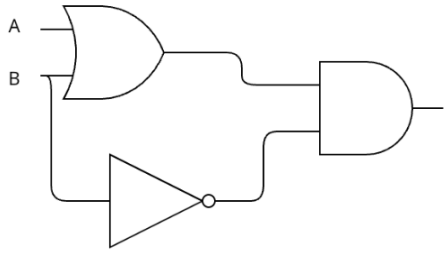
A	**B**	**A OR B**

0	0	0
0	1	1
1	0	1
1	1	1

Circuits

A circuit is a mathematical model that uses the logic gates we've seen here to perform operations on binary inputs. We can string multiple gates together to represent more complex logic. Two circuits are equivalent if they have the same truth table, so we often need to translate back and forth between a circuit diagram and its truth table, and vice-versa.

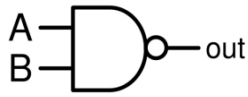
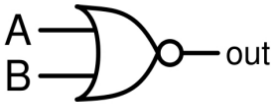
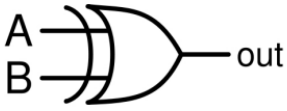
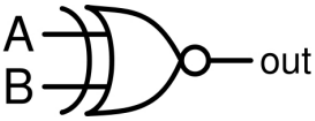
Here is an example of a circuit and its truth table. The circuit accepts two inputs, *A* and *B*, and produces one output. We read the circuit from left to right.



A	**B**	**A OR B**	**NOT B**	**(A OR B) AND (NOT B)**
0	0	0	1	0
0	1	1	0	0
1	0	1	1	1
1	1	1	0	0

Additional Logic Gates

We can do everything in logic with the operations *and*, *or,* and *not*. However, some outputs we need to represent are so common that we have specialized gates for them. Here are a few of them.

	NAND Gate This gate performs the negation of **A AND B**. It is 0 when *A* and *B* are both 1, and 1 otherwise.
	NOR Gate This gate performs the negation of **A OR B**. It is 1 when *A* and *B* are both 0, and 0 otherwise.
	XOR Gate This gate is called “exclusive or”. It is 1 when either *A* or *B* (but not both) is 1.
	XNOR Gate This gate performs the negation of XOR. Is it 1 when *A* and *B* have the same value, and 0 otherwise.

Additional Logic Gates - Truth Tables

A	**B**	**A NAND B**
0	0	1
0	1	1
1	0	1
1	1	0

A	B	A NOR B
0	0	1
0	1	0
1	0	0
1	1	0

A	B	A XOR B
0	0	0
0	1	1
1	0	1
1	1	0

A	B	A XNOR B
0	0	1
0	1	0
1	0	0
1	1	1