Truth Tables AND Logic Gates

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The Parts of a Conditional Statement

A *conditional statement* is made up a <u>hypothesis</u>, the "if" part, and a <u>conclusion</u>, the "then" part.

Instead of fully writing out these clauses in our logic notation, we write "p" to represent the <u>hypothesis</u> and "q" to represent the <u>conclusion</u>.

Conditional Statement Example

"If you worked on homework yesterday, then yesterday was a school day."

Hypothesis or p:

Conclusion or q:

Truth Table: Conditional Statement (p implies q)

P	Q	P => Q
T	T	
T	F	
F	T	
F	F	

If you did work on homework yesterday (P is True)...
  ...could you have been working on homework on a school
    day? (Q is True)
  ...could you have been working on homework on a weekend?
If you did not work on homework yesterday (P is False)...
  (Q is False)
  ...could it have been a school day and you were not
    assigned any homework that night? (Q is True)
  ...could it have been a weekend or holiday? (Q is False)

P	Q	P => Q
T	T	T
T	F	F
F	T	T
F	F	T

Truth Table Example 1

Conditional Statement:

"If you worked on homework yesterday, then yesterday was a school day."

truthtable1.py

Term Symbol(s) Definitions

Term	Symbol(s)	Definition
and	^	Both have to be true for the compound statement to be true
or	∨	One or the other or both have to be true for the compound statement to be true
Negation	~ ¬	The opposite truth value
Conditional	p=>q p→q	p implies q, stated as "if…, then…"
Converse	q=>p q→p p←q	The order of the hypothesis and conclusion is reversed
Inverse	~p=>~q ~p→~q	Both hypothesis and conclusion are negated
Contrapositive	~q=>~p ~q→~p	Hypothesis and conclusion are negated and reversed
Biconditional	p<=>q p↔q	When both a conditional and its converse are true; stated as "if and only if" (or iff)

Truth Table Example 2

Inverse of the Statement:

"If you worked on homework yesterday, then yesterday was a school day."

truthtable2.py

Program Assignment: Converse

Instructions:

1. Download the file 'truthtable1.py'.
2. Edit the file in IDLE so that your name and the assignment name appear at the beginning of the program in the comments.
3. Change the filename to 'Converse.' followed by your last name, your first name. Example: 'Converse.TurnerWill.py'
4. Edit the code such that the program outputs the result of the converse of the statement.

Logic Gates

Logic gates are the elementary building blocks of a digital circuit often with two inputs and one output (like each row of a truth table). There are seven types of logic gates, each with its own criteria for the inputs (binary conditions) to determine whether the output is true or false.

For logic gates we use 0 to represent "low voltage" or "false" and 1 to represent "high voltage" or "true."
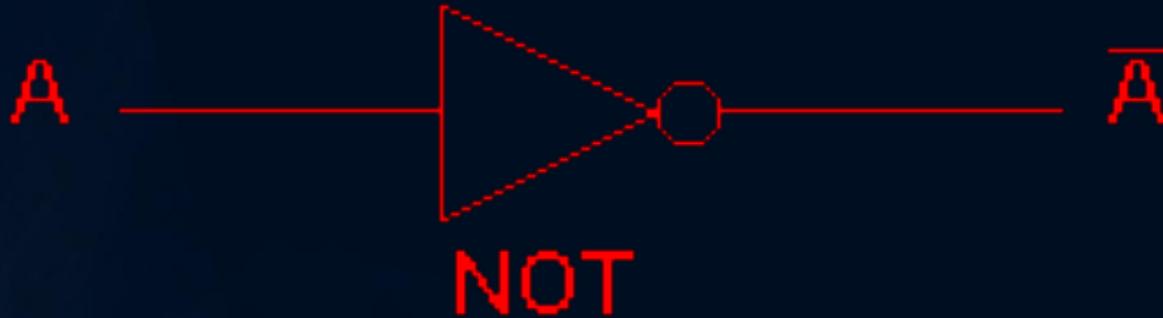
AND Gate

Output is true if both A _AND_ B are true.

OR Gate

Output is true if either A _OR_ B are true.

NOT Gate

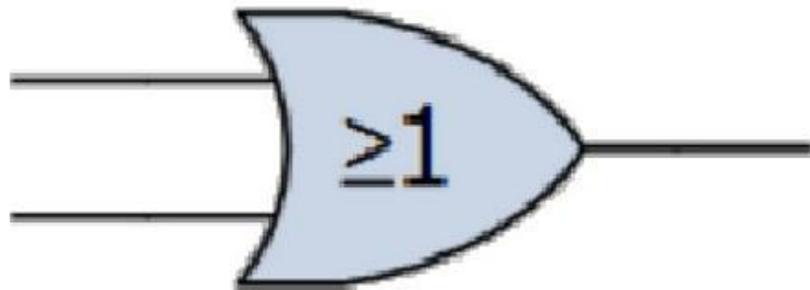Output is true only if A is _NOT_ true.

NAND Gate

Output is true if A _AND_ B is _NOT_ true.

NOR Gate

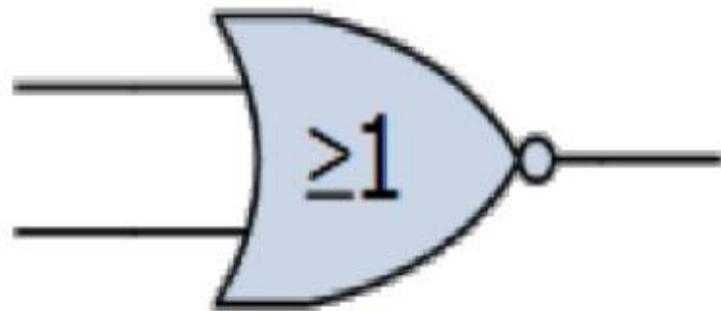Output is true if A _OR_ B is _NOT_ true.

Symbol	Truth Table		
	p	q	(p v q)
2-input OR Gate	0	0	
	0	1	
	1	0	
	1	1	

Symbol	Truth Table		
	p	q	~(p ∧ q)
2-input NOR Gate	0	0	
	0	1	
	1	0	
	1	1	

Today's Classwork (rest of class)

Complete the truth tables on the worksheet.

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When you have finished:

1. Upload and turn in your python file to School Loop.
2. Turn in the worksheet to Ms. Hardy.
3. Try programming your own conditional statement.