基本逻辑门

Logic gates are the basic building blocks of any digital system. A logic gate is a electronic circuit having one or more than one *input port(s)* and only one *output port*. The relationship between its input(s) and output is determined by a certain logic.

It's necessary to memorise the function, symbol as well as algebraic expression of some common logic gates introduced in this chapter.

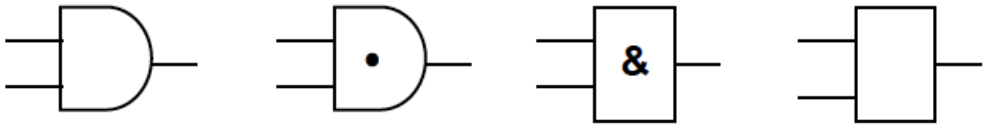
Basic Operations

AND Gate

The AND gate only outputs a positive signal when all of its inputs are getting positive signal.

Expression: $F = A \cdot B = AB$. Intuitively the AND logic can be treated as multiplication.

Symbol:

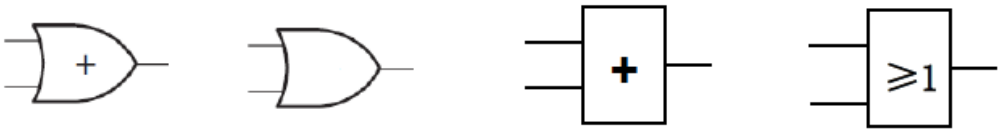


OR Gate

The OR gate only outputs a negative signal when all of its inputs are getting negative signal.

Expression: $F = A + B$. Intuitively the OR logic can be treated as addition.

Symbol:

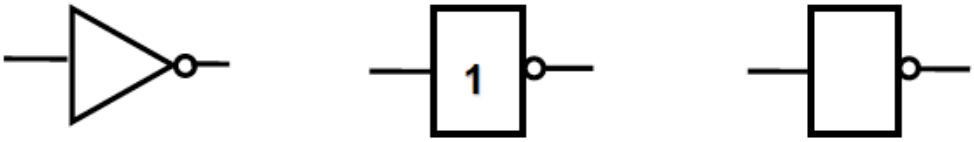


NOT Gate

The NOT gate will produce a signal different from its input.

Expression: $F = \bar{A} = A'$.

Symbol:

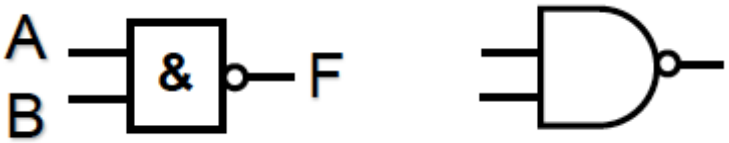


Other Operations

NAND Gate

NAND = NOT + AND, i.e. $F = \overline{AB}$.

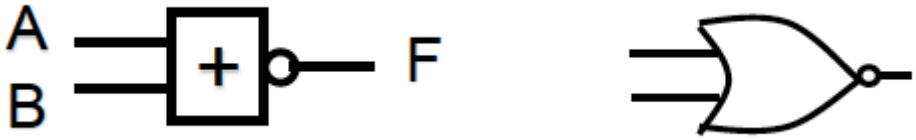
Symbol:



NOR Gate

NOR = NOT + OR, i.e. $F = \overline{A + B}$.

Symbol:



The symbol on the right side is so ugly that I'm wondering if my teacher drew it with line & curve tools in PowerPoint.

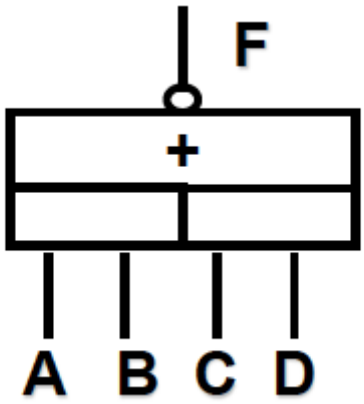
AND-OR-NOT Gate

This is not a common logic gate.

This kind of logic gate has 4 input ports, wiring them with AND gate two by two and then connects the two outputs with a NOR gate.

Expression: $F = \overline{AB + CD}$.

Symbol:



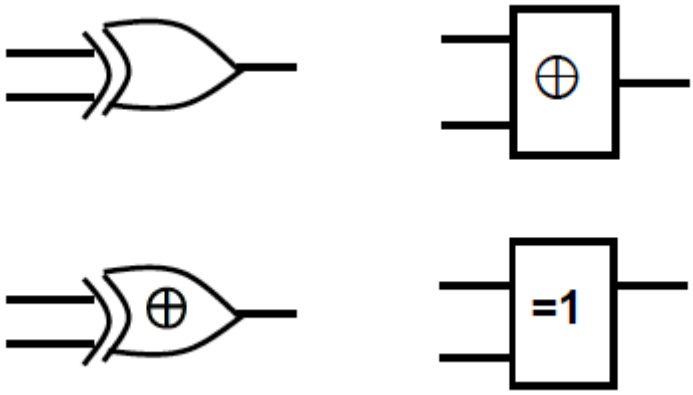
The fact is, I hold the opinion that this is not a logic gate. It's a kind of combinational logic block.

XOR Gate

Exclusive OR gate, or XOR gate, outputs a positive signal only when its two input signals are different from each other.

Expression: $F = A \oplus B = \bar{A}B + A\bar{B}$.

Symbol:

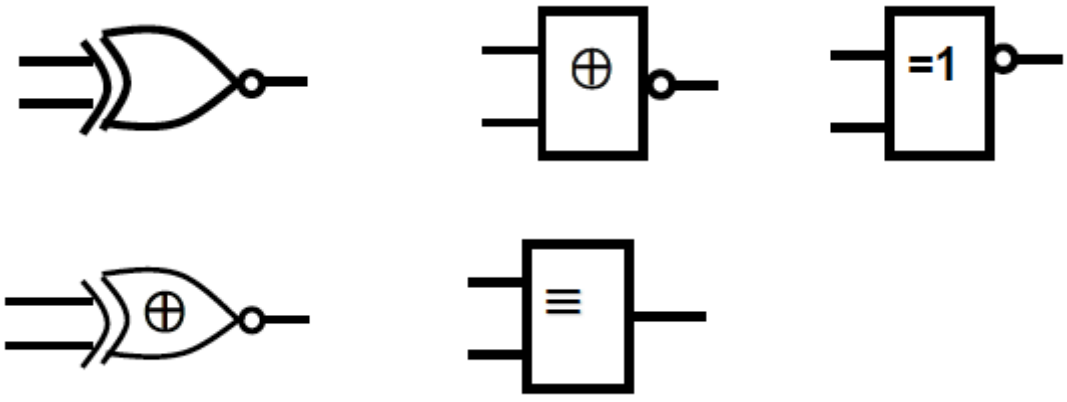


XNOR Gate

XNOR = NOT + XOR, i.e. $F = AB + \bar{A}\bar{B}$.

XNOR gate outputs a positive signal only when its two input signals are the same one.

Symbol:



The bottom-left symbol is more or less... rough.