MATH1061 Week 3 Tutorial

12 March 2013

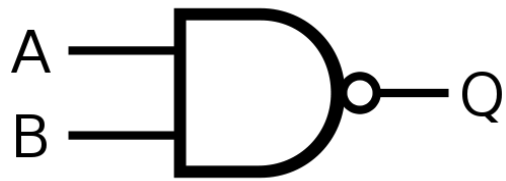
Valid arguments

Are the following arguments valid or invalid?

$$\big[(p \to (q \to r)) \wedge ((p \wedge \sim q) \to \sim p)\big] \to (p \to r)$$

Digital Logic

If p and q are statement forms, we define the **alternative denial** of p and q to be $\sim(p \wedge q)$, written $p \uparrow q$, said "p nand q". In building digital circuits, it is easy to build a NAND-gate out of transistors, and then we can build other gates (AND, OR, NOT) out of multiple NAND-gates.



1. Write a statement form equivalent to $\sim p$, using only $\uparrow$.
2. Write a statement form equivalent to $p \wedge q$, using only $\uparrow$.
3. Write a statement form equivalent to $p \vee q$, using only $\uparrow$.
4. (Bonus) Draw your answers to the above as digital logic circuits.

Quantified Statements

Write and simplify the negation of the following statement:

$$\forall x \in \mathbb{Z}, \forall y \in \mathbb{Z}, \left[x < y \rightarrow \left(\exists z \in \mathbb{R} : x < z < y\right)\right]$$

Which is true: the original or the negation?

Quantified Statements

Write and simplify the negation of the following statement:

$$\forall x \in \mathbb{R} : \big(\exists y \in \mathbb{R}, xy = 1\big) \vee \big(\forall y \in \mathbb{Z} : x < y\big).$$

Which is true: the original or the negation?