Notes for Discrete Math (MATH-245)
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1 Symbol reference

Symbol	Description	LaTeX
$\in$	In	`\in`
$\neg$	Negation	`\neg`
$\wedge$	And	`\wedge`
$\vee$	Or	`\vee`

(Febuary 7th)

2 Basic Logic

2.1 Operations

If...then ($\rightarrow$) A logical statement about correlation and causation. Formally expressed as "if p, then q" ($p \rightarrow q$) where p is the *hypothesis* and q is the *conclusion*. If the hypothesis p is true, then the conclusion q must then be true. Note that causation in the opposite direction is not implied: it is not stated that if not p then not q, so q can be true even if p is not true.

Negation ($\neg$) Changes true to false and false to true. Unary operator whose argument follows on the right. Also has basically highest precidence for order of evaluate.

And ($\wedge$) (Binary operation) Says if left and right, then true, else false.

Or ($\vee$) (Binary operation) Says if left or right, then true, else false.

Truth Tables

Used to evaluate all the potential outcomes of a logical statement given all posible combinations of inputs. Given two inputs p and q then would be four potential input combinations:

$$(p, q) \in \{T, F\} \times \{T, F\} = \{(T, T), (T, F), (F, T), (F, F)\}$$

Table 1: Are $\neg(p \wedge q)$ and $\neg p \wedge \neg q$ equivalent?

p	q	$p \wedge q$	$\neg(p \wedge q)$	$\neg p$	$\neg q$	$\neg p \wedge \neg q$
T	T	T	F	F	F	F
T	F	F	T	F	T	F
F	T	F	T	T	F	F
F	F	F	T	T	T	T

De Morgan's Laws

Method for negating a statement invovling an `and` or an `or` operation.

$$\neg(p \wedge q) \equiv \neg p \vee \neg q \tag{1}$$
$$\neg(p \vee q) \equiv \neg p \wedge \neg q \tag{2}$$