Propositional Logic and Implication

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Motivation: Formalize defn's and reasoning in proofs

Propositional Logic

Defn. A proposition is a statement that is either true or false

Propositional logic is a mathematical system for reasoning about propositions & how they relate to each other.

Every statement consists of propositional variables combined via propositional connectives.

Propositional connectives

Connective	Read as	C++	Fancy name
$\neg p$	not p	!p	negation
$p \wedge q$	p and q	p && q	conjunction
$p \vee q$	p or q	p || q	disjunction
$p \oplus q$	p xor q	p ^ q	exclusive or
$p \to q$	p implies q	N/A	material conditional
$(\neg p \vee q)$			
$p \leftrightarrow q$	p if and only if q	N/A	biconditional
$\neg(p \oplus q)$			
$\top$	true	true	Truth
$\bot$	false	false	Falsity

Operator precedence

$\neg$
$\wedge$
$\vee$
$\rightarrow$
$\leftrightarrow$

right associative
use parentheses to disambiguate

De Morgan's Laws

$$\neg(p \wedge q) = \neg p \vee \neg q$$

$$\neg(p \vee q) = \neg p \wedge \neg q$$