Truth tables

not P

P	$\sim P$
T	F
F	T

P and Q

P	Q	$P \wedge Q$
T	T	T
T	F	F
F	T	F
F	F	F

P or Q

P	Q	$P \vee Q$
T	T	T
T	F	T
F	T	T
F	F	F

P xor Q

P	Q	$P \underline{\vee} Q$
T	T	F
T	F	T
F	T	T
F	F	F

if P then Q

P	Q	$P \Longrightarrow Q$
T	T	T
T	F	F
F	T	T
F	F	T

P if and only if Q

P	Q	$P \Longleftrightarrow Q$
T	T	T
T	F	F
F	T	F
F	F	T

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Propositions and predicates:

A **proposition**, P, is a statement that has a truth value, i.e. it is either true (T) or false (F). Thus, for example, the statement P: *the earth is flat* is a proposition with truth value F.

A **compound proposition** is one constructed from elementary propositions and logical operators, e.g. $P \wedge (Q \vee R)$ is a compound proposition constructed from the propositions P, Q and R.

A compound proposition which is always true is called a **tautology**.

A compound proposition which is always false is called a **contradiction**.

Two compound propositions which are constructed from the same set of elementary propositions are said to be **logically equivalent** if they have identical truth tables.

A **predicate**, $P(x)$, is a statement, the truth value of which depends on the value assigned to the variable x. Thus, for example $P(x) : x^2 - 3 > 0$ is a predicate.

Quantifiers: $\forall$, for all (sometimes called the **universal quantifier**). $\exists$, there exists (sometimes called the **existential quantifier**). Quantifiers convert predicates to propositions. The proposition $\exists x\, P(x)$ is true if there exists at least one value of x for which $P(x)$ is true. The proposition $\forall x\, P(x)$ is true if $P(x)$ is true for every value of x.

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