

Truth tables

- Systematic list of all the possible combinations of truth values of the atomic propositions + truth value of compound proposition
- number of rows: 2^N , with N the number of atomic propositions
- number of columns: as many as you need to keep the overview.

p	$\neg p$
T	F
F	T

p	q	$p \wedge q$	$p \vee q$
T	T	T	T
T	F	F	T
F	T	F	T
F	F	F	F

Truth tables: example

Using a truth table to evaluate a compound proposition:

p	q	r	$p \wedge q$	$(p \wedge q) \vee r$
T	T	T	T	T
T	T	F	T	T
T	F	T	F	T
T	F	F	F	F
F	T	T	F	T
F	T	F	F	F
F	F	T	F	T
F	F	F	F	F

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Truth tables: example

Two propositions are logically equivalent when they have the same truth table:

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

Tautologies and contradictions

A tautology: a proposition that is always true.

Example: $p \vee \neg p$

p	$\neg p$	$p \vee \neg p$
T	F	T
F	T	T

A contradiction: a proposition that is never true.

Example: $p \wedge \neg p$

p	$\neg p$	$p \wedge \neg p$
T	F	F
F	T	F