Equivalence through Truth Table

- Consider $f = \neg(p \wedge q)$; $g = \neg p \vee \neg q$

p	q	$\neg(p \wedge q) = f$	$(\neg p \vee \neg q) = g$
T	T	F	F
T	F	T	T
F	T	T	T
F	F	T	T

same truth table, so $f \equiv g$.

- Consider $f = p \wedge (q \vee r)$; $g = (p \wedge q) \vee (p \wedge r)$

p	q	r	$q \vee r$	f	$p \wedge q$	$p \wedge r$	g
T	T	T	T	T	T	T	T
T	T	F	T	T	T	F	T
T	F	T	T	T	F	T	T
T	F	F	F	F	F	F	F
F	T	T	T	F	F	F	F
F	T	F	T	F	F	F	F
F	F	T	T	F	F	F	F
F	F	F	F	F	F	F	F

f & g same truth table $\Rightarrow f \equiv g$

- **Tautology**: Proposition formula f a tautology if $f \equiv$ TRUE

Consider $f = p \vee \neg p$

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

$p \vee \neg p \equiv$ TRUE

- **Satisfiable**: Proposition formula f satisfiable if exists a valuation $\vec{e}$ s.t. $f(\vec{e}) =$ TRUE (i.e., at least one entry in truth table for f is TRUE).

Otherwise, f unsatisfiable (also called a contradiction).

* f contradiction iff $\neg f$ tautology. ($f = p \wedge \neg p$)

* f satisfiable iff f not contradiction.