TRUTH TABLE AND LOGIC REFERENCE SHEET

p	q	Negation $\sim p$	Conjunction $p \wedge q$	Disjunction $p \vee q$	Conditional $p \rightarrow q$	Biconditional $p \leftrightarrow q$
T	T	F	T	T	T	T
T	F	F	F	T	F	F
F	T	T	F	T	T	F
F	F	T	F	F	T	T

Not p
Opposite truth values from p

p and q
True only when BOTH p and q are true

p or q
False only when BOTH p and q are false

If p, then q
False only when p is true and q is false

If and only if p, then q
True only when p and q have the same truth value

$$p \equiv q$$

Two statements are equivalent if they have the same truth value in all cases.

Variations of the Conditional Statement $p \rightarrow q$

- $p \rightarrow q$ is equivalent to $\sim q \rightarrow \sim p$, the contrapositive:
  $p \rightarrow q \equiv \sim q \rightarrow \sim p$
- $p \rightarrow q$ is NOT equivalent to $q \rightarrow p$, the converse
- $p \rightarrow q$ is NOT equivalent to $\sim p \rightarrow \sim q$, the inverse
- The negation of $p \rightarrow q$ is $p \wedge \sim q$: $\sim(p \rightarrow q) \equiv p \wedge \sim q$

De Morgan's Laws

- $\sim(p \wedge q) \equiv \sim p \vee \sim q$:
  The negation of $p \wedge q$ is $\sim p \vee \sim q$
- $\sim(p \vee q) \equiv \sim p \wedge \sim q$:
  The negation of $p \wedge q$ is $\sim p \vee \sim q$

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