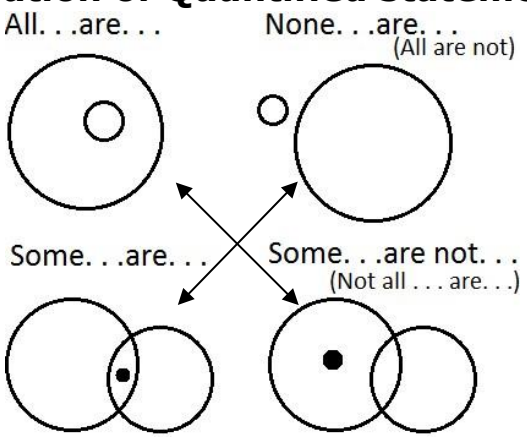
Summary of Logic Rules

Negation of Quantified statements



De Morgan's Law

$$\sim(p \wedge q) \equiv \sim p \vee \sim q \qquad \sim(p \vee q) \equiv \sim p \wedge \sim q$$

Conditional Equivalencies

$$p \to q \equiv \sim q \to \sim p \qquad \sim(p \to q) \equiv p \wedge \sim q$$

Direct statement	$p \to q$
Converse	$q \to p$
Inverse	$\sim p \to \sim q$
Contra positive	$\sim q \to \sim p$

Note $p \to q \equiv \sim q \to \sim p$ Contrapositive

But

$p \to q \not\equiv q \to p$ Converse

Or

$p \to q \not\equiv \sim p \to \sim q$ Inverse

Valid Arguments

Direct Reasoning	Contrapositive Reasoning	Transitive Reasoning	Disjunctive Syllogism	Disjunctive Syllogism
$p \to q$	$p \to q$	$p \to q$	$p \vee q$	$p \vee q$
p	$\sim q$	$q \to r$	$\sim q$	$\sim p$
$\therefore q$	$\therefore \sim p$	$\therefore p \to r$	$\therefore p$	$\therefore q$

Invalid Arguments

Fallacy of the Converse	Fallacy of the Inverse	Misuse of Disjunction	Misuse of Transitive Reasoning	Misuse of Transitive Reasoning
$p \to q$	$p \to q$	$p \vee q$	$p \to q$	$p \to q$
q	$\sim p$	p	$p \to r$	$r \to q$
$\therefore p$	$\therefore \sim q$	$\therefore \sim q$	$\therefore q \to r$	$\therefore p \to r$

How-to remember the basic truth tables of logic.

The Conjunction.

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

You are traveling in a car on a highway and come to a river. There's a bridge from your side to an island and a second bridge from the island to the other side. Think of a working bridge as True, and a broken bridge as False. To cross the river, you must

cross the first bridge AND the second bridge. You cannot cross the river if either one or both of the bridges are broken.

The "and" is only true when both are true.

The Disjunction.

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

You are traveling in a car on a highway and come to a river. The road forks and there are two bridges that cross the river. Think of a working bridge as True and a broken bridge as False. To cross the river, you can choose the first bridge OR the second bridge. You cannot cross the river if both bridges are not working.

The "or" is only false when both are false.

The Conditional.

p	q	$p \rightarrow q$	If I go to the store, then I'll bring candy
T	T	T	I go to the store; I bring candy.
T	F	F	I go to the store; I do not bring candy.
F	T	T	I don't go to the store; I bring candy.
F	F	T	I don't go to the store; I do not bring candy.

The "if then" is false only when you start true and end false.

The Biconditional.

p	q	$p \leftrightarrow q$
T	T	T
T	F	F
F	T	F
F	F	T

The prefix bi means two, as in bicycle (two wheels) and bilingual (speaking two languages).

The "if and only if" is true only when the both statements are the same.