

Creating a Truth Value Table

Example: If everyone is present on test day, then everyone receives a bonus point.

p	q	$p \rightarrow q$
T	T	T
T	F	F
F	T	T
F	F	T

~ Did I keep my promise?

Representing Conditional Statements in Truth Tables

p	q	$\sim p$	$\sim q$	$p \rightarrow q$	$\sim q \rightarrow \sim p$	$q \rightarrow p$	$\sim p \rightarrow \sim q$
T	T	F	F	T	T	T	T
T	F	F	T	F	F	T	T
F	T	T	F	T	T	F	F
F	F	T	T	T	T	T	T

conditional contrapositive converse inverse

Conclusions

- The conditional and the contrapositive always have the same truth value (logically equivalent).
- The converse and the inverse always have the same truth value (logically equivalent).

A compound statement is created by combining two or more statements.

When we combine p and q we can form a conjunction and a disjunction.

Compound Statements			
TERM	WORDS	SYMBOLS	EXAMPLE
Conjunction	A compound statement that uses the word <u>and</u>	p AND q $p \wedge q$	Pat is a band member AND Pat plays tennis.
Disjunction	A compound statement that uses the word <u>or</u>	p OR q $p \vee q$	Pat is a band member OR Pat plays tennis.

A conjunction is true only when all of its parts are true. p and q must both be TRUE!

A disjunction is true when any one of its parts are true. (AT LEAST ONE) \rightarrow either p or q must be true or both can be true.

Example: Use p, q and r to find the truth value of each compound statement.

p : Washington, DC is the capital of the US.

q : The after Monday is Tuesday.

r : California is the largest state in the US.

A. $q \vee r$
T

B. $r \wedge p$
F

C. $r \vee p$
T

D. $p \wedge q$
T

Fill in the following TRUTH TABLE.

p	q	$p \rightarrow q$	$p \wedge q$ ^{and}	$p \vee q$ ^{or}
T	T	T	T	T
T	F	F	F	T
F	T	T	F	T
F	F	T	F	F

1. Construct a truth table for the compound statement $\sim u \wedge \sim v$

u	v	$\sim u$	$\sim v$	$\sim u \wedge \sim v$ ^{"and"}
T	T	F	F	F
T	F	F	T	F
F	T	T	F	F
F	F	T	T	T

2. Construct a truth table for the compound statement $\sim u \wedge (v \vee w)$

u	v	w	$\sim u$	$v \vee w$	$\sim u \wedge (v \vee w)$
T	T	T	F	T	F
T	T	F	F	T	F
T	F	T	F	T	F
T	F	F	F	F	F
F	T	T	T	T	T
F	T	F	T	T	T
F	F	T	T	T	T
F	F	F	T	F	F