

Name _____

EXTRA CREDIT – TRUTH TABLES!

The logical operator utilized in our previous lesson objectives to form a truth table is the **logical implication** operator, in which a false value is produced when the *hypothesis* is true and the *conclusion* is false. The symbol used in these tables is denoted as $\rightarrow$.

Another logical operator we can use to create a truth table is called **logical conjunction**, in which a true value is produced when the *hypothesis* and *conclusion* are TRUE. The symbol used in these tables is denoted as $\wedge$.

Example: Construct a truth table using logical conjunction.

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

In **logical disjunction**, a true value is produced if the *hypothesis* or the *conclusion* is TRUE. The symbol used in these tables is denoted as $\vee$.

Example: Construct a truth table using logical disjunction.

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

Complete the following truth tables using the operators above.

1.

p	q	$p \wedge q$	$\sim(p \wedge q)$
T	T	T	F
T	F	F	T
F	T	F	T
F	F	F	T

2.

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

3.

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

4.

p	q	$\sim q$	$\sim p$	$\sim p \vee q$	$\sim q \rightarrow (\sim p \vee q)$
T	T	F	F	T	T
T	F	T	F	F	F
F	T	F	T	T	T
F	F	T	T	T	T

5.

p	q	$p \vee q$	$\sim(p \vee q)$
T	T	T	F
T	F	T	F
F	T	T	F
F	F	F	T

6.

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

7.

p	q	$\sim p$	$\sim p \rightarrow q$	$\sim q$	$\sim p \wedge \sim q$	$(\sim p \rightarrow q) \vee (\sim p \wedge \sim q)$
T	T	F	T	F	F	T
T	F	F	T	T	F	T
F	T	T	T	F	F	T
F	F	T	F	T	T	T

8.

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

9.

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

10. Using the truth tables above, which statements are logically equivalent? (hint: there should be ⁴ ~~three~~ pairs!)1. $(p \vee q) \wedge r$ ⑧ and $(p \wedge r) \vee (q \wedge r)$ ⑨2. $\sim(p \vee q)$ ⑤ and $\sim p \wedge \sim q$ ⑥3. $(p \wedge q) \vee \sim p$ ③ and $\sim q \rightarrow (\sim p \vee q)$ ④4. $\sim(p \wedge q)$ ① and $\sim p \vee \sim q$ ②