

Logic: Truth Tables & Equivalent Statements

1. Construct a truth table for each of the compound statements.

(a) $\sim p \vee q$

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

(b) $\sim p \wedge \sim q$

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

(c) $\sim p \wedge (p \vee \sim q)$

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

(d) $r \vee (p \wedge q)$

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

(e) $\sim (\sim p \wedge \sim q) \vee (\sim r \vee p)$

Notice that $\sim (\sim p \wedge \sim q) \equiv (p \vee q)$, and $(p \vee q) \vee (\sim r \vee p) \equiv (p \vee q \vee \sim r)$.

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

2. Use truth tables to show that the following statements are equivalent.

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

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

3. You are wandering around the forest of Logica Isle. There are two types of forest dwellers on Logica Isle, orcs and elves. Orcs always lie while Elves always tell the truth. You encounter two forest dwellers, Mike and Ike. Mike says, "Ike is an orc." Ike says, "neither one of us is an orc," Can you determine what type of forest dwellers Mike and Ike are?

Mike is an elf and Ike is an orc.