

Solution

- Given the following statements, determine if they are logically equivalent using a truth table:

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

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

Since these two columns have the same truth values, they are logically equivalent.

b. $p \wedge (q \vee r) \equiv (p \wedge q) \vee (p \wedge r)$

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

↑
a

↑
b

Since columns a and b have the same truth values, then they are logically equivalent.

2. Label each predicate and then rewrite the argument using the logical connectors. Determine if this argument is valid or invalid.

a. If I go to the movies, then I won't finish my homework.

If I don't finish my homework, then I won't do well on the test tomorrow.

Therefore, if I go to the movies, then I won't do well on my test.

p = Go to the movies

q = Don't finish my homework

r = Won't do well on my test

$p \rightarrow q$

$q \rightarrow r$

$\therefore p \rightarrow r$

Which is valid due to hypothetical syllogism, one of the laws of inference.

3. Use the set of conditional laws to verify the logical equivalences:

$$(p \rightarrow q) \wedge (p \vee q) \equiv q$$

$(\neg p \vee q) \wedge (p \vee q)$	conditional law
$(\neg p \wedge p) \vee q$	distribution law
$c \vee q$	negation law
q	identity law

Therefore, $(p \rightarrow q) \wedge (p \vee q) \equiv q$