

1. Prove that the following are logically equivalent pairs - use both the truth table method and the formal proof method to get extra practice.

a.	$p \vee q$	$(p \rightarrow q) \rightarrow q$
b.	$\sim (p \leftrightarrow q)$	$\sim p \leftrightarrow q$

2. Albert, Bill and Casey are all suspects in a police investigation. Each of them make the following statements.

- Albert: Bill is guilty and Casey is innocent.
- Bill: If Albert is guilty, then so is Casey.
- Casey: I am innocent, but at least one of the others is guilty.

Let a, b and c be “Alber is innocent”, “Bill is innocent” and “Casey is innocent” respectively. And do each of the following exercises.

- a. Rewrite the suspects’ statements in terms of a,b, and c with our regular logic operators.
 - b. If all are innocent, who committed perjury (lied in their official statement)?
 - c. If all the statements are true, who is innocent?
 - d. If the innocent were truthful and the guilty lied, who is innocent?
3. For each of the following either give a formal proof to show that the argument is valid or give values for the variables to demonstrate a counter example to show that it is not a valid argument form.

a.	$a \vee (b \wedge c)$ $a \rightarrow c$ c
b.	$(d \vee e) \rightarrow (f \rightarrow g)$ $(\sim g \vee h) \rightarrow (d \wedge f)$ g
c.	$(h \rightarrow i) \wedge (j \rightarrow k)$ $(i \vee k) \rightarrow m$ $\sim m$ $\sim (h \vee j)$
d.	$(m \vee n) \rightarrow (d \wedge p)$ $(d \vee q) \rightarrow (\sim r \wedge s)$ $(r \vee t) \rightarrow (m \wedge u)$ $\sim r$
e.	$(k \rightarrow \sim w) \wedge (x \rightarrow y)$ $(\sim w \rightarrow z) \wedge (y \rightarrow \sim a)$ $(z \rightarrow \sim b) \wedge (\sim a \rightarrow g)$ $k \wedge x$ $\sim b \wedge g$