

Exercise 1:

Let p, q, r be 3 propositions

Show that $\underbrace{p \wedge (q \vee r)}_{\text{LHS}} \Leftrightarrow \underbrace{(p \wedge q) \vee (p \wedge r)}_{\text{RHS}}$

p	q	r	$q \vee r$	LHS	$p \wedge q$	$p \wedge r$	RHS
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

The LHS and the RHS always have the same truth values. They are logically equivalent. ✓

Exercise 2

(2)

Let p_1 , p_2 , and q be 3 propositions.

Show that

$$(p_1 \vee p_2) \rightarrow q \Leftrightarrow (p_1 \rightarrow q) \wedge (p_2 \rightarrow q)$$

I define LHS = $(p_1 \vee p_2) \rightarrow q$

RHS = $(p_1 \rightarrow q) \wedge (p_2 \rightarrow q)$

p_1	p_2	q	$p_1 \vee p_2$	LHS	$p_1 \rightarrow q$	$p_2 \rightarrow q$	RHS
T	T	T	T	T	T	T	T
T	T	F	T	F	F	F	F
T	F	T	T	T	T	T	T
T	F	F	T	F	F	T	F
F	T	T	T	T	T	T	T
F	T	F	T	F	T	F	F
F	F	T	F	T	T	T	T
F	F	F	F	T	T	T	T

LHS and RHS always have the same truth values; they are equivalent.



Guard 1:
The ~~prince~~ treasure
is behind my door
✓

Guard 2:
There is
exactly one
liar among us
and the treasure
is behind my door
↓

Guard 3:
We are
all liars

The guards are either knights or knaves.

G ₁	G ₂	G ₃	G ₂ says	G ₃ says
K	K	K	F	F
K	K	K	T	F
K	K	K	T	F
K	K	K	F	F
K	K	K	T	F
K	K	K	F	F
K	K	K	F	F
K	K	K	F	T

K: knight; K: knave
In both possibilities, Guard 1 is a knight, he is telling the truth
The treasure is behind D1

