

## Solutions to Exercises

1.

P	q	$p \vee q$	$p \Rightarrow (p \vee q)$
T	T	T	T
T	F	T	T
F	T	T	T
F	F	F	T

The addition rule is valid.

2.

P	q	$p \wedge q$	$(p \wedge q) \Rightarrow (p \wedge q)$
T	T	T	T
T	F	F	T
F	T	F	T
F	F	F	T

The conjunction rule is valid.

3.

P	q	r	$p \vee q$	$\sim p$	$\sim p \vee r$	$q \vee r$	$(p \vee q) \wedge (\sim p \vee r)$	$[(p \vee q) \wedge (\sim p \vee r)] \Rightarrow (q \vee r)$
T	T	T	T	F	T	T	T	T
T	T	F	T	F	F	T	F	T
T	F	T	T	F	T	T	T	T
T	F	F	T	F	F	F	F	T
F	T	T	T	T	T	T	T	T
F	T	F	T	T	T	T	T	T
F	F	T	F	T	T	T	F	T
F	F	F	F	T	T	F	F	T

The resolution rule is valid.

4.

1.  $\sim q$  Premise
2.  $\sim p \Rightarrow q$  Premise
3.  $p$  Modus Tollens with 1. and 2.
4.  $\sim r \Rightarrow q$  Premise
5.  $r$  Modus Tollens with 1. and 4.
6.  $p \wedge r$  Conjunction with 3. and 5.
7.  $(p \wedge r) \Rightarrow s$  Premise
8.  $s$  Modus Ponens with 6. and 7.

5.

1.  $p \vee q$  Premise
2.  $\sim q$  Premise
3.  $p$  Disjunctive Syllogism with 1. and 2.
4.  $p \Rightarrow \sim r$  Premise
5.  $\sim r$  Modus Ponens with 3. and 4.
6.  $r \vee s$  Premise
7.  $s$  Disjunctive Syllogism with 5. and 6.
8.  $\sim t \Rightarrow \sim s$  Premise
9.  $t$  Modus Tollens with 7. and 8.

6. a) VALID

b) INVALID

Star could be a surgeon!

c) INVALID

Who knows... AI might love Cheerios.

d) VALID