

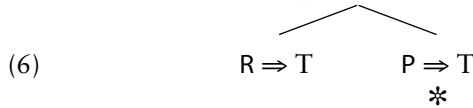
1. We start assuming that the premisses and the negation of the conclusion are all true:

- (1)  $(R \vee P) \Rightarrow T$
- (2)  $(R \vee Q) \Rightarrow T$
- (3)  $\neg(P \vee Q) \Rightarrow T$

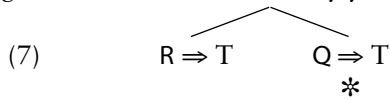
A negated disjunction is true (i.e. the disjunction is false) if each disjunct is false, i.e.

- (4)  $\neg P \Rightarrow T$
- (5)  $\neg Q \Rightarrow T$

The truth of the disjunction (1) gives us the alternatives



The right-hand branch immediately yields a contradiction: then we can use the disjunction (2) to get

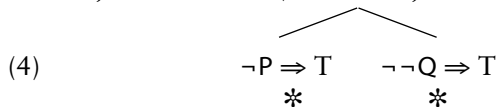


Which leaves the open branch where  $P \Rightarrow F, Q \Rightarrow F$  and  $R \Rightarrow T$  (which indeed makes the original premisses of the argument true and conclusion false – check that!). *Invalid argument*

2. Again, assume the premisses and the negation of the conclusion are all true:

- (1)  $\neg(P \wedge \neg Q) \Rightarrow T$
- (2)  $P \Rightarrow T$
- (3)  $\neg Q \Rightarrow T$

A negated conjunction is true (i.e. the conjunction is false) if one of the conjuncts is false, i.e.

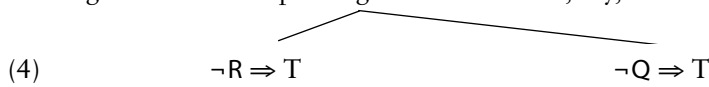


Both branches immediately lead to contradiction, since each branch contains a pair of wffs of the form  $A, \neg A$  each supposed to be true. *Valid argument*

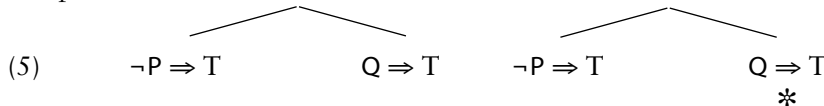
3. As always, assume the premisses and the negation of the conclusion are all true:

- (1)  $(\neg P \vee Q) \Rightarrow T$
- (2)  $(R \vee P) \Rightarrow T$
- (3)  $\neg(R \wedge Q) \Rightarrow T$

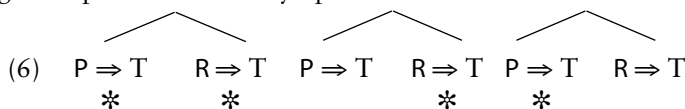
There is no right order for ‘unpacking’ these wffs: start, say, with the last .... That yields



Now we have to explore these alternative ways of making (3) correct; unpacking the first wff, we consider its implications for each alternative:



We can close off one branch (only one!). Now to explore the remaining three branches, we unpack (2), adding its implications to every open branch:



That leaves two open branches: one on which  $P \Rightarrow T, Q \Rightarrow T, R \Rightarrow F$ , the other where  $P \Rightarrow F, Q \Rightarrow F, R \Rightarrow T$ . A quick check confirms that those two valuations make the premisses true and conclusion false. *Invalid argument*

