

Worth: 2%**Due:** By 6pm on Wednesday 11 February

1. For each equivalence below, either give a derivation of the equivalence using the rules in the lecture notes (if the equivalence is true), or give a truth table showing that the equivalence is false (if it is, indeed, false). In your derivation(s), you may only use rules from the lecture notes, and you should justify each step (by stating the rule you are using). In your truth table(s), please highlight any row(s) that show the equivalence to be false.

(a) $p \wedge (q \vee p) \iff p \vee (q \wedge p)$

(b) $p \wedge q \Rightarrow r \vee s \iff (p \Rightarrow r) \wedge (q \Rightarrow r) \wedge (p \Rightarrow s) \wedge (q \Rightarrow s)$

(c) $(p \Leftrightarrow \neg q) \iff \neg(p \Leftrightarrow q)$

2. In class, we saw how to write down the infamous “epsilon–delta” proof structure. Write down the detailed proof structure corresponding to the *negation* of the “epsilon–delta” statement:

$$\exists e \in \mathbb{R}, e > 0 \wedge \forall d \in \mathbb{R}, d > 0 \Rightarrow \exists x \in \mathbb{R}, 0 < |x - a| < d \wedge |f(x) - \ell| \geq e,$$

where $a, \ell \in \mathbb{R}$ are constants and $f : \mathbb{R} \rightarrow \mathbb{R}$ is a function. Be sure to use indentation appropriately, and to state clearly all assumptions and all conclusions for each step of the proof.