

Tehnici de baza in activitatea stiintifica
Techniques for Scientific Work (WS 2016-2017)
Homework 1 (due November 23, 2016)

1. Check whether:

(a) $((P \Rightarrow R) \vee (Q \Rightarrow R)) \iff ((P \wedge Q) \Rightarrow R)$

(b) $((P \Rightarrow R) \wedge (Q \Rightarrow R)) \iff ((P \vee Q) \Rightarrow R)$

(c) $\forall_x (P[x] \Rightarrow Q) \iff \left(\left(\exists_x P[x] \right) \Rightarrow Q \right)$

2. Prove the following:

(a) $((P \Rightarrow Q) \wedge (Q \Rightarrow R)) \iff ((P \vee Q) \Rightarrow R)$

(b) We consider the following partial proof attempt of $((A \wedge B) \Rightarrow C) \Rightarrow ((A \Rightarrow C) \vee (B \Rightarrow C))$:

A We assume: $(A \wedge B) \Rightarrow C$ and we prove: $(A \Rightarrow C) \vee (B \Rightarrow C)$.

B We assume: $\neg(B \Rightarrow C)$ and we prove: $(A \Rightarrow C)$.

C We assume: A and we prove: C .

D From $\neg(B \Rightarrow C)$ we obtain B and $\neg C$.

For each statement below, decide whether it is correct or incorrect and explain the reasons:

- a The proof fails because we obtain $\neg C$ instead of the current goal C .
- b The proof fails because we obtain a contradiction.
- c The proof succeeds because we obtain a contradiction.
- d The proof is incorrect. (Indicate the incorrect steps.)
- e The proof is correct but not yet finished. (Indicate how it should continue.)
- f The step (D) of the proof is wrong because D does not occur in the formula.
- g The proof is correct but the result is wrong.
- h We proved the negation of the initial formula, because we obtain the negation of the current goal.

3. If Superman were able and willing to prevent evil, he would do so. If Superman were unable to prevent evil, he would be impotent; if he were unwilling to prevent evil, he would be malevolent. Superman does not prevent evil. If Superman exists, he is neither impotent nor malevolent. Does Superman exist?