Einführung in wissensbasierte Systeme, 3.0 VU, 184.737

Exercise Sheet 2 - Logic, Part 2

You have to tick the prepared exercises in TUWEL at the latest before
Friday, May 4 2012, 13:00 CET (AUFGABE Ankreuzen 2. Übungsblatt).
Be sure that you tick only subtasks which you can solve and explain on the blackboard!

Exercise 1 (2 pts.): Consider the following arguments:

(a) Watson's grass is wet (W) if it has been raining (R) or the sprinkler was on (S). The grass is not wet. Therefore, it has not rained and the sprinkler was not on.

(b) If he is king (K), he must either be the son of the previous king (S) or he killed the previous king (M). He neither killed the old king nor is he the son of the previous king. Therefore, he is not the king.

Translate the arguments into propositional logic and show by TC0 that the argument is either correct or else extract an interpretation from the tableau showing that the argument is not correct.

Exercise 2 (2 pts.): Your boss tells you that any binary relation which is symmetric and transitive is also reflexive. Is he right?

Translate the argument into the symbolism of first-order logic and show by TC1 that the argument is either correct or else extract an interpretation from the tableau showing that the argument is not correct.

Exercise 3 (2 pts.): Consider the following arguments:

(a) All humans are mortal. If someone is dead, he must be mortal. Aristotle is dead. Therefore, Aristotle must be human.

(b) The Sphinx asked every person she met a riddle. If someone did not solve the riddle, she killed that person, but if someone knows the answer, the person is not killed. Oedipus has met the sphinx and was not killed. Therefore, he must have known the answer.

Translate the argument into predicate logic and show by TC1 that the argument is either correct or else extract an interpretation from the tableau showing that the argument is not correct.

Exercise 4 (2 pts.): An *enthymeme* is in argument where not all premisses are explicitly stated or where the conclusion is not mentioned. That is, premisses can be left out because they can be assumed to be generally known or for rhetoric reasons where problematic premisses, which the listener may doubt, are suppressed. The suppression of a conclusion is often done because of not wanting to give bald comments explicitly, rather to let the listener make this conclusion himself (this is also referred to as engaging in *innuendo*).

Supply in the following enthymemes missing premisses or conclusions in order to obtain valid arguments. Justify your results.

(a) The accused could be guilty of the crime only if he was in Schenectady at 6 p.m. on January 1. But it has been established that he was in Albuquerque at that time. Therefore, he is not guilty.

(b) If it has snowed, it will be poor driving. If it is poor driving, I will be late unless I start early. Indeed, it has snowed. Therefore, I must start early.

(c) General G.I. Brassbottom: “Can Roger Ramjet sorten out the mess?"
Lance Crossfire: "Well, he is too soft-hearted.”

Exercise 5 (2 pts.): Let L be a language of propositional logic where formulas are build only from Boolean variables using the primitive connectives $\neg, \wedge, \vee, \rightarrow$, and $\leftrightarrow$ (thus $\top$ and $\bot$ are not part of the language). Furthermore, let A be a formula of L containing no occurrence of $\neg$ and let B be any formula of L.

Show the following propositions:

(1) Let I be an interpretation assigning to all atomic formulas of A the truth value 1. Then, A is true under I.

(2) If $\models B \leftrightarrow \neg A$, then B contains at least one occurrence of $\neg$.

Hint: Show Item (1) by induction on the logical complexity of A (i.e., on the number of occurrences of logical connectives in A). Show Item (2) using Item (1).