COMP 3400 Computational Logic and Automated Reasoning
Winter 2018 Assignment 2

Instructions:

1. **For your solution use the template file that was posted on the course news, and follow the instructions in it, and those here below.**

   In particular: (a) Include at the top of the first page: full name, student number, and email address. (b) Assignments have to be created with Latex, and submitted in pdf format. (c) Every problem solution MUST include the problem statement as found below in this assignment. The source file for this assignment is provided. (d) Latex has to be used as such, not as a simple text editor, such as Notepad. Latex is much more than that. In particular, formulas have to be written using Latex's mathematical features, and then compiled.

2. Assignments are individual; no group work allowed.

3. Submit by email to the instructor (bertossi@scs.carleton.ca), with "Assignment "Number", CompLog" in the subject. **Include your last name in the file name!** For example, in the subject: "Assig. 2 CompLog". The file name: "bertossi-2.pdf".

4. **Only a single pdf file will be accepted as submission. No tar or zip files (or anything like that), please.**

5. **Keep your Latex source files, you may be requested to show them. The same applies to the whole interaction with the automated reasoner as text files.**

6. Explain your solution very carefully, but still be succinct in your answers. No unnecessary verbose arguments, please. Go to the point.

   Make explicit all your assumptions.

7. **Not following the instructions above or the solution template file will make you lose points.**

1. An equivalence relation (ER) on a set can be seen as a structure $\langle A, R \rangle$, where A is a non-empty set, and $R \subseteq A \times A$ is a binary relation with the following properties:

1. For every $a \in A$: $(a, a) \in R$ (reflexivity)
2. For every $a, b \in A$: $(a, b) \in R \Rightarrow (b, a) \in R$ (symmetry)

3. For every $a, b, c \in A$: $(a, b) \in R$ and $(b, c) \in R \;\Rightarrow\; (a, c) \in R$ (transitivity)

Use Prover9 to prove from 1. - 3. the following theorem of the theory of ERs:

"For every $a, b, c \in A$: $(a, c) \in R$ and $(b, c) \in R \;\Rightarrow\; (a, b) \in R$,

that is, that two elements related to the same elements are mutually related themselves.
For this one, you cannot use propositional logic, but predicate logic, as with the theorem of theory of groups seen in class.

2. Produce a knowledge base in **PROPOSITIONAL LOGIC** capturing the following information as closely as possible as stated here: *If Tweety is a bird and it is not an abnormal bird, then it flies. A bird is abnormal exactly when it is an ostrich, a penguin, or not an abnormal wooden bird. A wooden bird is abnormal exactly when operated under remote control. Tweety is a bird, it is not an ostrich nor a penguin nor a remote controlled wooden bird.*

Prove using Prover9 that *Tweety flies.* Notice that the two forms of abnormality mentioned here may be different, one is if birds, the other is for wooden birds.

You have to provide the knowledge base as part of your written report. *Start by listing the propositional variables and their intended meanings.* Then produce the formulas that will go into your input file, explaining them. Explain in the report what Prover9 did to prove the claim.

Deadline: Feb. 18, at 23:55