COMP 3400 Computational Logic and Automated Reasoning
Winter 2018 Assignment 3

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. 3 CompLog". The file name: "bertossi-3.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.**

For the problems below you have to hand in your interaction with SWI Prolog and the underlying run, which can be usually done by means of a "trace" that can be specified before running your program. Save that interaction as a text file.

1. (a) Write in **PROPOSITIONAL** Prolog a knowledge base that represents the information below. **Explain each formula and its role in the program**. **You have to use explicit "abnormality" (possibly in different forms), as opposed to "normality". You should also use propositional variables such as "supermanFlies", etc.**

"Superheroes fly unless they are abnormal (as superheroes). Superman is a superhero. Green Lantern is a superhero. Ironman is a superhero and is abnormal (as a superhero) unless he is abnormal (in his own sense). Ironman is abnormal (ins his own sense) when he uses his Ironman suit."

(b) Add the fact "superman" to the program and determine by means of a **complete** Prolog refutation tree (draw a picture as in the course slides) if Superman flies.

(c) Do the same as in (b) by adding the fact "ironman".

(d) Do the same as in (c) by adding the extra fact "usesIronmanSuit".

(e) Now do all of the above with SWI Prolog, using dynamic predicates to add information, i.e. at run time. Show the results and explain them one by one. Also, attach as an appendix the whole interaction with Prolog.

2. To paint the map containing Argentina, Bolivia, Chile and Peru (see map in assignment 1) you have colors white, blue and green. Each country must have a single color, and no two adjacent countries may share a color. Write a program in **PROPOSITIONAL** Prolog and run it interactively to paint the map, i.e. you can dynamically add and delete propositions from the Program. Similarly, the program can be queried dynamically (about a country's color, about violating the colorability conditions for any country or any two adjacent countries, etc.).

(a) First explain your methodology and how you will draw conclusions from your run. (b) Run the program and explain the results you obtain (you do not have to explain the single resolution steps). Attach a file showing the run and interaction with Prolog.

Hint:[1] Introduce propositional variables (propositional predicates) of the form: `can_paint_chile_white`, `not_chile_white`, `chile_white`, etc. (the last dynamic)

Deadline: March 10, at 23:55

[1] A solution would be much simpler using Prolog with predicates, with arguments and variables. That will be an assignment.