CSE 4/563 Knowledge Representation
Professor Shapiro
Homework 4
Maximum Points: 42
Due: 1:30 PM, Thursday, October 8, 2009

Name(s)⟨user name(s)⟩: _____

October 1, 2009

You must turn in the answers to this homework set in a submitted file by 1:30 PM on the date shown above.

The submitted file must be named hw4.*ext*, for an appropriate value of *ext*. **Include your name(s) and user name(s) at the top of the file.** Submit that file by executing the Unix command

`submit_cse463 hw4.`*`ext`*

or

`submit_cse563 hw4.`*`ext`*

whichever is appropriate for you. The file can be a text file, or produced by some word processing software, but it must be formatted so it is easy to read.

You are also to submit one file for Question 4d. The file must be named `hw4Prove` with an appropriate extension, preferably either `.cl` or `.txt`.

1. (3) Translate $(A \Leftrightarrow (B \wedge \neg C))$ into a logically equivalent set of clauses. Show every step.
2. (3) Give the resolution refutation proof that $A, B \vee C, D \models (A \wedge B) \vee (C \wedge D)$
3. (3) Translate $\forall x(Passenger(x) \Rightarrow \exists y Driver(y))$ into Ground Predicate Logic assuming that the only individual constants are $Betty$, $Sally$ and Tom. Show every step.

4. (33) For this question,[1] you are to use `prover` to deduce Victor's murderer assuming that everyone, except possibly for the murderer, is telling the truth.

   (a) Arthur, Bertram, and Carleton are suspects, but only one of them is the murderer.
   (b) Arthur says that Bertram was the victim's friend but that Carleton hated the victim.
   (c) Bertram says he was out of town the day of the murder, and besides he didn't even know the guy.
   (d) Carleton says he saw Arthur and Bertram with the victim just before the murder.

   (a) (9) List the atomic propositions you use to formalize the problem, and give the intensional semantics of each.
   (b) (12) Show the translation of the four sentences into CLIF, the machine-readable propositional-logic language of `prover`.
      i. (3) Arthur, Bertram, and Carleton are suspects, but only one of them is the murderer.
      ii. (3) Arthur says that Bertram was the victim's friend but that Carleton hated the victim.
      iii. (3) Bertram says he was out of town the day of the murder, and besides he didn't even know the guy.
      iv. (3) Carleton says he saw Arthur and Bertram with the victim just before the murder.
   (c) (6) Give, in English and CLIF, any additional background knowledge you need. This should not trivialize the problem, but give relations between propositions that are needed but were not stated in the problem.
   (d) (3) Show the call to `prove` that results in the murder's being solved. **Submit a file containing your name(s), user name(s), and this expression.**
   (e) (3) Show what `prover` prints as a result of the evaluation of the above call to `prove`

[1] From Michael R. Genesereth and Nils J. Nilsson, *Logical Foundations of Artificial Intelligence*, Morgan Kaufmann Publishers, Los Altos, CA, 1987, p. 93.