Homework 5[1]

Due 12/7/2018 at 11:59pm

This problem set contains some exercises for knowledge representation and for performing inferences.

1. (Adapted from an exercise in the textbook):

   "If the unicorn is mythical, then it is immortal, but if it is not mythical, then it is a mortal mammal. If the unicorn is immortal or a mammal, then it is horned. The unicorn is magical if it is horned."

   Use resolution by refutation to determine which one(s) of the following is(are) entailed by the blurb above.
   - The unicorn is horned.
   - The unicorn is magical.
   - The unicorn is mythical.

   You need to first translate the English sentences into propositional logic -- please define your proposition symbols clearly. Then you need to convert your propositional logic sentences into conjunctive normal form. Finally, repeatedly apply resolution by refutation to reach your conclusion. Please show your steps clearly for the grader.

2. Do Exercise 13.18 from the textbook.

3. Do Exercise 14.11 from the textbook.

4. Do Exercise 14.12 from the textbook.

5. (Adapted from Pearl, 1988) A bag contains ten balls, numbered 1 to 10 (one each). I pick a ball from the bag with uniform randomness. I observe the number on that ball; say it's X. I then prepare a second bag that contains only X balls, numbered 1 to X (one each). You know my process but you don't know what X is. I now pick a ball from the second bag, again with uniform randomness. I tell you that this ball's value is Y. How does your knowledge of Y affect your belief about X? Find the distribution of X given Y.

[1] Also available as Google Doc: https://docs.google.com/document/d/1mES30yYW2UQIQGuwU6ddiLEgaI12tlCuroGqRR2BmBY/edit?usp=sharing

What to submit

- Please prepare a PDF document with the answers for the above questions (a scan is fine; please make sure it is legible, however) uploaded to the appropriate GitHub repository created for you.

Grading Guideline

Assignments are graded qualitatively on a non-linear five point scale. Below is a rough guideline:

- 5 (100%): Answered all the questions correctly.
- 4 (93%): Minor mistake or vague answers for some questions.
- 3 (80%): Major mistake in only one problem.
- 2 (60%): Major mistake in multiple problems.
- 1 (40%): An attempt has been made, but the answers are incorrect.