CS4811: Homework 5 --- Machine Learning, Reasoning Under Uncertainty

Due: Friday, April 11, 2014, beginning of class.
(Assigned: Friday, April 4 2014)

Reminder: This is an individual assignment. All the work should be the author's and in accordance with the university's academic integrity policies. You are allowed to use any written source in preparing your answers, but if you use any other source than the textbook and the class notes, you should specify it on your assignment.

Problem 1:(40 points) Consider the problem of getting a dog for a pet. For simplicity, we will use 4 attributes:

- One can adopt or buy a dog, the allowable values are from {a, b};
- The dog can be purebred or hybrid/mixed i.e., the allowable values are from {p, h};
- The size can be small, medium, large, i.e., the allowable values are from {s, m, l};
- The dog can be cat-friendly or not, i.e., the allowable values are from {y, n}.

Consider the following examples in the given order:

- + (a p m y)
- - (b p m y)
- + (a h m y)
- - (a p s y)
- + (a h m n)

Initialize the G and S sets to {W, X, Y, Z} and { }, respectively, and show their values after each example. Be sure to fully document why you came up with a particular set.

Problem 2:(40 points) Consider the following statements:

- If Pat plants tulip bulbs in the Fall and it is consistent that the ground is above freezing then Pat will see tulips in Spring.
- Pat planted tulip bulbs in the Fall.

(a) Express the above statements in nonmonotonic logic using the modal operator **M**.

(b) Draw an LTMS and show the initial labels.

(c) Expand and label the LTMS with IN or OUT as the following information comes into the knowledge base:
If the snow on the ground is plowed the ground will freeze.

(d) Expand and label the LTMS again with IN or OUT as the following information comes into the knowledge base:
The snow on the ground was plowed.

(e) Expand and label the LTMS again with IN or OUT as the following information comes into the knowledge base:
The previous report was incorrect, only the driveway was plowed.

Problem 3:(20 points) Imagine that affordable robot helpers have been manufactured and both you and your neighbor have one. Yours is named Robby and your neighbors' is named By-a-rob. One day, Robby looks out of the window and says ``By-a-rob is walking the dog.'' Robby is 100% reliable in detecting that a dog being walked. On the other hand, 70% of the time he mistakes a human for a robot (or vice versa). You know that your neighbor takes the dog out himself 90% of the time, and lets By-a-rob do it at other times.

(a) Write down all the prior and conditional probabilities that you can gather from the above description. Briefly describe the propositions you use.

(b) What is the probability that By-a-rob is walking the dog?

(c) What is the probability that your neighbor is walking the dog?