

CSE 4/563 Knowledge Representation
Professor Shapiro
Homework 4
Maximum Points: 42
Due: 10:45 AM, Monday, March 8, 2004

February 23, 2004

Put your answers in a file named `hw4.ext`. **Include your name 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.

1. (22) Formalize the following domain in Standard Full First-Order Predicate Logic using the syntax of SNARK wffs. You must have one and only one sentence of FOL (SNARK assertion) for each sentence.
 - (a) No one believes what is said by anyone he believes to be a liar, but Bob believes everything said by anyone he doesn't believe to be a liar.
 - (b) When there's danger, if someone hears a warning, then he takes evasive action if and only if he believes the warning.
 - (c) When there's danger, anyone who doesn't take evasive action gets injured.
 - (d) When there's danger, whoever is near Bob warns him.
 - (e) Larry warns Bob by saying to him the warning "There's danger!".
 - (f) Terri warns Bob by saying to him the warning "Watch out!".
 - (g) Bob believes that Larry is a liar.
 - (h) Bob doesn't believe that Terri is a liar.
 - (i) Bob hears anything said to him by someone near him.
 - (j) On Tuesday, Terri was near Bob and there was danger.
 - (k) On Wednesday, Larry was near Bob and there was danger.
2. (11) Give the syntax and semantics of all the atomic symbols you used in your formalization.
3. (3) List, in English and in your formalization, any additional "background knowledge" you need in order to answer the following questions. Do not, thereby, trivialize the problems.

4. (6) Use the `ask` program, in the form `(ask query [:answer pattern] :printProof t)`, to answer the following questions based on the knowledge base consisting of your formalization of the above sentences and the background knowledge you added.

- (a) When was Bob injured, and what was said to him then?
- (b) Who was near Bob when he took evasive action?

Include in your answer:

- (a) a transcript of the runs of `ask`;
- (b) a comment with every clause that derived from an assertion saying what sentence of the KB the clause came from;
- (c) a clear English statement answering each question.