

CSE 4/563 Knowledge Representation  
Professor Shapiro  
Homework 10  
Maximum Points: 32  
Due: 1:30 PM, Tuesday, November 24, 2009

November 19, 2009

Put your answers in a file named `hw10.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 hw10.ext
```

or

```
submit_cse563 hw10.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. The file is to end with a transcript of a demo run of your program.

You are also to submit a single file of your SNePSLOG program for this homework set. Name this file `hw10.snepslog`.

Note: You are allowed to do this homework set by translating the answers of HW7 from SNARK to SNePSLOG. (However, do not use the `Holds` predicate for this homework set.) You may use your answers to HW7, or the answers posted on *UBlearns*. You must state at the top of your answer file which of those you used, or if you answered the questions anew.

1. (16) Formalize the following domain in SNePSLOG. You must have one and only one SNePSLOG assertion for each sentence.
  - (a) The way someone warns someone on some day is by telling them on that day that there's danger on that day. (Hint: The logical content of "The way someone does  $X$  is to do  $Y$ " is "If someone does  $X$ , then that person does  $Y$ .")
  - (b) If someone  $x$  tells someone  $y$  something  $p(d)$  about a day on that same day  $d$ , then it's true if and only if they are not a liar. (Note: This is slightly different from the HW7 version.)
  - (c) If someone  $x$  tells someone  $y$  something  $p(d)$  on that same day  $d$ , then  $y$  believes  $p$  if and only if  $y$  doesn't believe that  $x$  is a liar.
  - (d) Bob takes evasive action on any day if and only if he believes that there's danger on that day.
  - (e) If there's danger on some day, a person gets injured on that day if and only if they do not take evasive action then.
  - (f) Neither Larry nor Teri are liars.
  - (g) Bob believes that Larry is a liar, but doesn't believe that Teri is a liar.
  - (h) Teri warns Bob on Bob's 25th birthday, and Larry warns Bob on the following day.

Note:

- You will need a representation of days, and you will need to decide which predicates and which functions take days as arguments. The technical term for a function or predicate that takes a time as one of its argument is a **fluent**. Such a predicate is called a **propositional fluent**, and other such functions are called **functional fluents**. It is traditional to make the time the last argument of a fluent.
  - In this homework, you will need to represent time at the **granularity** of days, but you will not need any finer nor any larger granularity of time. That is, you will not need to distinguish hours, minutes, seconds, nanoseconds, etc. You will also not need to represent different weeks, months, years, centuries, etc.
  - Although one can believe a proposition on one day, and not believe it on some other day, for simplicity in doing this homework, let's assume that all believings are independent of time.
  - You only need to represent categories of objects when it will make a difference in the reasoning tasks you will perform (or ask the program to perform). In this homework, you do not need to represent any categories. Specifically, you do not need to represent the category of days nor of persons.
  - Remember, every well-formed expression of SNePSLOG is a term. In particular, proposition-valued terms may be arguments of functions.
  - Also note that, in SNePSLOG, variables may occur in the position of a function symbol.
2. (10) Give the syntax and intensional semantics of all the constant atomic symbols you used in your formalization in the following categories of symbols. (You needn't mention symbols that are built into SNePSLOG.)

#### **Individual Constants**

#### **Non-Proposition-Valued Functional Fluents**

#### **Non-Proposition-Valued Non-Fluent Functions**

#### **Proposition-Valued Functional Fluents**

#### **Proposition-Valued Non-Fluent Functions**

3. (6) Use the SNePSLOG command `askwh` to answer the following questions based on the knowledge base consisting of your formalization of the above sentences.
- (a) (3) When does Bob not get injured?
  - (b) (3) When does Bob get injured?

Your "program" file, `hw10.snepslog`, should have the following format:

```
;;; <Name(s) and other identifying information>

set-mode-1

<Commented assertions for the sentences in question (1)>

<Commented questions>
```

Append a transcript of a demo run of your "program" to your file, `hw10.ext`.