

CSE 4/563 Knowledge Representation
Professor Shapiro
Homework 9
Maximum Points: 34
Due: 10:30 AM, Wednesday, April 9, 2007

April 2, 2007

Put your answers in a file named `hw9.ext`, using an appropriate *ext*. **Include your name at the top of the file.** Submit that file by executing the Unix command

```
submit_cse463 hw9.ext
```

or

```
submit_cse563 hw9.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 should be able to prepare one SNePSLOG input file for all the questions of this homework. Name this file `hw9.snepslog`, and submit it by the day and time this homework is due. That is, you are to submit two files: `hw9.ext`, containing a transcript of the run for each question; `hw9.snepslog`, containing your SNePSLOG input file.

To make it easy to run the `hw9.snepslog` file multiple times while preparing and debugging it, put the SNePSLOG command `clearkb` at the top of it.

SNePS has a mechanism to remember the question it is working on, and, if additional information is relevant to it, provide additional answers. To keep SNePS from answering an earlier question when you provide the additional information for a later question, put the SNePSLOG command `clear-infer` before the inputs for questions (2) and (3).

1. (12) Using the following predicates

- $\llbracket Ako(x, y) \rrbracket$ = the proposition that $\llbracket x \rrbracket$ is a subclass or subcategory of $\llbracket y \rrbracket$.
- $\llbracket Isa(x, y) \rrbracket$ = the proposition that $\llbracket x \rrbracket$ is an instance of the class or category $\llbracket y \rrbracket$

formalize in SNePSLOG the following atomic propositions

- (a) (2) Mammals, birds, and fish are subcategories of the vertebrates.
- (b) (2) Dogs and cats are subcategories of Mammals.
- (c) (1) Rover is a dog.
- (d) (1) Fluffy is a cat.

and the following domain rules (Note that, unlike Prolog, SNePSLOG has no problem with recursive rules.)

- (a) (2) Subcategory is a transitive relation.
- (b) (2) An instance of a category is an instance of all its supercategories.

Then ask SNePSLOG the following questions. The correct answers are shown in square brackets.

- (a) (1) Is Rover a vertebrate? [Yes]
- (b) (1) What categories are Fluffy in? [cats, mammals, and vertebrates]
2. (6) Using the SNePSLOG predicate
- $\llbracket \text{Exclusive}(\{x_1, \dots, x_n\}) \rrbracket$ = the proposition that the classes/categories/sets $\llbracket x_1 \rrbracket, \dots, \llbracket x_n \rrbracket$ are mutually exclusive
- (a) (2) Add to the above KB the proposition that mammals, birds, and fish are mutually exclusive.
- (b) (3) Add to the KB the rule that says that nothing is an instance of more than one mutually exclusive category.
- (c) (1) Have SNePSLOG tell you if Rover is a fish. [No.]
3. (16) Using the predicate
- $\llbracket \text{Partitions}(\{x_1, \dots, x_n\}, y) \rrbracket$ = the proposition that the classes/categories/sets $\llbracket x_1 \rrbracket, \dots, \llbracket x_n \rrbracket$ partition the class/category/set $\llbracket y \rrbracket$
- (a) (2) Add to your KB the proposition that urochordates, cephalochordates, and vertebrates partition the phylum of chordates.
- (b) (9) Add to your KB rules that explain that partitions are mutually exclusive subcategories that exhaust their immediate supercategory. (Where necessary, you may assume that there are three subcategories that partition their immediate supercategory.)
- (c) (2) Add to your KB the proposition that Carol is a chordate, but neither a urochordate nor a cephalochordate.
- (d) (1) Ask SNePSLOG if Rover is a chordate. [Yes]
- (e) (1) Ask SNePSLOG if Fluffy is a cephalochordate. [No]
- (f) (1) Ask SNePSLOG if Carol is a vertebrate. [Yes]