

CSE 4/563 Knowledge Representation
Professor Shapiro
Homework 6
Maximum Points: 38 plus 16 bonus points
Due: 10:45 AM, Monday, April 12, 2004

April 5, 2004

Put your answers in a file named `hw6.ext`. **Include your name at the top of the file.** Submit that file by executing the Unix command

```
submit_cse463 hw6.ext
```

or

```
submit_cse563 hw6.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. To make it easy to run this file multiple times while preparing and debugging it, put the SNePSLOG command `clearkb` at the top of it. Also, when you are ready to produce your final output, put the SNePSLOG command

```
^(setf *infertrace* nil)
```

as the first line of the file.

1. Using the following predicates

- $[[Subclass(x, y)]]$ = the proposition that $[[x]]$ is a subclass or subcategory of $[[y]]$.
- $[[Isa(x, y)]]$ = the proposition that $[[x]]$ is a member of the class or category $[[y]]$

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 (Use SNePSLOG rules, not path-based rules. Note that, unlike Prolog, SNePSLOG has no problem with recursive rules.)

- (a) (3) Subcategory is a transitive relation.
- (b) (3) A member of a category is a member of all its supercategories.

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

- (a) (2) Is Rover a vertebrate? [Yes]
- (b) (2) What categories are Fluffy in? [cats, mammals, and vertebrates]

2. Using the SNePSLOG predicate

- $[[Exclusive(\{x_1, \dots, x_n\})]]$ = the proposition that the classes/categories/sets $[[x_1]], \dots, [[x_n]]$ are mutually exclusive
- (2) Add to the above KB the proposition that mammals, birds, and fish are mutually exclusive.
 - (3) Add to the KB the rule that says that nothing is a member of more than one mutually exclusive category.
 - (3) Have SNePSLOG tell you if Rover is a fish. [No.]

3. Using the SNePSLOG predicate

- $[[Partitions(\{x_1, \dots, x_n\}, y)]]$ = the proposition that the classes/categories/sets $[[x_1]], \dots, [[x_n]]$ partition the class/category/set $[[y]]$
- (2) Add to your KB the proposition that urochordates, cephalochordates, and vertebrates partition the phylum of chordates.
 - (6) Add to your KB rules that explain that partitions are mutually exclusive subclasses.
 - (3) Ask SNePSLOG if Rover is a chordate. [Yes]
 - (3) Ask SNePSLOG if Fluffy is a cephalochordate. [No]

4. (16 bonus points) Redo all the above exercises in SNePSLOG mode-3 using path-based inference wherever possible. (Begin this section of your SNePSLOG file with the SNePSLOG command `set-mode-3`. That will also initialize the KB.)

To summarize, build one KB with the following rules

- Subcategory is a transitive relation.
- A member of a category is a member of all its supercategories.
- Nothing is a member of more than one mutually exclusive category.
- Partitions are mutually exclusive subclasses.

and the following facts

- Urochordates, cephalochordates, and vertebrates partition the phylum of chordates.
- Mammals, birds, and fish are subcategories of the vertebrates.
- Mammals, birds, and fish are mutually exclusive.
- Dogs and cats are subcategories of Mammals.
- Rover is a dog.
- Fluffy is a cat.

and ask SNePSLOG the following questions

- Is Rover a vertebrate? [Yes]
- What categories are Fluffy in? [cats, mammals, vertebrates, and chordates]
- Is Rover a fish? [No.]
- Is Rover a chordate? [Yes]
- Is Fluffy a cephalochordate? [No]