

CSE 4/563 Knowledge Representation
Professor Shapiro
Homework 7
Maximum Points: 42
Due: 1:30 PM, Thursday, November 11, 2010

November 4, 2010

You must turn in the answers to this homework set in a submitted file by 1:30 PM on the date shown above.

The submitted file must be named `hw7.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 hw7.ext
```

or

```
submit_cse563 hw7.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 are also to submit the two Prolog programs, `hw7q1.prolog` and `hw7q1.prolog`. Each is to end with commented versions of the Prolog versions of the questions, surrounded by Prolog's comment brackets, `/*` and `*/`. (Not including the period.)

1. (14)

(a) (6) Express the following as a Prolog program, called `hw7q1.prolog`.

- i. (3) If two people believe the same thing, it's true.
- ii. (1) Tom believes that John is a driver.
- iii. (1) Betty believes that Mary is a driver.
- iv. (1) John believes that Mary is a driver.

(b) (6) Give the syntax and semantics of your atomic symbols in the following categories:

- i. (2) Individual constants
- ii. (2) Functions
- iii. (2) Predicates

(c) (2) Use your Prolog program to find out who the driver is (or who the drivers are). Respond to each answer by entering a semicolon, `;` so that you make sure that you get all the answers. Submit your program as `hw7q1.prolog`, and put a transcript of the run here in your answer file.

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2. (28) In this exercise, you will create a partitioning of a category using reified categories, and test it in several ways. The basic notion comes from the idea that there may be several ways of partitioning the same category. For example, one partitioning of Human is Male vs. Female, and another is Child vs. Adult vs. Senior. We can create two “partitionings” of Human, say Sex and Age, and say that Male and Female are in the Sex partitioning, while Child, Adult, and Senior are in the Age partitioning. Since you will be using Prolog, and have to be careful to avoid infinite recursive loops, it will be a good idea to use different predicates for membership of a category in a partitioning and for membership of an instance in a category.

Remember that in Prolog, a variable starts with a capital letter, while a constant must begin with a lower case letter.

- (a) (19) Write a Prolog program, called `hw7q2.prolog` containing the following rules:
- i. (3) The fact that the Big 3 is a partitioning of the category of American cars.
 - ii. (3) The facts that the categories of Chrysler cars, Ford cars, and GM cars are in the Big 3 partitioning.
 - iii. (1) The fact that `car1` is a Chrysler car.
 - iv. (3) The facts that `car2` is an American car, but neither a Chrysler car, nor a GM car.
 - v. (3) Categories in a partitioning of a category are subcategories of the category: the general rule that if an instance, x is in a category, c , c is a member of a partitioning p , and p is a partitioning of a category s , then x is in the category s .
 - vi. (3) Categories in a partitioning are mutually exclusive (disjoint): the general rule that if an instance, x is in a category, $c1$, $c1$ is a member of a partitioning p , and $c2$ is another member of p , then x is not an instance of $c2$.
 - vii. (3) Categories in a partitioning are exhaustive of their supercategory: the general rule that if an instance, x , is in some category, s , then it is in one member of a partitioning, p , of s if it is not in any other member of p .
- (b) (6) Give the syntax and semantics of your atomic symbols in the following categories:
- i. (2) Individual constants
 - ii. (2) Functions
 - iii. (2) Predicates
- (c) (1) Use your Prolog program to find out if `car1` is an American car. The answer should be `yes`. Transcribe the question and answer here in your answer file.
- (d) (1) Use your Prolog program to find out if `car1` is a GM car. The answer should be `no`. Transcribe the question and answer here in your answer file.
- (e) (1) Use your Prolog program to find out if `car2` is a Ford car. The answer should be `yes`. Transcribe the question and answer here in your answer file.