

Homework #3: Chapter8 and Prolog

The following exercises are due at the beginning of class on Tuesday, March 6. Note, problem 3 is continued on the reverse.

1. [50 pts.] Do exercise 8.24 (a - j) from the book (p. 319). Use the following constants and predicates (and no others):

- **F**: a constant representing French class
- **G**: a constant representing Greek class
- **S**: a constant representing Spring 2001
- **UK**: a constant representing the U.K.
- **Agent(x)**: x is an agent
- **Barber(x)**: x is a barber
- **Expensive(x)**: x is expensive
- **Insured(x)**: x is insured
- **LocalMan(x)**: x is a man living in the town
- **Person(x)**: x is a person
- **Policy(x)**: x is a policy
- **Semester(x)**: x is a semester
- **Smart(x)**: x is smart
- **Student(x)**: x is a student
- **BornIn(x,c)**: person x is born in country c
- **Buys(x,y)**: person x buys item y
- **CitizenByBirth(x,c)**: person x is a citizen by birth in country c
- **CitizenByDescent(x,c)**: person x is a citizen by descent in country c
- **CitizenOf(x,c)**: person x is a citizen of country c
- **GreaterThan(x,y)**: $x > y$. You may assume that the standard mathematical semantics apply to this predicate.
- **Parent(x,y)**: person x is the parent of y
- **Passes(x,c)**: student x passes course c
- **ResidentOf(x,c)**: person x is a resident of country c
- **Sells(s,x,b)**: person s sells item x to person b
- **Score(x,c,s,n)**: student x received a score of n when taking course c in semester s .
- **Shaves(x,y)**: person x shaves person y
- **TakesCourse(x,c,s)**: student x takes course c in semester s

2. [10 pts.] Write down a first-order logic sentence such that every world in which it is true contains exactly one object in its domain.

3. [40 pts. total] In this exercise you will use Prolog to create a knowledge base about the world of a popular series of books. Part (a) should be saved as a file named `userid-hw3.pl` (~~hw4.pl~~). Please include an introductory comment with your name, the course number and date in it. As specified at the beginning of the assignment, send an e-mail to me containing both your program and your output from part (b). You should also include hardcopies of both files with your homework submission.

- a) [25 pts.] Create a Prolog program to reason with the knowledge provided below. Only include facts and rules that correspond to the information given here; do not encode any additional knowledge of the world that you may have. Hint: The Prolog program will be easier to write if you use unary predicates to represent categories.

Hogwarts is a wizard academy. If someone teaches at a wizard academy, then they are a wizard. ~~If someone is the head of a house, then they are a member of that house.~~ Every child of a wizard is also a wizard. If someone is not a wizard, then they are a muggle. If a Hogwarts student is shift, then they are in Slytherin house. If a Hogwarts student is brave, then they are in Gryffindor house. The head of a house is a member of the house. The head of a house teaches at the school the house belongs too. Any member of a house at a wizard academy is a wizard. Hermione is in the same house as Harry. James is a wizard. McGonagal is head of Gryffindor house. Snape teaches at Hogwarts. One of Ron's parents is Arthur. One of Harry's parents is

James. Harry and Draco are Hogwarts students. Harry is brave. Draco is shifty. Gryffindor is part of Hogwarts.

- b) [15 pts.] Test your Prolog program by asking it the following questions. In order to make sure that you have implemented the program exactly as specified, I have designed to knowledge base so that some of the questions may be answered in a way that is inconsistent with the books. Note, in some cases, it may be impossible to avoid getting the same answer more than once for a query.
- i) Is Harry a wizard?
 - ii) Is Ron a muggle?
 - iii) What house is Hermione in?
 - iv) Who teaches at Hogwarts?
 - v) Are Harry and McGonagal members of the same house?
 - vi) Who is in Gryffindor house?

Include a printout that shows your Prolog query and the program's responses (you may simply copy this from SWI-Prolog's main window and paste it into a file for printing).