Assignment 1

Due: Friday, 12.05.2017, 15:59 via Git

For help, contact alp-staff@lists.iai.uni-bonn.de (staff only) or alp-course@lists.iai.uni-bonn.de (staff and participants).

Submit results into the folder “assignment01/” of the git repository of your group.

For task 1 submit your implemented predicate as a file named “task1.pl”. At the bottom of the file add a comment containing console output that shows all results of a successful test run.

For each other task submit your answers as either a .txt or .pdf file named according to the task number, e.g. “task2.pdf” or “task3.txt”.

Task 1. *Friends* (9 Points)

Write a Prolog predicate that solves the following logic puzzle:

1. Tick, Trick and Track are friends.
2. One friend is 15, one 17, and one 18 years but we do not know who has which age.
3. One friend’s last name is Chang.
4. Miss Yang is three years older than Tick.
5. The person whose last name is Thatcher is 17 years old.

Tip 1: *The condition that X is bigger by 3 than Y is written in Prolog as “X is Y+3”.*

Tip 2: *Consider what the puzzle tells you about the three friends and think of a suitable term structure representing a person. Then represent each of the three friends by a person term with variables for the values that are unknown. Represent our little “world” of three friends by a list holding the three (incomplete) persons. Then use 'member(Person, List)' to search the list for a person that fulfills one of the hints given in the second to fifth sentence of the puzzle. If you do this for each hint and also consider tip 1 you have the complete predicate that solves the puzzle.*

Task 2. *Declarative semantics* (4 Points)

Assume that the information that a class or interface extends another class or interface by is represented the predicate extends/2 and that the subtype/2 predicate is defined recursively based on extends/2 as follows:

```
        extends(a, b).
        extends(c, d).
        extends(d, e).

        subtype(X,Y)  :- extends(X,Y).
        subtype(X,Y)  :- extends(X,Z), subtype(Z,Y).
```

For the above program write down

a) (2 Points) its translation to first order logic (quantified implications).
b) (2 Points) its model (its logical consequences).

Tip: See Chapter 2 of the lecture slides.

Task 3. *Declarative semantics* (2 Points)

```
        extends(class(a),class(b)).
        extends(class(c),class(d)).
        extends(class(d),class(e)).

        subtype(X,Y)  :- extends(X,Y).
        subtype(X,Y)  :- extends(X,Z), subtype(Z,Y).
```

Write down the model of the above, slightly modified, program.

Task 4. *Declarative semantics* (5 Points)

```
        natural(0).
        natural( s(X) )  :- natural(X).
```

a) (2 Points) Write down the model of the above program.
b) (1 Points) What difficulty did you encounter in step a)?
c) (2 Points) Compare this task to Task 3 and try to make a general statement about the effect of function symbols in logic programs.

Task 5. *Unification* (3 Points)

Write down a unifier for each successful unification (for getting 0,5 extra points per unifier, provide a *most general* unifier – see slides 26 to 28 from Chapter 3). If the unification doesn't succeed explain why.

a) likes(calvin,hobbes)=likes(X,Y)
b) likes(calvin,hobbes)=likes(X,susie)
c) father(Jim, father(X))=grandfather(john, jane)
d) append([A,B,C], [D,E,F], G)=append([h,i,j], [k,l,m], [N|O])
e) [a,[b|H]|C]=[a,b,c,d]
f) [[X,Y],e|[y,z]]=[A,B,C,D]