Exercise 6

Integrated Logic Systems (Part I)

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Exercise 6.1

Compute all answer sets for the following answer set program.

```
dom1(a). dom1(b).
dom2(1). dom2(2).
rel(a,1). rel(b,2). rel(c,3). rel(d,2).

dom3(X) :- rel(X,Y), dom1(X), dom2(Y).
dom3(X) :- rel(X,Y), not dom1(X), not dom2(Y).

1 {p(X,Y):dom2(Y) } 1 :- dom3(X).
:- 2 {p(X,2):dom1(X) }.
```

Exercise 6.2

Consider the following scenario: We assume that a bird can fly if the converse is not explicitly stated. We also assume that a penguin does not fly. Now let tux be a penguin and tweety be a chicken (both are birds).

a) Give an encoding of this scenario using an ASP with *classical negation* (cf. Slides IV/14-15).

b) Ground the program and compile the classical negation away.

c) Use the propagation rules to derive that the program obtained in b) entails that tweety flies whereas tux does not fly (where a program P entails a ground literal l if l is satisfied by every answer set of P).

Exercise 6.3

Reconsider the encoding for Undirected Hamiltonian Cycles from Slide IV/34. It does not work for graphs containing loops (edges from a node to itself).

a) Give an example graph which yields a wrong answer using the encoding from Slide IV/34.

b) Fix the problem.

Exercise 6.4

Consider the following domain: there are four positions a, b, c and d, an agent starting at a and an obstacle starting at c. The agent moves in every step to an arbitrary but different position that is not currently occupied by the obstacle. The obstacle only moves at even step numbers and only clockwise ($a \rightarrow b$, $b \rightarrow c$, $c \rightarrow d$ and $d \rightarrow a$). A GDL like description is to be found on the course web page (`ex64.pl`). Solve the following tasks using `clingo`.

a) Provide a "state generator" (cf. Slide IV/40) which enables all subsets of fluents to be model candidates and a "transition generator" which generates possible legal actions.

b) Try to prove that in every reachable state there is exactly one obstacle. Which further property must be assumed beforehand in order to achieve this?

c) Prove that for even step numbers we have that agent and obstacle are at different positions.