Exercise 5

Integrated Logic Systems (Part I)

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Exercise 5.1

For the following program, determine all stable models by search over the truth-values of atoms and by using propagation. Show a complete search tree and all applied Propagation Rules.

```
a :- not d.
a :- d, not e.
b :- e, not f.
c :- not b, not e.
c :- f, e, not a.
d :- not a, not c.
e :- not c.
f :- a, not b, not d.
```

Exercise 5.2

The goal of the following exercise is to construct an ASP encoding which solves the following *Einstein Puzzle*: There are four different persons: Marc, Joey, Sandra and Ellen. Each person likes exactly one of the sports hiking, volleyball, basketball or tennis and exactly one of the drinks tea, water, coffee or beer. The favorite sport and drink of each person differs from those of the respective other persons. Moreover you have the following clues:

1) Joey drinks beer.
2) Marc likes neither tea nor volleyball.
3) Either Sandra goes hiking or Joey plays basketball.
4) The coffee drinker plays basketball.
5) Ellen plays basketball if Sandra likes tea.
6) The water drinker plays tennis or volleyball.

Download the Answer Set Solver `clingo` via the link from the web page and solve the following tasks:

a) Define clauses for the background information using the predicates `name/1`, `drink/1` and `sport/1` (to assign the given names, drinks and sports, resp.) as well as `does/2` and `drinks/2` (to relate names to sports and names to drinks, resp.).

b) Encode all the clues using clauses and constraints and determine the single stable model of the program.

Exercise 5.3

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 ($a \to b$, $b \to c$, $c \to d$ and $d \to a$). A GDL like description is to be found on the course web page (`ex53.pl`). Solve the following tasks using `clingo`.

a) Provide a "state generator" (cf. Slide V/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.