Integrated Logic Systems (Part I)

Prof. Michael Schroeder, Sebastian Voigt

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Exercise 5.1

For the following programs, 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)
```
a :- b, not c.
b :- a, not c.
```

b)
```
dom(1). dom(2).
p(X) :- not q(X), dom(X).
q(X) :- not p(X), dom(X).
:- p(1),p(2).
```

c)
```
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

a) Prove the following: If S is a stable model of some program P, then S is a minimal Herbrand model of P.

Hint: Prove that

1) S is a Herbrand model of P, and that
2) there is no Herbrand model S' of P such that $S' \subset S$ (by contradiction).

b) Does the converse of a) also hold?

Exercise 5.3

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 `plays/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.