Exercise 4

# Foundations of Agent Programming

Prof. Michael Thielscher, Sebastian Voigt

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## Exercise 4.1

Determine all stable models of the following programs. Motivate your answers.

a)
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legal(p,move(a)) :- legal(p,move(b)), not legal(p,move(c)).
legal(p,move(b)) :- legal(p,move(a)), not legal(p,move(d)).
```

b)
```
position(a) :- not position(b), not position(c).
position(b) :- not position(c), not position(a).
position(c) :- not position(a), not position(b).
```

c)
```
n1 :- not n2.
n2 :- not n3.
n3 :- not n4.
n4 :- not n1.
```

d)
```
p(1,2).
q(X) :- p(X,Y), not q(Y).
```

e)
```
dom(a). dom(b). dom(c). dom(d).
1 {p(X) : dom(X)} 2.
:- p(a), p(b).
```

## Exercise 4.2

Reconsider the Blocks World from Exercise 1.2 and 2.2.

a) Assume two auxiliary predicates: $Goal$ specifies the goal conditions (for example $Goal := On(A,B) \wedge On(B,C) \wedge Table(C)$ ) and $GoalPos(a)$ means that, according to the goal conditions, block $a$ is in goal position (for example for the goal condition given before we have $GoalPos(B) := On(B,C) \wedge Table(C)$ ). Give Linear Temporal Logic formulas (cf Slide IIIb/9) for the following statements:

   1) Never stack block $A$ onto block $B$.
   2) Never move a block that is in goal position.
   3) Reach the goal after at most $n$ actions.
   4) Do not stack a block directly on top of a block which is in goal position.
   5) Move block $A$ only after having moved block $B$ some time.

b) Assume an infinite situation sequence $S_0, S_1, S_2, S_3, S_3, \ldots$ such that $Holds(Table(B), S_0)$, $\neg Holds(Table(B), S_1)$, $\neg Holds(Table(B), S_2)$, and $Holds(Table(B), S_3)$.

   Show that for the situation sequence $S_0, S_1, S_2, S_3, S_3, \ldots$ mentioned above we have:

$$S_0 \models (Table(B) \supset \Diamond(\neg Table(B) \wedge \Diamond Table(B)))$$

   Which statement is encoded via this formula?