

# Advanced Data Modeling

Summer Semester 2008

- Exercises IX -

- 1) SLDNF resolution generalizes SLD resolution to negation as failure. It is based on the notion of a SLD trees (Lloyd, 1984):

let  $P$  be a normal program and  $G$  a normal goal. An SLDNF-tree for  $P \cup \{G\}$  is a tree satisfying the following:

1. Each node of the tree is a (possibly empty) goal.
2. The root node is  $G$ .
3. Let  $\leftarrow L_1, \dots, L_m, \dots, L_p$  ( $p \geq 1$ ) be a non-leaf node in the tree and suppose that  $L_m$  is selected. Then either
  1.  $L_m$  is an atom and, for each program clause (variant)  $A \leftarrow M_1, \dots, M_q$  such that  $L_m$  and  $A$  are unifiable with mgu  $\theta$ , the node has a child :  
 $\leftarrow (L_1, \dots, L_{m-1}, M_1, \dots, M_q, L_{m+1}, \dots, L_p)\theta$ , or
  2.  $L_m$  is a ground negative literal  $\neg A_m$  and there is a finitely failed SLDNF-tree for  $P \cup \{\leftarrow A_m\}$ , in which case the only child is  $\leftarrow L_1, \dots, L_{m-1}, L_{m+1}, \dots, L_p$ .
4. Let  $\leftarrow L_1, \dots, L_m, \dots, L_p$  ( $p \geq 1$ ) be a leaf node in the tree and suppose that  $L_m$  is selected. Then either
  1.  $L_m$  is an atom and there is no program clause (variant) in  $P$  whose head unifies with  $L_m$ , or
  2.  $L_m$  is a ground negative literal  $\neg A_m$  and there is a SLDNF-refutation of  $P \cup \{\leftarrow A_m\}$ .
5. Nodes, which are the empty clause, do not have children.

Give an SLDNF derivation for the following program:

```
p ← ¬r
r ← q(x)
q(a)0 ←
```

- 2) Show that  $r$  is a logical consequence of the completion of the following program, but can not be derived using SLDNF resolution. Why?

```
r ← p
r ← ¬p
p ← p
```

- 3) Give a well founded model for the following program using the fixpoint and the alternating fixpoint semantics for programs under the well founded semantics:

```
flies(X) :- bird(X)
penguin(X) :- bird(X), ~flies(X)
bird(X) :- penguin(X)
penguin(X) :- bird(X), lovesFish(X)
freezes(X) :- polarAnimal(X)
penguin(tweety)
```