T-79.5102 **Autumn 2007**
Special Course in Computational Logic
Tutorial 8

1. Study the details of the Dowling-Gallier algorithm, i.e., $\mathsf{LeastModel}(M)$, formulated for positive programs.

(a) Verify the given *invariants*

(i) $Q \subseteq M \subseteq \mathrm{LM}(P)$.
(ii) $\forall r = a \leftarrow B \in P$: $\mathsf{count}[r] = |B \setminus (M \setminus Q)|$.
(iii) $\forall a \in \mathrm{Hb}(P)$: $(a \in M \iff \exists r = a \leftarrow B \in P$: $\mathsf{count}[r] = 0)$.

(b) Verify the measure of progress $|\mathrm{LM}(P) \setminus M| + |Q|$.

(c) Provide justification for the *postcondition* $M = \mathrm{LM}(P)$ supposed to hold when the execution of the algorithm terminates.

2. Reconsider the principles P1–P4 employed in the definition of the lower bound $\mathrm{LB}(P, L)$. Any prospects of generalizing them for cardinality rules?

3. Calculate the approximation $\mathsf{Expand}(P, \{d\})$ for a normal logic program P consisting of the following rules:

$$a \leftarrow d, {\sim}b. \quad b \leftarrow {\sim}a, {\sim}b. \quad b \leftarrow c, {\sim}d. \quad b \leftarrow e.$$
$$c \leftarrow {\sim}a. \quad d \leftarrow a, {\sim}e. \quad e \leftarrow c, {\sim}e.$$

4. Determine stable models using the branch&bound algorithm (no look-ahead) in order to solve the following reasoning problems.

(a) What is the number of stable models for the normal program

$$a \leftarrow {\sim}b. \quad b \leftarrow {\sim}c. \quad c \leftarrow {\sim}d. \quad c \leftarrow {\sim}e. \quad d \leftarrow {\sim}a. \quad e \leftarrow b.$$

(b) Is e true in every stable model of a normal program consisting of

$$a \leftarrow {\sim}b, {\sim}c. \quad b \leftarrow {\sim}a, {\sim}c. \quad c \leftarrow {\sim}a, {\sim}b.$$
$$d \leftarrow a, {\sim}c, {\sim}d. \quad d \leftarrow b, {\sim}a. \quad e \leftarrow c, {\sim}d. \quad e \leftarrow d.$$