Lehrstuhl für Automatentheorie
Institut für Theoretische Informatik, TU Dresden
Prof. Dr. F. Baader

Hans-Grundig-Str. 25
Dresden Johannstadt
Tel.: 0351/463–38237
Tel.: 0351/463–39171

8. Exercises for the Course „Logic-based Knowledge Representation“

Exercise 27:

Let $\mathcal{D} = (D, H, V)$ be a domino system. A solution $\tau : \mathbb{N} \times \mathbb{N} \rightarrow D$ is called *periodic* iff there exist natural numbers $h, v > 0$ such that $\tau(x, y) = \tau(x + h, y) = \tau(x, y + v)$. Show that

(a) It is partially decidable whether a domino system has *no* solution.

(b) It is partially decidable whether a domino system has a *periodic* solution.

(c) There exist solvable domino systems that admit only non-periodic solutions.

Exercise 28:

Use a reduction of the domino problem to prove that satisfiability of first-oder logic formulas is undecidable. In the reduction, you are allowed to use equality, but no constants and function symbols.

Exercise 29:

For the following pairs of $\mathcal{FL}_0$-concepts C, D, use the algorithm from the lecture to decide whether C is subsumed by D:

(a) $C = \forall R.\forall R.(A \sqcap B), \quad D = \forall R.\forall R.A$

(b) $C = \forall R.A \sqcap \forall S.B, \quad D = \forall R.(A \sqcap B) \sqcap \forall S.(A \sqcap B)$

(c) $C = \forall R.(A \sqcap \forall S.B), \quad D = \forall R.(\forall S.B) \sqcap \forall R.A$

(d) $C = \forall R.\forall S.A \sqcap \forall S.\forall R.A, \quad D = \forall R.\forall R.A \sqcap \forall S.\forall S.A$

(e) $C = A \sqcap \forall R.A \sqcap \forall S.B, \quad D = A \sqcap \forall R.A$

Exercise 30:

To complete the proof of Corollary 6.2., show that the transformation of an $\mathcal{FL}_0$-concept into normal form can be computed in polynomial time.