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

Nöthnitzer Str. 46
01187 Dresden
Tel.: 0351/463–38237
Tel.: 0351/463–39171

# 6. Exercises for the Course
# „Complexity and Logic"

**Exercise 24:**

Prove the space compression theorem (Theorem 3.8 from the lecture): for all $\varepsilon \in \mathbb{R}^+$ and all $S : \mathbb{N} \to \mathbb{R}^+$, we have $\mathsf{DSpace}(S) \subseteq \mathsf{DSpace}(\mathsf{max}(n, \varepsilon \cdot S(n)))$.

**Exercise 25:**

Complete the proof of Lemma 3.10 from the lecture: let $S$, $M$, and $X$ be as in the proof sketch given in the lecture. Show that, for words $w \in \Sigma^* \setminus X$, the question "$w \in L(M)$?" can be decided by simulating $M$ using only space $S(|w|)$.

**Exercise 26:**

Prove Theorem 3.12 from the lecture, i.e., the gap theorem for time: for every total computable function $g$ with $g(n) \geq n$, there is a total computable function $T$ with $DTime(T) = DTime(g \circ T)$.