Universität Leipzig
Institut für Informatik
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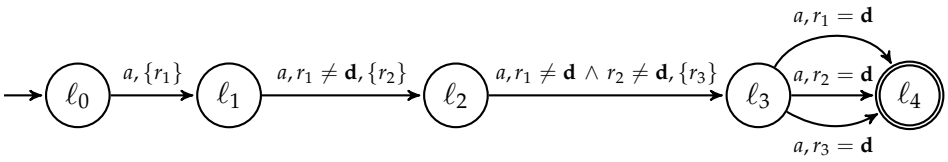
Exercises

Verification for Infinite-State Systems

Exercise Sheet 2 (for 29.10.2026)

Exercise 2.1

Is the following register automaton deterministic and/or complete?



Exercise 2.2

Prove that the decision problem is in **P**: given a finite set of registers $\mathcal{R}$ and two register tests ϕ, ϕ' in $\Phi(\mathcal{R})$, does $\phi \models \phi'$ hold?

Exercise 2.3

Prove that the problem of deciding whether a given register automaton $\mathcal{A}$ is **not** complete is in **NP**.

Exercise 2.4

Give a polynomial-time-reduction from the problem to decide whether a given propositional formula in conjunctive normal form is unsatisfiable to the problem of deciding whether a given register automaton is complete.

Exercise 2.5

Which of the following data languages over $\Sigma = \{a, b\}$ are data regular, that is, can be accepted by a register automaton? Prove your answer!

(a) $L_{11} = \{(a, d_1) \dots (a, d_n) \mid d_i \neq d_n \text{ for all } 1 \leq i < n, n \geq 1\}$

(b) $L_{12} = \{(a_1, d_1) \dots (a_n, d_n) \mid$ there exists some $1 \leq i \leq n$ such that $a_i = a$, and $a_j \neq b$ or $d_j \neq d_i$ for all $i < j \leq n\}$