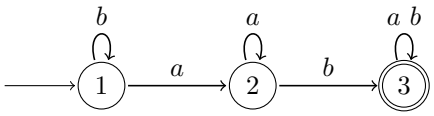
universität innsbruck

Automata and Logic	26W	LVA 703302 + 703303
Lecture 5		November 20, 2026

Solved exercises must be marked and solutions (as a single PDF file) uploaded in OLAT. The (strict) deadline is 7 am on November 20.

Exercises

⟨1⟩ 1. Construct a WMSO formula φ such that $L(\varphi) = L(M)$ for the following DFA M:



⟨3⟩ 2. Show that the following sets are not regular. If possible use the Myhill–Nerode theorem or other properties of regular sets from the slides.

(a) $\{a^n b^m \mid n \neq m\}$

(b) $\{x \in \{a, b, c\}^* \mid x \text{ is a palindrome}\}$

(c) The set PAREN of balanced strings of parentheses ( ). For example, the string (((())())()) is in PAREN, but the string)(() is not.

⟨3⟩ 3. Which of the following subsets of $\{a, b\}^*$ are regular and which are not? Provide justification.

(a) $A = \{x \mid \#a(x) = 2 \cdot \#b(x)\}$

(b) $B = \{x \mid \#a(x) - \#b(x) < 10\}$

(c) $C = \{x \mid \#a(x) \cdot \#b(x) \text{ is even}\}$

⟨3⟩ 4. Consider the regular expression $\alpha = (a + b)^* ab(a + b)^* b$.

(a) Compute the minimum-state DFA M for $L(\alpha)$.

(b) Give a regular expression for each of the equivalence classes of the Myhill–Nerode relation $\equiv_M$ of M.