

Automata and Formal Languages – Exercise sheet 6

Exercise 6.1

Given a formula of the form $\sum_i a_i x_i \equiv c \pmod k$ with $\gcd(2a_i, k) = 1$ for all i .

1. Show that the minimal deterministic automaton accepting solutions (represented in base 2) of this formula has exactly k states.
2. Show that there does not exist any smaller nondeterministic automaton accepting that language.

Exercise 6.2

Give an MSO sentence defining the language $\{ab, ba\}^*$ over the alphabet $\{a, b\}$.

Exercise 6.3

Construct an automaton for the following MSO sentence

$$\exists X \forall x \forall y: (\lambda(x) = a \wedge x \notin X) \vee \lambda(y) = b \vee (x < y \wedge y \in X)$$

over $\{a, b\}^*$.

Exercise 6.4

Apply Angluin's L^* -algorithm for learning the language $L = a(ba)^*$ over the alphabet $\{a, b, c\}$.

Exercise 6.5

Give a Büchi automaton for the language L of all words $\alpha \in \{a, b, c\}^\omega$ such that α contains infinitely many a 's, finitely many c 's, and between any two a 's there is an even number of b 's or c 's.