

Finite Automata Theory and Formal Languages

TMV027/DIT321 – LP4 2014

Regular Languages

Week 5

In these exercises, book sections, exercise numbers and pages refer to those in the third edition of the course book.

1. If $w \in \{0, 1\}^*$, we write $\#i(w)$ for the number of occurrences of i in w (with $i = 0$ or 1). Show with the help of the Pumping lemma that the following 2 language are not regular

$$\begin{aligned}\mathcal{L} &= \{w \in \{0, 1\}^* \mid \#0(w) = 2 \times \#1(w)\} \\ \mathcal{M} &= \{w \in \{0, 1\}^* \mid \#0(w) \leq \#1(w) \leq \#0(w) + 1\}\end{aligned}$$

(hint: look at example 4.2).

Show however that the following language is regular

$$\mathcal{N} = \{w \in \{0, 1\}^* \mid \#0(w) \times \#1(w) \text{ is even}\}$$

2. Do exercises 4.1.1, 4.1.2 a, e–h and 4.1.4
3. Do exercises 4.2.1, 4.2.2, 4.2.3, 4.2.4, 4.2.5 a–e, 4.2.13 and 4.2.15.
4. Do exercise 4.2.17.

Note: the statement can be easily proved if one considers the definition of strings given in the book. For the one we use in the lectures one needs to prove a more general lemma where the equality is true for any state and then instantiate this more general lemma on the starting state.

5. Write a program for the table-filling algorithm.
6. Prove that the equivalence of states is indeed an equivalence relation.
7. Do exercises 4.4.1 and 4.4.2.