Finite Automata Theory and Formal Languages
TMV027/DIT321 – LP4 2013

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 $\sharp i(w)$ 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

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

   (hint: look at example 4.2).

   Show however that the following language is regular

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

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.