

# Finite Automata and Formal Languages

## TMV026/DIT321 – LP4 2012

### Regular Languages

#### Week 4

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 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.