Theory of Computer Science

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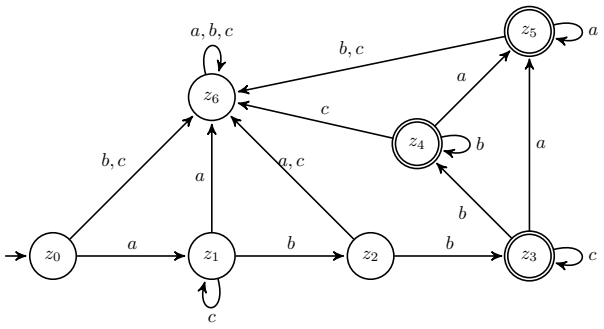
Exercise Sheet 5

Due: Sunday, April 2, 2017

Note: Submissions that are exclusively created with LaTeX will receive a bonus mark. Please submit only the resulting PDF file (or a printout of this file).

Exercise 5.1 (1.5 + 1.5 marks)
Consider the following DFA M:



(a) Which language does the DFA accept?

(b) Specify a *regular* grammar, which produces the same language.

Exercise 5.2 (1.5+1.5 marks)

(a) Specify a deterministic finite automaton that accepts the language of all words over $\Sigma = \{\mathtt{a}, \mathtt{b}\}$ that do *not* contain `abb` (e.g., ther word `aabba` is not contained).

(b) Specify a non-deterministic finite automaton that accepts the language of those words over $\Sigma = \{\mathtt{a}, \mathtt{b}\}$ that start with `ab` or contain `bab`.

Exercise 5.3 (2 marks)
Consider the following regular expressions over the alphabet $\Sigma = \{0, 1\}$. For each regular expression, specify two words that are in the corresponding language and two words that are not in the corresponding language.

(a) $110|1001$

(b) $1^*(01^*01^*)^*$

(c) $(0\varepsilon|1(0|1))(0|1)^*$

(d) $1(\varepsilon|0)|0\emptyset 1$

Exercise 5.4 (4 marks)
Are the following languages over $\Sigma = \{\mathtt{a}, \mathtt{b}, \mathtt{c}\}$ regular? If so, prove it by specifying a regular expression which describes the language. If not, prove it with help of the Pumping-Lemma.

(a) $L_1 = \{\mathtt{a}^n\mathtt{b}^m\mathtt{c}^{n+m} \mid n, m \in \mathbb{N}_0\}$

(b) $L_2 = \{\mathtt{a}^2\mathtt{b}^n\mathtt{a}^2\mathtt{c}^m \mid n, m \in \mathbb{N}_0\}$

Note on marking: One of the languages is regular, the other one is not. The subtask with the regular language is worth 1 point, the other subtask 3 points.