Formal Models SS 2020: Assignment 1

Based on Videos "Lecture 06. March 2014" and
"Lecture 13. March 2014" on our webpage.

Institute for Formal Models and Verification, JKU Linz

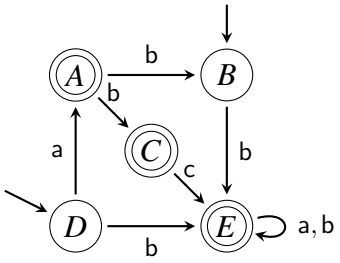
Due 19.03.2020

Guideline:

- To indicate that you solved an exercise, tick it off in our MOODLE course until **10am on the day of the exercise (19.03.2020)**. Unmarking and marking exercises later is **not** possible.
- **Upload your solved exercises in the Moodle course. Generate a single PDF file, which contains all solved exercises, your name, and your matriculation number. Upload the PDF file - do not generate a ZIP!** Not following the format leads to deduction of points!
- We will randomly select and correct solved exercises.
- A sample solution will be provided.

Exercise 1

Given the finite automaton (FA) A_1 as shown on the right. Specify A_1 formally as a 5-tuple, including all of its components. Is $\varepsilon \in L(A_1)$, $abc \in L(A_1)$ and $babb \in L(A_1)$? Is A_1 deterministic? Is A_1 complete? Justify your answers.



Exercise 2

Construct an FA $A_2 := (S_2, I_2, \Sigma_2, T_2, F_2)$ with $\Sigma_2 := \{a, b, c\}$ such that $L(A_2)$ exactly contains all words w over Σ_2 where each a is followed by one b and an arbitrary number of c (also none). Draw A_2 and specify it formally as a 5-tuple.

Exercise 3

Graphically describe an automaton which accepts the numbers 1 to 19 written in Roman style, i.e., the language is {I, II, III, IV, V, VI, VII, VIII, IX, X, XI, XII, XIII, XIV, XV, XVI, XVII, XVIII, XIX}.

Exercise 4

Let $P_3 := A_3 \times A_4$ be the product automaton of FA A_3 and FA A_4 as shown on the right. Draw P_3 and fully specify it formally as a 5-tuple. Find three words w with $w \in L(P_3)$. What is the maximum number of states P_3 can have in theory? Justify your answers.