ETH zürich
Departement Informatik

Theoretische Informatik

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`https://courses.ite.inf.ethz.ch/theoInf20`

Exercises – Sheet 1

Zürich, September 18, 2020

Remarks on solving the exercises:

- For all exercises (also on the following sheets), you have to argue the correctness of your solution. Simply providing a number or a formula is not sufficient.
- We recommend working on the exercises in small groups of up to three persons and handing in one common solution. Please indicate on your solution your names, student numbers, and the exercise group (number of the group, name of the teaching assistant, or the room number) *clearly legible*.
- Each new exercise sheet and exemplary solutions are made available after the lecture on Friday at `https://courses.ite.inf.ethz.ch/theoInf20`.

Exercise 1

(a) Let $n \in \mathbb{N}$. How many words of length n over the alphabet $\Sigma = \{a, b, c\}$ are there that contain each of the three letters at least once?

(b) We consider the alphabet $\Sigma = \{0, 1\}$ and a natural number $n \in \mathbb{N}$. Determine the number of words from Σ^n that do not contain 11 as a subword.

10 Points

Exercise 2

Prove or disprove the following statements:

(a) There is a non-empty finite language $L \neq \{\lambda\}$ satisfying $L^2 = L$.

(b) There are three languages L_1, L_2, and L_3 over the alphabet $\Sigma = \{0\}$ such that $L_1 \cdot (L_2 \cap L_3)$ is finite and $L_1L_2 \cap L_1L_3$ is infinite.

10 Points

Exercise 3

Prove that an infinite language L is recursive if and only if there is an algorithm enumerating L.

10 Points

Submission: Friday, September 25, by 11:15 at the latest, either into the boxes in room CAB F 17.1 or as a clearly legible PDF via e-mail directly to the respective teaching assistant.