



Exercises – Sheet 1

September 18, 2026

General instructions for solving the tasks:

- Please provide justification of your solutions to all tasks (also in the upcoming exercise sheets). It is not sufficient to only give a number or a formula.
- We recommend that you work on the exercises in small groups of up to three students and hand in one joint solution. Please *legibly* indicate your names, student numbers, and the exercise group (the weekday and room of the group or the name of the teaching assistant) on your solution sheets.
- New exercise sheets and solutions are made available after the lecture on Friday on Moodle (<https://moodle-app2.let.ethz.ch/course/view.php?id=29077>).
- Further, the first Moodle-quiz is available on Moodle. The quiz is to be handed in until Tuesday, September 22nd, until 08:00. You do not need to click “Submit all and finish”, open attempts will be submitted automatically.

Task 1

2 + 2 + 2 + 4 points

Let $k, l \in \mathbb{N} - \{0\}$ be given arbitrarily. For each of the subtasks, give an alphabet Σ and two languages L_1 and L_2 over Σ (depending on k and l) satisfying the respective conditions.

- (a) $|L_1| = k$ and $|L_1 L_2| = k + 1$,
- (b) $|L_1| = k$ and $|L_1 L_2| = k + 5$,
- (c) $|L_1| = k$, $|L_2| = l$ and $|L_1 L_2| = k \cdot l$,
- (d) $|L_1| = k$, $|L_2| = l$, $|\Sigma| = 1$, and $|L_1 L_2| = k \cdot l$.

(please turn the page)

Task 2

3 + 3 + 4 points

Let L_1 and L_2 be two arbitrary languages over an alphabet Σ and let $u, v \in \Sigma^*$. Prove or disprove each of the following statements:

(a) $(uv)^R = v^R u^R$,

(b) $(L_1 \cap L_2)^* = L_1^* \cap L_2^*$,

(c) $(L_1^*)^c = (L_1^c)^*$.