Important Information for the Exam Review:

- Grading *strictly* follows the correction scheme (see below).
- If you have complaints about your correction, be sure to refer to the correction scheme below.
- We reserve the right to lower your score when reassessing your solutions.
- Based on our data from other lectures, it is not advantageous to submit a multitude of complaints "just in case." Please refrain from doing so as it causes us a lot of work.
- The purpose of the review is to rectify errors in the correction. We do not answer questions. If you have questions about the solution to a problem, please ask them on Zulip.

The following types of complaints will be ignored without comment from us:

- "Based on the model solution, my idea was heading in the right direction, so I should get at least 1 point." – We strictly adhere to the correction scheme; if no points are allocated for the idea, none will be awarded.
- "I'm only one point away from passing; can't you evaluate my exam a bit more generously?" – Unfortunately, a line must be drawn somewhere.
- "The correction scheme is inappropriate; I had almost everything correct and still got no points. Please adjust it!" – We are aware that the correction scheme does not cover all possible cases. However, we must ensure that all submissions are evaluated in the same way. We do not make changes to the scheme during the exam review.
- "I received no points because my solution was too vague. What I actually meant was..." – We evaluate only what you wrote on the exam. Subsequent explanations of your thought process are unnecessary.

All Exercises

Follow-up errors and partial points are only awarded if explicitly provided for in the correction scheme.

In tasks where part of the solution involves selecting an answer, an incorrect response is evaluated as **0P**, except as mentioned below. Selecting the correct answer without providing an explanation is also evaluated as **0P**.

Problem 1

1c

-1P for each path or loop that is omitted. (If a path containing loops is omitted, they count separately.)

-1P for writing r^*s^* instead of $(r+s)^*$, where the latter would be correct.

1d

1P for "or" instead of "xor"

1e

1P if the automaton only accepts words where at some point aaa or bbb appears, but is otherwise correct.

1f

2P for the idea to take an ω-regular expression for L and replace every s^ω with s^*.

0P for the idea to take an ω-regular expression for L of the form $r\,s^\omega$, and use just r.

1g

3P if the counterexample does not work, but the correct idea is explained and the counterexample needs only minor adjustment (e.g. replacing $<$ with $\leq$).

Problem 2

2a

-1P for each transition mistake (one transition being unlabeled does not count as a mistake as long as the other transition has the correct label; swapping the labels of two transitions from the same state counts as one mistake).

-1P for each non-final state marked as final or unmarked final state (you can lose at most **2P** this way). Marking one final state as non-final and one non-final state as final counts as one mistake unless q or r are marked as final.

2b

+1P for each correct equivalence class (correct for the DFA you got in a)). If your DFA has more than four equivalence classes, you can only get **4P** this way if all equivalence classes are correct.

3P if the solution can be corrected by splitting one equivalence class in two

Problem 3

3a

4P for swapping the final and non-final states in the minimal DFA for L. Minimality of the DFA for $\overline{L}$ does not need to be argued.

3P if minimality of the DFAs is not mentioned

3b

0P for arguing that $L_1 \cup L_2$ has at most $2n$ residuals because you can place the DFAs side by side

Problem 4

4a

+1P each for boxes 1 and 2, **+2P** for box 3.

In box 1, $q_1 = q_2$ is incorrect, since also for $q_1 = q_\emptyset$ and $q_2 = q_\varepsilon$ we have to return $q_\emptyset$.

In box 1, $q_1 = q_2 \vee q_1 = q_\emptyset$ is correct, since it never answers wrong and contains the important cases (of the sample solution).

In box 3, **0P** for answers like diff(...). Box 3 has to contain an assignment to r_i, since r_i is otherwise undefined in the next line.

In box 3 both points for $r \leftarrow diff(q_1^{a_i}, q_2^{a_i})$, i.e. if the index i is missing only on r.

1P in box 3 for $r_i \leftarrow diff(q_1, q_2)$.

4b

+**1P** for every correct answer with sufficient justification.

We do not allow follow-up errors here. In particular writing a bad algorithm in a) such that b) is easy to argue is not allowed.

The slightly imprecise argument "some transition stays on the same level" is sufficient for p_1.

4c

+**1P** for the correct decision between polynomial and exponential.

+**2P** for choosing between the first three options correctly.

If multiple contradictory statement are chosen (namely at least two of the first three or both polynomial and exponential) then the corresponding points are lost.

Problem 5

Using the wrong alphabet, for example using a second row of $0, 1$ for the non-free variable x in b) and c), gives 0 points.

Writing an NFA instead of a DFA are also 0 points.

5a

2P for correct automaton, no special cases.

5b

2P for correct automaton, no special cases.

5c

1P if only the loop with $\binom{a}{1}$ is missing (which restricts X to first-order variables).

Leaving away the a and writing 0 for $\binom{a}{0}$ does not count as wrong alphabet.

Problem 6

6a

0P if the alphabet is wrong

-1P if Σ^* is outside the brackets or at the end of the expression in the bracket

-1P if $+\{p, q\}$ is missing

6b

0P if the alphabet is wrong

2P if the automaton also accepts words for which $p \wedge \mathrm{X}q$ holds only at every second position

-1P if only the set of final states is wrong

-1P for each "small" mistake (incorrect transition, missing transition, extra transition)

1P for a *correct* nondeterministic co-Büchi automaton

6c

0P if the alphabet is wrong

2P if the automaton recognizes $\mathrm{FG}(q\mathrm{U}p)$ or $\mathrm{G}(p\mathrm{U}q)$

1P if the automaton recognizes $\mathrm{FG}q$ or $\mathrm{FG}(p \vee q)$

-1P if only the set of final states is wrong

-1P for each "small" mistake (incorrect transition, missing transition, extra transition)