Chair of Algorithms
Department of Computer Science
Technical University of Munich

**Eexam**
Place student sticker here

**Note:**

- During the attendance check a sticker containing a unique code will be put on this exam.
- This code contains a unique number that associates this exam with your registration number.
- This number is printed both next to the code and to the signature field in the attendance check list.

# Master EFV August 2023

**Exam:** IN0000 / aptitude-08-2023
**Date:** Tuesday 22nd August, 2023
**Examiner:** Prof. Dr. [redacted]
**Time:** 10:00 – 11:30

|   | P 1 | P 2 | P 3 |
|---|---|---|---|
| I |   |   |   |

## Working instructions

- This exam consists of **8 pages** with a total of **3 problems**.
  Please make sure now that you received a complete copy of the exam.
- The total amount of achievable credits in this exam is 6 credits.
- Detaching pages from the exam is prohibited.
- Allowed resources:
  - one **analog dictionary** English ↔ native language
- The exam consists of Multiple-Choice questions only. Please note the following instructions:

*Mark correct answers with a cross* ☒
*To undo a cross, completely fill out the answer option* ■
*To re-mark an option, use a human-readable marking* ×■

- Do not write with red or green colors nor use pencils.
- Physically turn off all electronic devices, put them into your bag and close the bag.

Left room from ________ to ________ / Early submission at ________

## Problem 1 Logical Thinking (2 credits)

There are three types of people on the island of truth-tellers and liars: Truth-tellers who always tell the truth, liars who always lie, and ordinary people who lie sometimes and tell the truth other times. Out of three people A, B and C, there is exactly one truth-teller, exactly one liar, and exactly one ordinary person. They make the following statements one after another:
**A:** I am an ordinary person
**B:** The statement by **A** is true
**C:** I am not an ordinary person
Who is the ordinary person, who is the liar and who is the truth-teller among A, B and C?

☐ **A** is a liar, **B** is a truth-teller and **C** is an ordinary person.

☐ **A** is a truth-teller, **B** is a liar and **C** is an ordinary person.

☐ **A** is an ordinary person, **B** is a truth-teller and **C** is a liar

☐ **A** is a truth-teller, **B** is an ordinary person and **C** is a liar

☐ **A** is an ordinary person, **B** is a liar and **C** is a truth-teller.

☐ **A** is a liar, **B** is an ordinary person and **C** is a truth-teller

**Additional area for notes. (Not considered for points)**

## Problem 2 **Theoretical Computer Science (2 credits)**

Note: an *alphabet* $\Sigma$ is a finite set.
Convention: a nondeterministic finite automaton (NFA) has exactly one start state.

Let $A, B, C \subseteq \Sigma^*$ be languages. Which of the following statements is true?

☐ $|A||B| \leq |AB|$

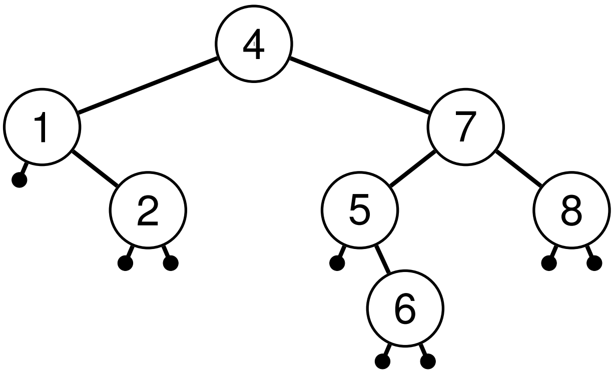
☐ $A \cup B^*$ is countable.

☐ $A \neq B \implies A^* \neq B^*$

**Additional area for notes. (Not considered for points)**

## Problem 3 AVL-Trees (2 credits)

Delete the element **1** from the following AVL-Tree. Choose the correct resulting tree from the choices below.



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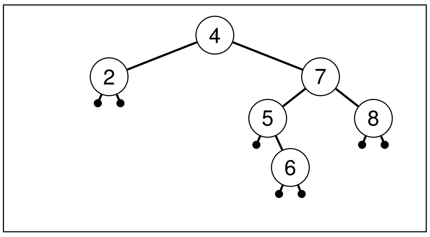

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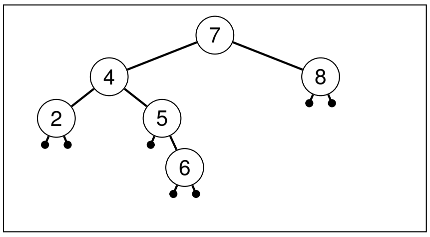

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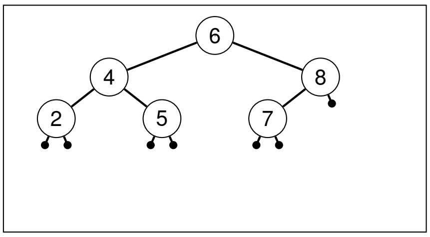

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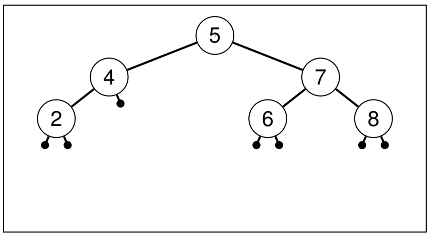

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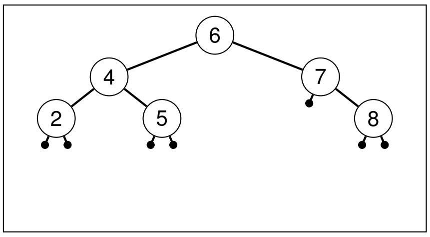

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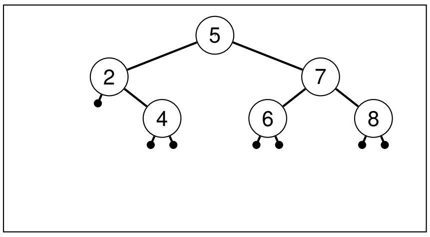

**Additional space for solutions–clearly mark the (sub)problem your answers are related to and strike out invalid solutions.**