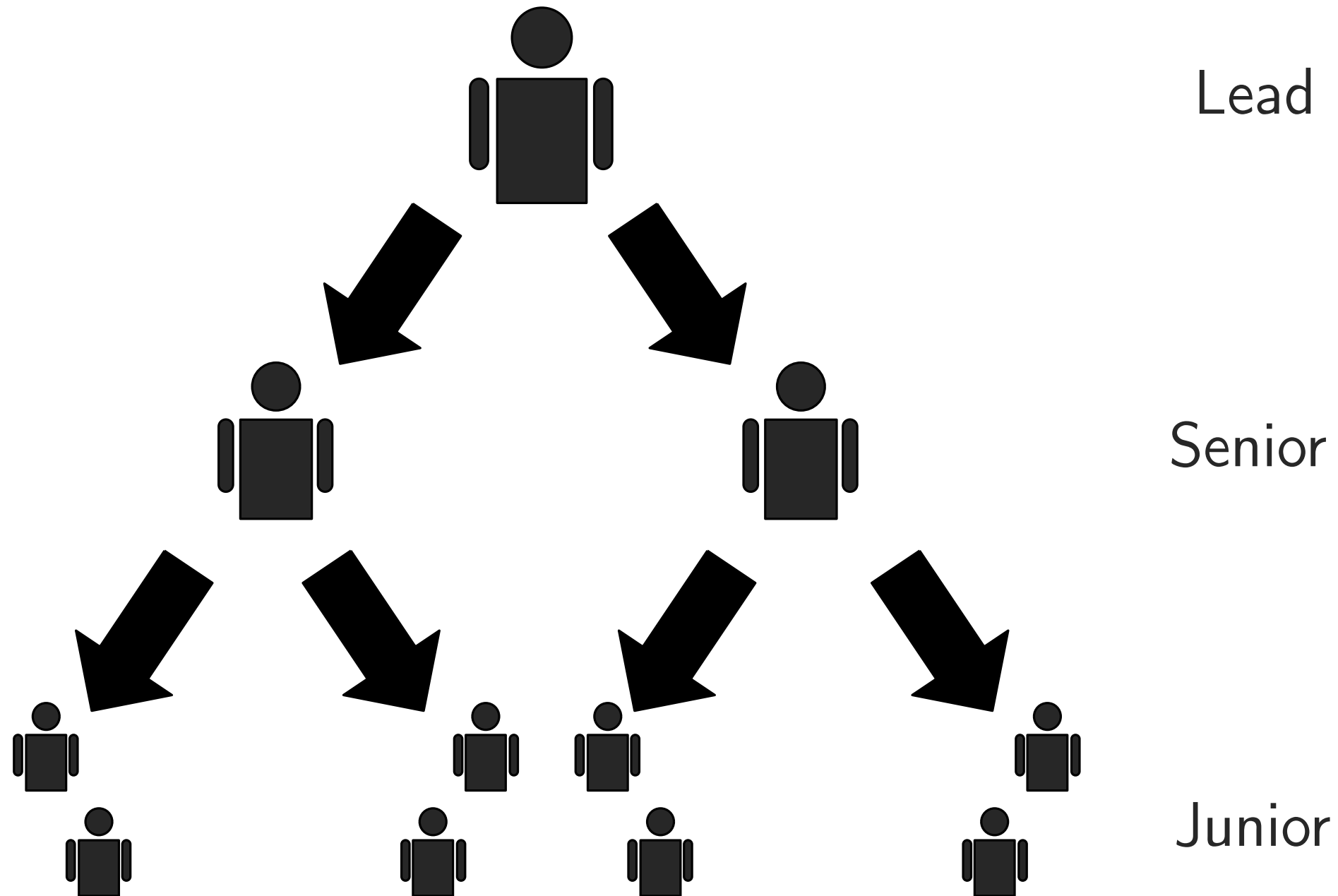


Discrete Algebraic Structures

WiSe 2025/2026

Prof. Dr. Antoine Wiehe
Research Group for Theoretical Computer Science

- Mathematics necessary for advanced topics in CS
- Advanced topics necessary for your future
- Long career ahead of you: only knowledge that will stick is math
- Need skills beyond prompting LLMs



- Room D2.022
- 4 groups: A-Fe (8:30–10:30), Ff-L (11:00–13:00), M-R (13:30–15:30), S-Z (16:00–18:00)
- one 2-sided A4 **handwritten** set of notes allowed, black/blue pen
- Tools to perform additions/multiplications with numbers are provided when needed
- Must have with you: login/password, identification with picture
- Due to complaints: Bonus points only count if your grade is enough to pass

For each question in blue:

- Minimum is 0 points
- Correct answers give $+x$
- Incorrect answers give $-x$
- “?” gives 0

Welche der folgenden Aussagen treffen zu?
Which of the following statements are true?

Wählen Sie für jede Antwortmöglichkeit aus, ob diese richtig oder falsch ist. Wenn Sie eine falsche Auswahl treffen, dann reduziert dies Ihre Punktzahl. Antwortmöglichkeiten, für die Sie keine Auswahl treffen, werden mit 0 Punkten bewertet.

A ☐ ☒ ☐ Die Vereinigung $\{0, \{1\}\} \cup \{1\} \cup \{1, 2\}$ ist $\{0, 1, 2\}$
The union $\{0, \{1\}\} \cup \{1\} \cup \{1, 2\}$ is $\{0, 1, 2\}$

B ☐ ☒ ☐ 2 ist ein Element von $\{\pi, \{\emptyset, 2\}\}$
2 is an element of $\{\pi, \{\emptyset, 2\}\}$

C ☐ ☒ ☐ Sei $f: A \rightarrow A$ eine surjektive Funktion. Dann ist $f \circ f$ auch surjektiv.
Let $f: A \rightarrow A$ be a surjective function. Then $f \circ f$ is surjective.

D ☐ ☒ ☐ Es gibt eine Injektion von $\mathcal{P}(\mathbb{N})$ nach \mathbb{Z}
There is an injective function $\mathcal{P}(\mathbb{N}) \rightarrow \mathbb{Z}$

Bad strategy
Guess

Good strategy

- Prove
- Check your answer

You need to know the following:

- check basic properties and answer multiple choice questions correctly:
 - sets: union/intersection/difference/symmetric difference/products,
 - functions: injectivity/surjectivity/bijectivity,
 - relations: (anti)reflexivity/(anti)symmetry/transitivity,
 - logic: logical equivalence/satisfiability/negation of a formula,
 - composition laws: associativity/commutativity/neutral element/inverse/distributivity
- compute
 - union, intersection
 - composition/inverse of functions,
 - transitive/reflexive/symmetric closure,
 - truth table
 - polynomial addition/multiplication/division,
 - GCD for numbers/polynomials,
 - Bézout coefficients,
 - modular inverses for numbers.
- write proofs concerning elementary concepts (sets, relations, functions, counting)