

Diskmath Week 3

Emil Straschil

A dark blue diagonal gradient bar that starts from the bottom left corner and extends towards the top right corner, covering the lower half of the slide.

Hello

I am Emil.

I have a **website**:

emils.site (yes thats the URL)

repo: <https://github.com/emil3tr/emil3tr.github.io>

All materials will be uploaded there.

Any Feedback / Questions /
Wishes / ... ?

→ estraschil@student.ethz.ch

→ “Emil” (floxi4) on dinfk-discord

→ Diskmath-questions: ask here
so others can benefit (:

Where are we right now?

Basics

Abstraction
Formulas
Statements
Prop. Logic
Pred. Logic
→ Proof Patterns

Sets and
Relations

Sets
Set Operations
Relations
Equivalence
Partial Order
Functions
Countability

Number Theory

Division
Primes
Modular Arith.
Diffie-Hellman

Algebra

Monoids
Groups
Euler Totient
RSA
Rings
Polynomials
Finite Fields
Err. Corr. Codes

Logic

Proof Systems
Logic
Calculi
Res. Calculus
Prop. Logic
Pred. Logic

Today

We have a lot to do...

1. Questions?
2. Last Serie
3. Recap Logic
4. Kahoot
5. PROOF PATTERNS DEEP DIVE
6. Exercise
7. (Sets?)
8. Outlook

I have some slides for you (:

Questions?

Last Serie

Logic Recap

What is important?

- Predicate Logic
- Lemma 2.1
- Quantifiers
- Quantifier Rules

You will see all of this again in chapter 6.

Predicates

Functions that either evaluate to true or false.

Allow us to “embed” non-logic into logic.

Example: $\text{prime}(x)$ is true only when x is a prime.

The Universe

Set of all elements that the formula
“works on”.

Quantifiers

\forall means “for all”

\exists means “exists”

Interpretations

An interpretation of a formula fixes:

1. The universe U
2. The meaning of the predicates
3. Other “free” symbols (more in chapter 6)

Example

$\forall x \exists y P(x,y)$ is a **formula**.

→ Interpretation:

- Universe are the natural numbers
- $P(x,y)$ is true exactly if y is greater than x

Now it is a statement!

Formulas from Sentences

Use the quantifiers and prop. logic to express the sentence as formula

Tips:

- “if x is A then x must also be B” becomes $\text{isA}(x) \rightarrow \text{isB}(x)$
- “y is the only A” becomes $\forall x (x=y \vee \neg \text{isA}(x))$

Example: “every even number is divisible by 2” becomes:

$\forall x (\text{even}(x) \rightarrow \text{divides}(2,x))$

Formulas from Sentences

Look at exercises from last week
for examples!

<https://discmath.ch/content/ch2/predicate-logic> also has examples
(scroll down to last example)

Kahoot

Disclaimer: Made by Tobias
Steinbrecher