Diskmath Week 3

Emil Straschil

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 / ... ?

- → <u>estraschil@student.ethz.ch</u>
- → "Emil" (floxi4) on dinfk-discord
- → Diskmath-questions: ask here so others can benefit (:

Where are we right now?

Basics	Sets and Relations	Number Theory	Algebra	Logic
Abstraction Formulas Statements Prop. Logic Pred. Logic Proof Patterns	Sets Set Operations Relations Equivalence Partial Order Functions Countability	Division Primes Modular Arith. Diffie-Hellman	Monoids Groups Euler Totient RSA Rings Polynomials Finite Fields Err. Corr. Codes	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.

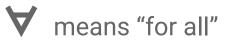
Allow us to "embed" non-logic into logic.

Example: prime(x) is true only when x is a prime.

The Universe

Set of all elements that the formula "works on".

Quantifiers



= 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 $isA(x) \rightarrow isB(x)$
- "y is the only A" becomes $\forall x (x=y \lor \neg isA(x))$

Example: "every even number is divisible by 2" becomes:

 $\forall x (even(x) \rightarrow divides(2,x))$

Formulas from Sentences

Look at exercises from last week for examples!

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

Kahoot

Disclaimer: Made by Tobias Steinbrecher