

Algebraic Topology I

October 12, 2026. Regensburg

Clara Löh

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Universität Regensburg

Team and homepage



Clara Löh



Franziska Hofmann



Tobias Hirsch

https://loeh.app.ur.de/teaching/topologie1_ws2627
GRIPS

Organisation

- ▶ **Lectures.** Mo 10:15–12:00/Thu 8:25–10:00, M 104
- ▶ **Exercise sessions.** In several groups;
distribution via GRIPS; registration by Wed 10:00
The exercise sessions will start in the second week

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Exercise sheets

- ▶ New set: Thu, 10:00
- ▶ Submission: by the following Thu, 8:20 (mailboxes/GRIPS)
- ▶ Maximal team size: 2
- ▶ **First exercise sheet: Sheet 1, Submission: 22.10.2026**
- ▶ Instructions: homepage, GRIPS, first exercise session, below

Smallprint

▶ Course work/Studienleistung

Successful participation in the exercise classes:

- ▶ at least 50% of the regular credits and
- ▶ presentation of at least one solution in class

▶ Examination/Prüfungsleistung

Oral exams (25 minutes)

- ▶ Dates: will be announced later
- ▶ Re-exam: by individual appointment

▶ ECTS

9 ECTS (modules: BV, MV, MGAGeo)

Details

- ▶ https://loeh.app.ur.de/teaching/topologie1_ws2627/org.pdf
- ▶ Modulkatalog/Prüfungsordnung

The future

- ▶ There will be a course in SS 2027 that is compatible with this course

Material



- ▶ **Lecture notes**
will be updated after each lecture
- ▶ **Further literature**
a selection is contained in the lecture notes

O tempora . . .

Recent developments

During the semester break . . .

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Joscha Sauer. www.nichtlustig.de

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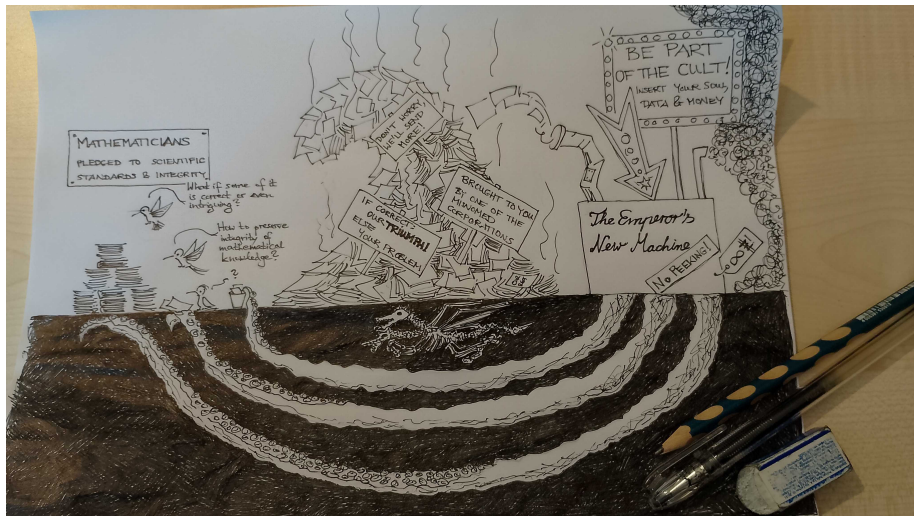


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... the mathematical world has changed.

What happened?



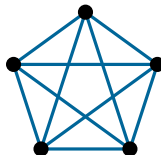
The key virtues of Mathematics persist

In times of inflation. Focus on lasting values!

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- ▶ Creating and using precise language
- ▶ Employing precise and transparent reasoning
- ▶ Explaining methods
- ▶ Embracing the power of abstraction
- ▶ Searching for unifying ideas
- ▶ Modelling complex situations
- ▶ Encouraging critical questions
- ▶ Cultivating independent rational thinking



Machine-assisted Mathematics

Types of machine-assisted Mathematics

- ▶ Algorithmic calculation (numerically and exact)
- ▶ Proof assistants
- ▶ LLM generation of
 - ▶ mathematical prose
 - ▶ code in proof assistants

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Principal scope and limitations

- ▶ Gödel's completeness theorem of first order logic
- ▶ Gödel's first incompleteness theorem
- ▶ Gödel's second incompleteness theorem
- ▶ Recursive enumerability of all true first order sentences
- ▶ Undecidability of arithmetic

Using LLMs

Machine-assisted Mathematics is here to stay

“Was einmal gedacht wurde, kann nicht mehr zurückgenommen werden.”
Friedrich Dürrenmatt. Die Physiker [Möbius, zweiter Akt]

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Service providers for LLM tools in academic research

- ▶ AI Services by GDWG

<https://docs.hpc.gwdg.de/services/ai-services>

- ▶ in particular: ChatAI

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interactive access to several internally hosted models

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Transparency

- ▶ All use of tools must be declared transparently
- ▶ Take responsibility for everything written in your name

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... is **not** “having” “the” “perfect” “solution”!



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Teleport!



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- ▶ Getting familiarised with new terminology, concepts, theorems, methods, and proof strategies



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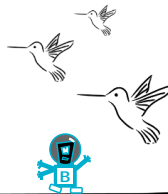
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- ▶ Improving mathematical communication skills in writing, discussions, presentation
- ▶ Learning about possible pitfalls, mistakes, misconceptions first hand



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 - ▶ how exactly you used the models
Which strategies, prompts, agents? ...

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Which strategies, prompts, agents? ...
- ▶ Submitting a certificate in a proof assistant is not sufficient
 - ▶ solutions in proof assistants need to be human-comprehensible and
 - ▶ be accompanied by a justification
why/how the formalised statement corresponds to the original claim