Syllabus Formalized Mathematics in Lean (P2A1, P4A1). WiSe 24/25

Instructor: Floris van Doorn, office *Endenicher Allee 62* room 1.002,
vdoorn@math.uni-bonn.de

Tutor: Adrian de Lon, adelon@uni-bonn.de

Class times: Lecture on Tuesday 16:00 - 18:00 and exercise session on Friday 12:00 - 14:00.
Location: PC-Pool, Endenicher Allee 60, annex building.

Office Hours: My office hours are Thursday 14:00 - 15:00 or by appointment.

About the course: In this course you will learn how to explain mathematical theories to a computer using a computer program called Lean. Using the language of Lean you can write mathematical definitions, theorems and proofs, and then Lean can check whether your proofs are correct and contain no holes. In this course we will learn how to interact with Lean and write your own proofs in it, and we will prove basic results in various mathematical topics, including algebra, topology and analysis. You will choose a topic to formalize yourself and give a presentation about this formalization.

Goals:

- Learn to explain mathematics to the computer program Lean
- Improve your understanding of mathematical proofs
- Learn some new mathematics
- Learn computer skills (VSCode, git)
- Personal project management skills

Recourses:

- The online textbook *Mathematics in Lean* by Jeremy Avigad and Patrick Massot
- Learning recourses on the Lean website:
  https://leanprover-community.github.io/learn.html

Registration: Make sure to register for this course on both Basis and eCampus.

Homework: There will be a weekly set of homework problems. You have to hand-in the homework on Tuesday before class.
For the second half of the course, you are required to do a formalization project yourself, where you formalize a small mathematical theorem or some definitions and their properties. There will be time to work on this during the class, but most of the work has to be done outside the class. You have the freedom to choose the topic of formalization, or you can select one of the suggested projects by the professor.
You have to give an presentation about your project towards the end of the course. During your presentation you should explain the mathematical concepts that you formalized, and talk about the formalization itself (what went well? What was hard?). The duration of the presentation depends on the number of registered students, but will roughly be 30 minutes.

Grades: Your work will be weighted as follows.

- Homework problems 20%;
- Project 50%;
- Presentation 30%.

Code of conduct and ombudspersons:
Everyone attending this class will contribute to an inclusive and welcoming environment where we all treat each other professionally and with mutual respect, regardless of origin, beliefs, physical ability, gender or sexual identity. Discriminatory, racist, sexist, exclusionary, bullying, or harassing behavior will not be tolerated. In the event that you witness inappropriate behavior, please consider intervening if it is safe for you to do so and / or informing an ombudsperson. You might also consider contacting the victim and offering help.
The ombudspersons can be contacted at any time in the event of conflict between individuals, perceived misconduct, or any form of harassment. They are bound by secrecy.
The ombudspersons in mathematics are currently:
Dr. Regula Krapf (`krapf@math.uni-bonn.de`), Mathematical Institute
Dr. Jack Davies (`davies@math.uni-bonn.de`), Mathematical Institute
For more information, see
`https://www.mathematics.uni-bonn.de/en/department/fachgruppe-mathematik#fgombud`