Introduction to Formal Reasoning

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September 2024

Module Information

- Module code: COMP2068
- Total credits: 10
- Level: 2
- Target students: Only available for Level 2 computer science and computer science with AI students.

Summary of Content

- This module is an introduction to formal reasoning with applications in program verification and mathematics.
- We use an interactive proof system Lean to learn how to make precise statements and how to verify them using formal proofs.

Topics

- Propositional logic
- Classical logic
- Predicate logic
- The Booleans
- The Natural Numbers
- Lists and Trees

Educational aim

This module aims to develop mathematical and formal reasoning skills to specify and reason about programs and mathematical problems.

Lectures and Labs

- Lecture materials
  - lecture notes in HTML with embeded lean code available online
  - lecture slides in PDF
- Continuous assessment
  - Lean exercises
  - Support in lab
- Class test: limited time, using Lean 3.

What and when?

- Lectures: 2 pm on Tuesdays, DB-C05
- Labs
  - group 1: 9 am on Fridays, IAMET 406
  - group 2: 11 am on Fridays, IAMET 406
- Tutorials
  - group 1: 10 am on Fridays, IAMET 406
  - group 2: 12 at noon on Fridays, IAMET 406

Assessment

- Coursework (25%)
  - 4 small courseworks, each worth 3%
  - a class test under exam conditions, 13%
- Written exam (75%)

Academic Misconduct

- You cannot use answers that you have obtained from anyone else, this includes other students and some external person. Using such methods is unfair to other students, and are serious misconduct offences with severe penalities.
- We have the right to use many methods (including Turnitin) to detect such cases.
- Successful completion means that you are able to explain your solution during the lab.
- Do not post your solutions anywhere.
- Do not post the Coursework or Exam questions anywhere.
- Do not seek help for assessment answers on social media.

Communication 1

If you have a question, then

- ask it in the lecture,
- ask it after the lecture,
- ask it in the lab,
- ask it in the tutorial,
- ask it on the Moodle discussion forum,
- ask it during the office hours,
- if (and only then) it is a personal issue, please send us an email from your university account and include the module code (COMP2065).

Communication 2

If you know the answer, then

- say it in the lecture,
- say it in the tutorial,
- help people in the lab, but **do not give them the solution**,
- answer on the Moodle discussion forum, but **do not post answers to the coursework**.

Reading

The main textbook:

Thorsten Altenkirch, *Introduction to Formal Reasoning*, 2023, `https://people.cs.nott.ac.uk/psztxa/comp2065.23-24.ifr-notes/_build/html/index.html`

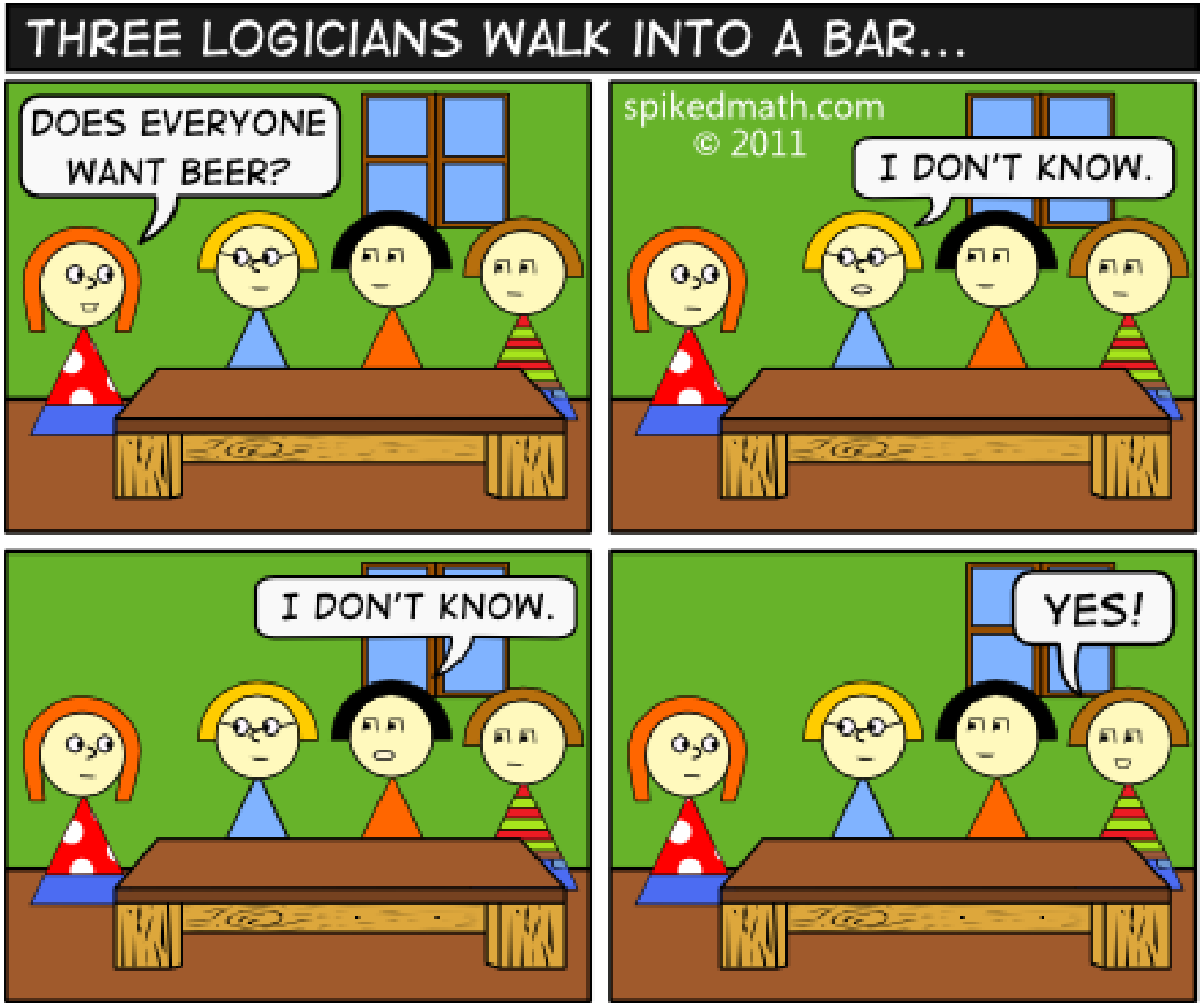
Additional reading:

- Jeremy Avigad, Leonardo de Moura and Soonho Kong, *Theorem proving in Lean*, Microsoft Research, 2015.
- Anne Baanen, Alexander Bentkamp, Jasmin Blanchette and Johannes Hölzl, *The Hitchhiker's Guide to Logical Verification*, 2020.

Software

- We are using the Lean prover, available on Windows, Linux and OSX.
  Make sure to install **Lean 3** not Lean 4.
- Lean can be used online via a browser.
- Lean is available on the lab machines.
- Lean can be used via Visual Studio Code (recommended).
- We offer no support with installation issues.
- However, you can help each other. Use the Forum!

Three logicians walk into a bar



http://spikedmath.com/445.html