Methods 1: Logic

Introduction, overview, & practicalities

Michael Franke

Why are you here?

Logic puzzle

There are two villages. In the honest village (H) everybody always speaks the truth. In the dishonest village (D) everybody always says the opposite of what is true.
Before you the road splits: one way leads to the honest, the other to the dishonest village.
At the splitting there is a man. He may be from village H or D, you don't know.
What do you ask the man to find out where the honest village is?

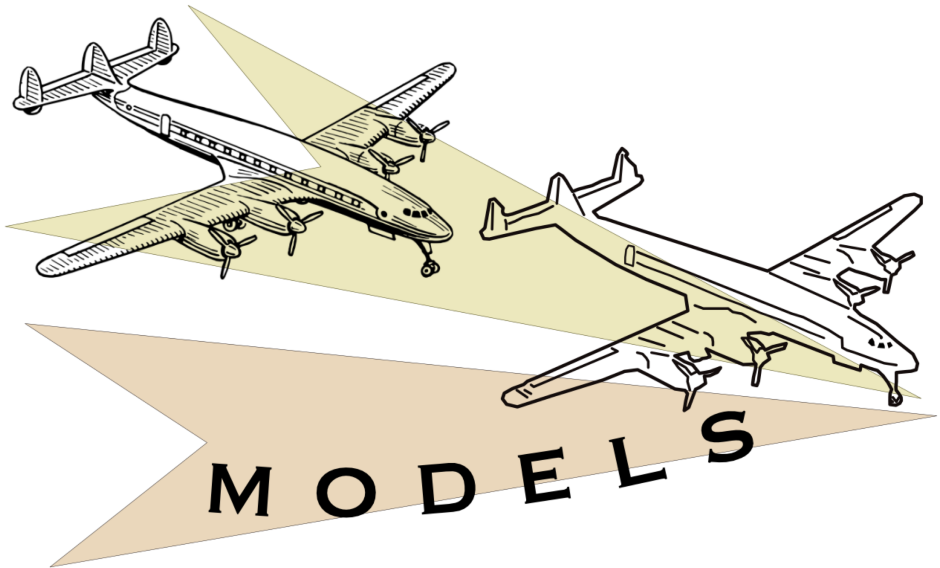
honest village	man	where're you from?
left	honest	"left"
left	dishonest	"left"
right	honest	"right"
right	dishonest	"right"

What is logic?

proof entailment meaning

All Europeans are human.
All humans are mortal
Therefore, all Europeans are mortal.

Modeling



Logis as a *normative* model: how language & thought *should* be

proof	entailment	meaning
argumentation	inference	precision of expression

The focus of this course is more on logic as a tool in psychological / linguistic explanations. There will be less emphasis on the role of logic in the foundations of mathematics (so-called logicism).

Big-picture learning goals

- understand the significance of logic for the development of modern Linguistics, Philosophy, Cognitive Science and AI
  - formal language theory (with syntax & semantics); meta vs object language
  - picture theory of meaning and correspondence theory of truth
  - symbol-manipulation theory of human cognition
- distinguish “good reasoning” from “fallacious reasoning”, as well as “logical entailment” from “commonsense entailment”
- be able to excavate the logical structure of natural language sentences and represent it in logical notation

What is **a** logic?

- there are different kinds of logic
- a logic is a formal system that captures some structural properties of meaning
- this course will cover three logics:
  1. propositional logic [meaning of connectives *and*, *or*, *not* . . .]
  2. predicate logic [meaning of quantifiers *all*, *some*, *none* . . .]
  3. modal logic [meaning of epistemic attitudes *belief*, *knowledge* . . .]

Course content

- set theory
- (informal) proofs
- propositional logic
- predicate logic
- natural deduction
- modal (epistemic) logic
- probability theory
- information theory

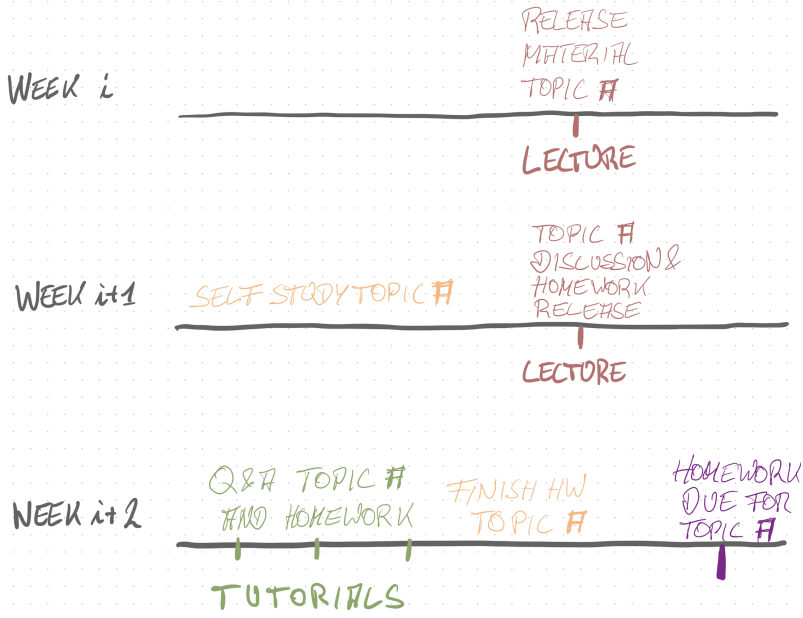
	topic
1	Course overview
2	Basics of (naive) set theory
3	Proofs
4	Relations
5	PropLog: Syntax
6	PropLog: Translations & logical validity
7	PropLog: Natural Deduction
8	PredLog: Syntax
9	PredLog: Semantics
10	Modal logic
11	Probability theory
12	Information theory
13	Recap
14	Final exam

Practicalities

- enroll for this course on **moodle**
- necessary for
  - assessing course material
  - receiving notifications
  - asking questions in the forum
  - submitting homework
  - receiving feedback on homework

Best practice guide

1. self-study
   - prepare the assigned reading material before the lecture
   - bring questions, know what you don't know, ask and probe
2. lecture
   - provides motivation, context and overview
   - focuses on conceptual understanding
3. homework [start as early as possible each week]
   - discussion with others is allowed & encouraged
   - write-up & submissions must be made individually
   - ask general questions on moodle, but do not share solutions
4. tutorials [go to at least one tutorial every week!]
   - start working on homework questions before the tutorial(s)
   - emphasis on hands-on support for exercises


WEEK i
RELEASE MATERIAL TOPIC #
LECTURE
WEEK i+1
SELF STUDY TOPIC #
TOPIC # DISCUSSION & HOMEWORK RELEASE
LECTURE
WEEK i+2
Q&A TOPIC # AND HOMEWORK
FINISH HW TOPIC #
HOMEWORK DUE FOR TOPIC #
TUTORIALS

How to get answers

- general questions (for everyone to see) about content:
  - use the “General Questions” section on moodle
- confidential, non-content-related questions:
  - email to lecturer

do not use moodle’s messaging system!!

Homework

- **no copying from others** [plagiarism will lead to failure]
- release: Thursday after lecture
- submission:
  - Friday 18:00 (one week after release)
  - electronically via moodle as PDF
  - handwritten (legible) or typeset (as PDF)

Exam