Logic as a Knowledge Representation Language

Chapter 7.4–7.8, 8.1–8.3, 8.5

Some material adopted from notes by Andreas Geyer-Schulz and Chuck Dyer

Logic roadmap overview

- **Propositional logic**
  - Problems with propositional logic
- **First-order logic**
  - Properties, relations, functions, quantifiers, …
  - Terms, sentences, wffs, axioms, theories, proofs, …
  - Variations and extensions to first-order logic
- **Logical agents**
  - Reflex agents
  - Representing change: situation calculus, frame problem
  - Preferences on actions
  - Goal-based agents

Disclaimer

"Logic, like whiskey, loses its beneficial effect when taken in too large quantities."

- Lord Dunsany

Big Ideas

- **Logic**: great knowledge representation (KR) language for many AI problems

- **Propositional logic**: simple foundation and fine for many AI problems

- **First order logic (FOL)**: more expressive as a KR language; needed for many AI problems

- **Variations** on classical FOL are common: horn logic, higher-order logic, modal logic, three-valued logic, probabilistic logic, fuzzy logic, etc.

AI Use Cases for Logic

Logic has many usecases even in a time dominated by deep learning, including these examples:

- Modeling and using knowledge in the Hunt the Wumpus game

- Allowing agents to develop complex **plans** to achieve a goal and create optimal plans

- Defining and using semantic **knowledge graphs** such as schema.org and Wikidata

- Adding **features** to neural network systems

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