

Reasoning with Logic in AI

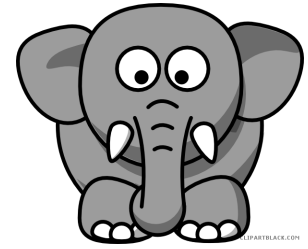


Chapters 7, 8.1–8.3, 9

Logic roadmap overview

- **Basic concepts, Hunt the Wumpus use case**
- **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

For starters...



- What is knowledge?
- How can we represent knowledge?
- How can we use it to help understand the world, what people say, what we see?
- Possible example:
 - All elephants are grey
 - Clyde is an elephant
 - What color is Dumbo?
- Logic as knowledge motivated by this example
- But there's much more to knowledge

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 use cases 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](https://www.wikidata.org/)
- Supporting common sense reasoning
- Adding features to neural network systems

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