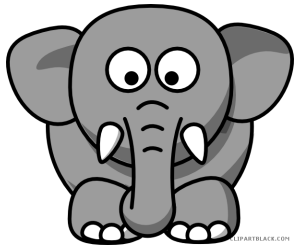
Realoing with Logic in AI

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
- Supporting common sense reasoning
- Adding features to neural network systems

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