Title: Logical Agents
AIMA: Chapter 7 (Sections 7.1, 7.2, and 7.3)

Introduction to Artificial Intelligence
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Outline

- Knowledge bases
- Wumpus world
- Logic for Knowledge Representation & Reasoning
  - Syntax
  - Semantics
  - Inference mechanisms: complexity, completeness

  Propositional logic/sentential logic
  Predicate logic/first-order logic

Knowledge Base

A fact in the world: A representation of a fact in the world
A sentence= a representation of a fact in the world in a formal language

A Knowledge Based (KB): A set sentences
A set (of representations) of facts about the world

Issues: Access to KB, Representation (language), Reasoning (inference)

Level of Knowledge

Agents can be viewed at various levels:

1. **Epistemological**:
   Abstract description of what the agent knows about the world

2. **Logical**:
   Encoding of knowledge into sentences

3. **Implementation**:
   Actual implementation (lists, arrays, hash tables, etc.)
   - Very important for performance of agent
   - Irrelevant for higher levels of knowledge

A simple KB-agent

function KB-AGENT(*percept*) **returns** an *action*
static: *KB*, a knowledge base
t, a counter, initially 0, indicating time

TELL(*KB*, MAKE-PERCEPT-SENTENCE(*percept*, *t*))
action ← ASK(*KB*, MAKE-ACTION-QUERY(*t*))
TELL(*KB*, MAKE-ACTION-SENTENCE(*action*, *t*))
t ← *t* + 1
return *action*

The agent must be able to:

- represent states, actions, etc.
- incorporate new percepts
- update internal representations of the world
- deduce hidden properties of the world
- deduce appropriate actions

Knowledge-Based Agent

function KB-AGENT(*percept*) **returns** an *action*
static: *KB*, a knowledge base
t, a counter, initially 0, indicating time

TELL(*KB*, MAKE-PERCEPT-SENTENCE(*percept*, *t*))
action ← ASK(*KB*, MAKE-ACTION-QUERY(*t*))
TELL(*KB*, MAKE-ACTION-SENTENCE(*action*, *t*))
t ← *t* + 1
return *action*

Perceives: Tells KB about new percepts (new sentences)
Representation: MAKE-PERCEPT-SENTENCE

Access to KB: Asks KB about actions to take (inference)
Two primitives: ASK and TELL hide reasoning details

Acts: Tells KB about actions (new sentences)
Representation: MAKE-ACTION-SENTENCE,
MAKE-ACTION-QUERY