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

Introduction to Artificial Intelligence
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Berthe Y. Choueiry (Shu-we-ri)
choueiry@cse.unl.edu, (402)472-5444

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

```plaintext
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

```plaintext
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