

AI lecture, October 2, 2006
AIMA, Chapter 7, Sections 7.1–4

- A. Discussion of 5.11 & 5.13 and maybe a little about NP-completeness.
 B. Assignment: Read Sections 7.1–4 and practice at learnprolognow.org with Prolog on the network.

C. Logical Agents: Statement Logic

I always confused Propositional Logic with Predicate Logic, so I'm going to call the first Statement Logic instead. You already know some about it from Boolean Algebra. Statement Logic is an example of Boolean Algebra.

1. What does an agent know?

a. Need a knowledge representation language (KRL).

- An ontology picks out the things, relations, and functions.
- For example, in the monkey & bananas problem, the floor was not mentioned.
- For example, in the game of Clue®, Colonel Mustard, the Conservatory, the Lead Pipe are things.
- We will eventually use Prolog:
 - " Visit learnprolognow.org; download swi-prolog.org.
 - " It does some of predicate logic, but not all.
- A declarative approach to KRL, not a procedural approach, as OOP would be.

b. We will use statement logic as our KRL in this chapter. An alphabet stands for statements; that is, things that are either true or false.

- and: \wedge , symbol given first in math and then in Prolog
 or: \vee ;
 not \neg not just like with truth tables in earlier courses
 implies \Rightarrow :- $a \Rightarrow b$ is shorthand for $\neg a \vee b$.
 it's not "can prove b from a"; it's not "a causes b"!
 iff: \Leftrightarrow shorthand for $(a \Rightarrow b) \wedge (b \Rightarrow a)$

c. Example: $p \wedge q \Rightarrow \neg q$ What assignments of p, q will make this true? false?

- Call assignments of truth a "possible world" or a "model" of the (compound) sentence.
 $m \models \alpha$. E.g. $\{p=\text{true and } q=\text{false}\} \models p \wedge q \Rightarrow \neg q$.

We say m **satisfies** α .

- Satisfaction, as I said in my September 29 lecture notes, is a CSP.
- Then we allow m to be a single sentence, $\alpha \models \beta$, " α entails β " means for all truth values assigned to the letters of α , then β is true. We discover this by "model checking" (which is exponentially complex without help).
- Tautology $\models \beta$ (always true, valid)
- Contradiction $\models \neg \beta$ (always false)
- Deduction Theorem: $\alpha \models \beta$ if and only if $\models \alpha \Rightarrow \beta$
- Entailment is a relationship between sentences, but they represent or model the world.

• Contrast	<u>about the language</u>	<u>in the language</u>
	$\alpha \models \beta$	$\alpha \vdash \beta$
	entailment	implication
	truth tables	$\neg \alpha \vee \beta$
		or inference algorithm
	semantics	syntax

- Statement logic is **sound**: Everything derived is entailed. (Derivation preserves truth.)
- Statement logic is **complete**: Everything entailed is derived.

d. Wumpus world: Performance, Environment, Actuators (fwd, right, left, grab, shoot), Sensors (stench, breeze, glitter, bump)