CS 730/730W/830: Intro AI

What is KR?

Prop. Logic

Reasoning

2 handouts: slides, assignment 2 730W entries were due

What is KR?

- What is KR?
- History of Logic
- Advice Taker
- The PSSH

Prop. Logic

Reasoning

Introduction to Knowledge Representation and Reasoning

What is Knowledge Representation?

What is KR?

What is KR?

History of Logic
Advice Taker
The PSSH
Prop. Logic
Reasoning

- Representing facts
- Reasoning with facts

Can computers be meaningful?

History of Logic

What is KR?

■ What is KR?

■ History of Logic

- Advice Taker
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Prop. Logic

Reasoning

Philo of Megara (5C BC): truth tables

Aristotle (322BC): tautologies of proper arguments

Leibniz (1646-1716): inference as math-like logic (but bogus system)

George Boole (1854): *The Laws of Thought* (almost propositional logic)

Gottlob Frege (1879): Conceptual Notation (propositional and first-order logic)

Dartmouth Conference (1956): modern AI movement CYCorp (1984-, www.cyc.com): slightly more complicated than first-order logic

The Advice Taker (1958)

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John McCarthy: "Al", Lisp, time-sharing

Empirical Philosophy = Science

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Prop. Logic

Reasoning

The Physical Symbol System Hypothesis: A physical symbol system has the necessary and sufficient means for general intelligent action. (Newell and Simon)

where a

Symbol is a designating pattern that can be combined with others to form another designating pattern

and

Designation means standing in for something in the world

What is KR? Prop. Logic Prop. Logic Logic An Example Break Reasoning

Propositional Logic

Propositional Logic

What is KR?

Prop. Logic

■ Prop. Logic

- Logic
- An Example
- Break

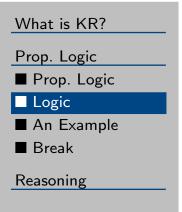
Reasoning

$$it - is - raining$$

$$i - am - wet$$

$$it - is - raining \rightarrow i - am - wet$$

Logic



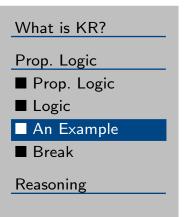
A logic is a formal system:

- syntax: defines sentences
- semantics: relation to world
- inference rules: reaching new conclusions

three layers: proof, models, reality

flexible, general, principled

Encode in Propositional Logic



If the unicorn is mythical, then it is immortal, but if it is not mythical, then it is a mortal mammal. If the unicorn is either immortal or a mammal, then it is horned. The unicorn is magical if it is horned.

Break

What is KR?

Prop. Logic

Prop. Logic

Logic

An Example

Break

Reasoning

- asst 1:
- asst 2: first-order logic
- office hours
- third exam: 10:30-11:50 May 11, N133

What is KR?

Prop. Logic

Reasoning

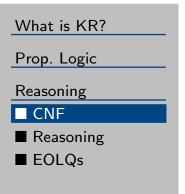
CNF
Reasoning

Reasoning

EOLQs

Reasoning

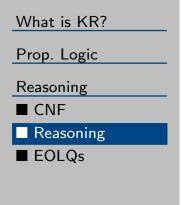
Conversion to Conjunctive Normal Form



Syntax: $\land, \lor, \neg, \rightarrow (\supset, \Rightarrow), \leftrightarrow$

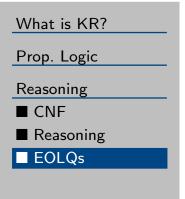
- 1. eliminate \leftrightarrow
- 2. eliminate ightarrow
- 3. move \neg inward: $\neg \neg x$, $\neg (x \land y)$, , $\neg (x \lor y)$
- 4. distribute \vee : $x \vee (y \wedge z)$

Propositional Reasoning



modes ponens resolution (do unicorn proof)





Please write down the most pressing question you have about the course material covered so far and put it in the box on your way out.

Thanks!