

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?

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Prop. Logic

Reasoning

- Representing facts
- Reasoning with facts

Can computers be meaningful?

History of Logic

What is KR?

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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: “AI”, Lisp, time-sharing

Empirical Philosophy = Science

What is KR?

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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*

x	y	$x \wedge y$
T	T	T
T	F	F
F	T	F
F	F	F

x	y	$x \rightarrow y$
T	T	T
T	F	F
F	T	T
F	F	T

$\frac{x \quad x \rightarrow y}{y}$ modus
ponens

$\wedge, \vee, \neg, \rightarrow (\supset, \Rightarrow), \leftrightarrow$

What is KR?

Prop. Logic

■ Prop. Logic

■ Logic

■ An Example

■ Break

Reasoning

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

What is KR?

Prop. Logic

■ Prop. Logic

■ Logic

■ **An Example**

■ Break

Reasoning

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
- EOLQs

Reasoning

Conversion to Conjunctive Normal Form

What is KR?

Prop. Logic

Reasoning

■ CNF

■ Reasoning

■ EOLQs

Syntax: $\wedge, \vee, \neg, \rightarrow (\supset, \Rightarrow), \leftrightarrow$

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

Propositional Reasoning

What is KR?

Prop. Logic

Reasoning

■ CNF

■ Reasoning

■ EOLQs

modes ponens

resolution (do unicorn proof)

EOLQs

What is KR?

Prop. Logic

Reasoning

■ CNF

■ Reasoning

■ EOLQs

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!