Logical Modeling

The IDP³ System and the FO(·) Language

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The IDP$^3$ System and the FO(·) Language

Overview

- IDP$^3$: *Inductive Definition Programming*
- FO(·): *First Order + Extensions*

https://dtai.cs.kuleuven.be/software/idp
FO(·) formulae differ from FO formulae in two ways:
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FO($\cdot$) in Detail

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▶ it is a many-sorted logic
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- terms are extended by aggregate terms
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Many-sorted Logic (informally)

▶ variables have an associated type, and
▶ each type has an associated domain.
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Aggregate Terms

- functions over a set of domain elements and associated num. values,
- mapped e.g. to the sum, cardinality, minimum value of the set.
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FO(·) in Detail

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- **Vocabularies**
  - Declare a set of types and typed symbols.
    - Predicate names (types) and (typed) constants.
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- **Theories**
  - Consist of sentences and definitions over a vocabulary.
  
  ▶ Definitions are of the form $\forall \bar{x} : p(\bar{x}) \leftarrow \phi[\bar{x}]$, where $\phi$ is an FO(·) formula.
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- **Structures**
  - Specify factual data over some vocabulary.
    - Thus, a (partial) interpretation of the symbols in its vocabulary.
The \( \text{IDP}^3 \) System and the FO(\( \cdot \)) Language

\( \text{IDP}^3 \) main inference tasks

The *model expansion* inference

Given a theory \( \mathcal{T} \) and a vocabulary \( \Sigma \), a partial interpretation \( \mathcal{I} \) over \( \Sigma \) and an “output” vocabulary \( \Sigma_{\text{out}} \subseteq \Sigma \).

- Search for interpretation of \( \Sigma_{\text{out}} \) such that an extension exists to \( \Sigma \) that also extends \( \mathcal{I} \) and is a model of \( \mathcal{T} \).