

ON DESCRIPTION LOGICS

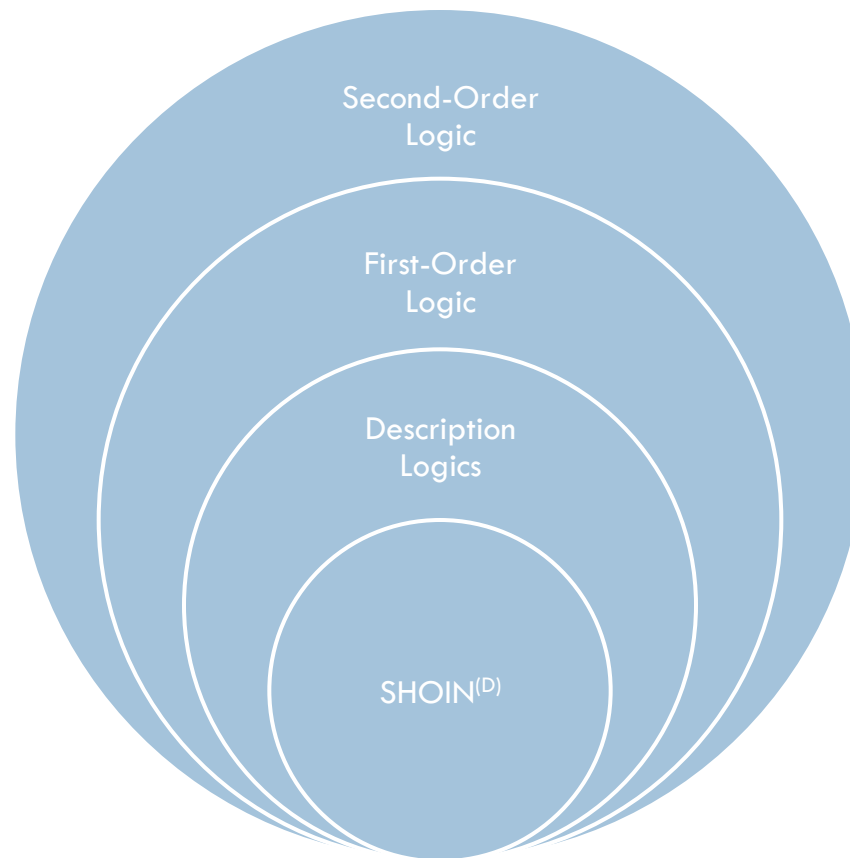
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DL's vs. First-Order Logic



- First-order logic (FOL) is very expressive, but is only semi-decidable
- DL's are a subset of FOL with limited expressiveness as a trade-off for decidability or more efficient decision problems
- Not all DL's are the same – there are many varieties depending on which operators are allowed

Expressiveness



DL Operators

- DL's are typically named by the operators they allow, showing their expressivity:
 - AL: Attributive Language
 - C: Complex Concept Negation
 - S: ALC with Transitive Roles
 - H: Role Hierarchy
 - O: Nominals
 - I: Inverse Properties
 - N: Cardinality Restrictions
 - ^(D): Use of Datatype Properties
- SHOIN^(D) (OWL-DL is based on this) is a DL that allows all of these operators

DL Operators

- Some more operators:
 - F: Functional Properties
 - U: Concept Union
 - E: Full Existential Qualification
 - Q: Qualified Cardinality Restrictions
- SHOIN^(D), for example, is a DL without existential qualification (E), and therefore cannot express many things that can be expressed in FOL
 - $\exists x(\text{Person}(x) \wedge \forall y(\text{Time}(y) \rightarrow \text{Hungry}(x)))$

Trade-Offs



- Why use DL's?
 - ▣ Can be fully decidable, unlike FOL
 - ▣ Even when semi-decidable, can still have much more efficient decision problems
- What is lost from FOL?
 - ▣ Expressivity – Every operator lost is expressivity lost
 - ▣ Completeness – Can no longer derive every truth

Questions

