

Description Logics

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UIC CS 421

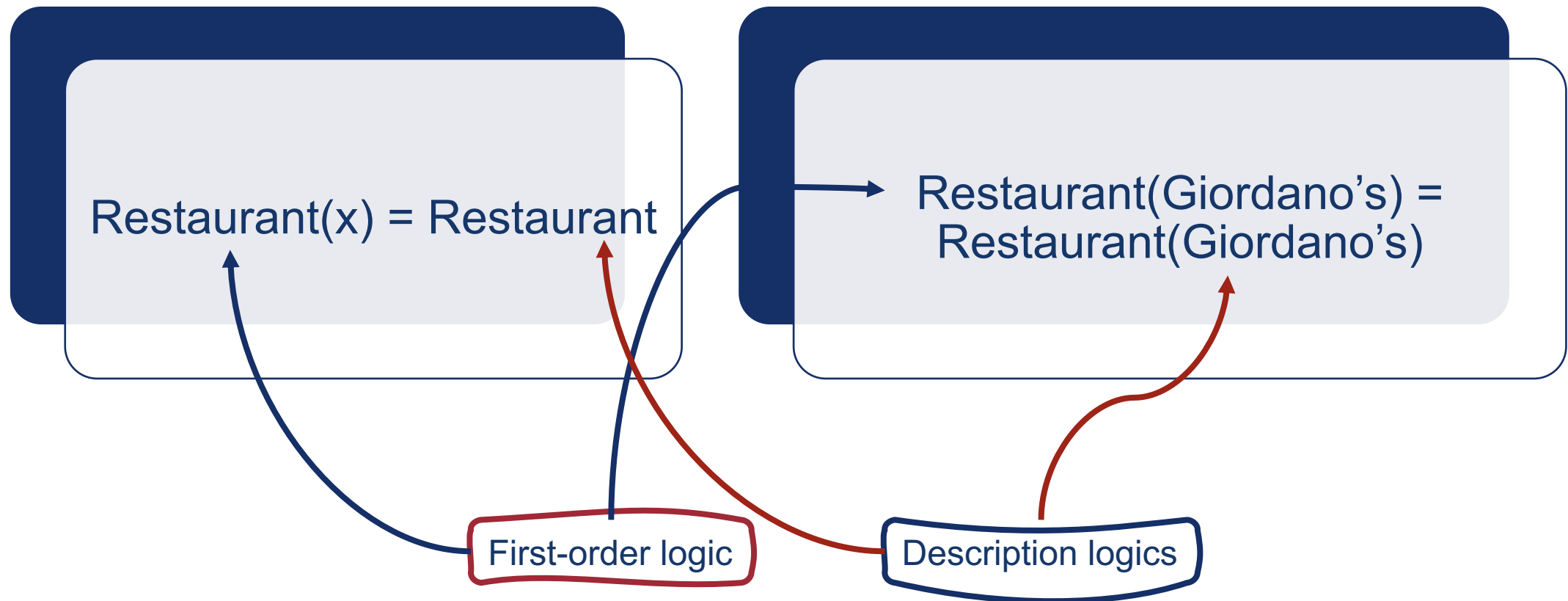
Description Logics

- How to add increased structure to semantics defined by models so far?
 - **Description Logics:** Different logical approaches that correspond to subsets of first-order logic
- More specific constraints make it possible to model more specific *forms* of inference

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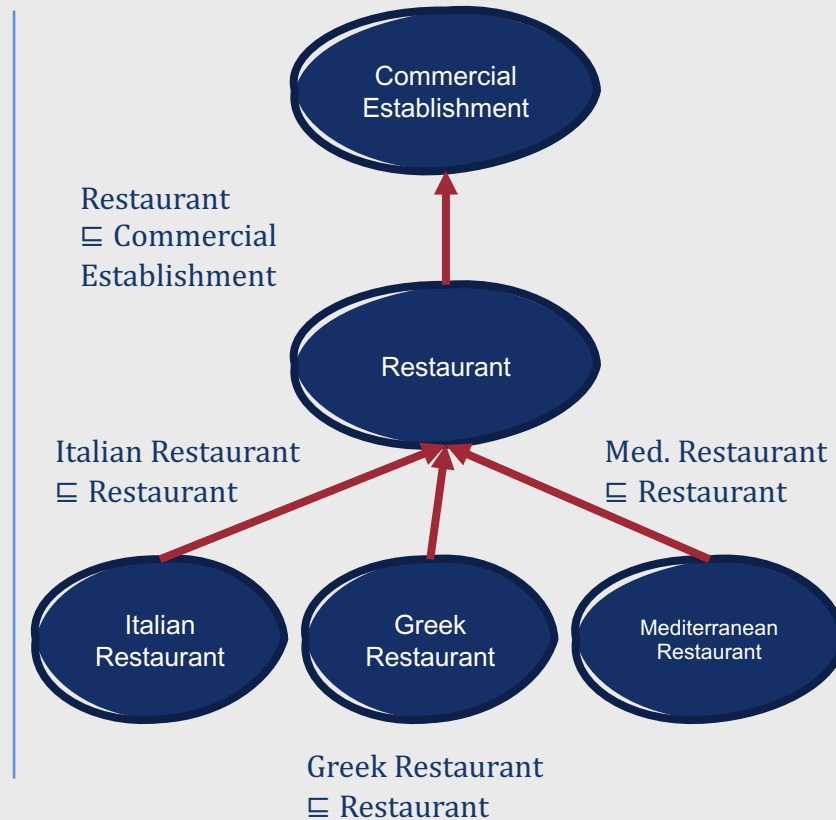
- Represent knowledge about:
 - Categories
 - Individuals who belong to those categories
 - Relationships that can hold among those individuals
- **Terminology:** The set of categories comprising a given application domain
- **TBox:** The portion of the knowledge base containing the terminology
- **ABox:** The portion of the knowledge base containing facts about individuals
- **Ontology:** Hierarchical representation of subset/superset relations among categories

Representation



Hierarchical Structure

- Can be directly specified using subsumption relations between concepts
 - **Subsumption:** All members of category C are also members of category D , or $C \sqsubseteq D$



Category Membership

- Coverage or disjointness can be further specified using logical operators
 - Italian Restaurant \sqsubseteq NOT Greek Restaurant
 - Restaurant \sqsubseteq
OR (Italian Restaurant, Greek Restaurant, Mediterranean Restaurant)

Category Membership

- Relations provide further information about category membership
 - Italian Cuisine \sqsubseteq Cuisine
 - Italian Restaurant \sqsubseteq Restaurant $\sqcap \exists \text{hasCuisine.ItalianCuisine} = \forall x \text{ItalianRestaurant}(x) \rightarrow \text{Restaurant}(x) \wedge (\exists y \text{Serves}(x, y) \wedge \text{ItalianCuisine}(y))$

Hierarchical Structure

- Relations also allow us to explicitly define necessary and sufficient conditions for categories
 - Italian Restaurant \sqsubseteq Restaurant $\sqcap \exists \text{hasCuisine.ItalianCuisine}$
 - Greek Restaurant \sqsubseteq Restaurant $\sqcap \exists \text{hasCuisine.GreekCuisine}$

Inference

- Subsumption as a form of inference
 - Based on the facts in our terminology, does a superset/subset relationship exist between two concepts?

