IDS Lecture 7: Predicate Logic 2

Satisfiability and Validity

A formula is: Satisfiable : if it has a model.

Unsatisfiable if it has no models.
Falsifiable is thre is some interpretation that is not a model.
Valid (tautology) is every interpretation is a model.

Equivalence

Equivalence ($\equiv$) Two formulas are *logically equivalent* if they have the same models.

Universal and Existential Quantification

Universal Quantification ($\forall$)

Everyone taking IDS is smart:

$$\forall x(Takes(x, dbs) \rightarrow Smart(x))$$

- typically $\rightarrow$ is the main connective with $\forall$

Existential Quantification

Someone takes IDS and fails:

$$\exists x(Takes(x, dbs) \wedge Fails(x, dbs))$$

- typically $\wedge$ is the main connective with $\exists$

Quantifier duality

Each quantifier can be expressed using the other.

$$\forall x \text{ Likes}(x, cake) \equiv \neg\exists x\neg \text{ Likes}(x, cake)$$

$$\exists x \text{ Likes}(x, broccoli) \equiv \neg\forall x\neg \text{ Likes}(x, broccoli)$$

Equivalence Properties

Commutativity, Associativity, Distributivity, Idempotence, Absorption, De Morgan, Implication

Safety

Safety A query is safe if it gives a finite answer on all databases and this answer does not depend on the universe Δ.