Logic Programming - 1

Datalog

Prolog facts → Relational Database

- One Predicate per row; One fact per row

Prolog Rules → Relational Views

- Intentional definition; materialised when needed

Prolog Queries → Relational Algebra

Prolog allows us to use declarative problem specifications as an executable solution generator. This means formalising a problem amounts to solving a problem. Prolog clauses can be viewed both declaratively (as denoting a logical formula) and also procedurally (as a way of unfolding a query).

Prolog:

```
teenager(X) :- (Male(X) ; Female(X)), age(X, Y), Y > 12, Y < 20.
```

Declarative:

$$\forall X \forall Y (teenager(X) \leftarrow (Male(X) \wedge female(X)) \wedge age(X, Y) \wedge Y > 12 \wedge Y < 20$$

Prolog's logically specified definitions can be queried in ways that go beyond their original purpose. For example, if we can specify how to concatenate two lists then the inverse is splitting the resultant list. This can break the correspondence between declarative and procedural semantics and limit the ways in which definitions can be queried.

Arithmetic operators require grounded arguments.

Logic programming is not classical logic, prolog's core syntax restricts first-order logic (to definite clausal normal form). Prolog's core semantics extend first-order logic (to minimal model constructors)

Prolog assumes false atmos with no reason to suggest that they may be true.

- This allows prolog to compute relations that are not class

FINISH THIS SECTION ONCES SLIDES ARE RELEASED

Variables: X Y - denote arbitrary objects (in some implicit domain)

Constants: Oliver Peter - denote specific objects

Functions: mother/1 father/1 denote mappings between objects

Propositions: p q - represent unstructured assertions

Predicates: happy/1 loves/2 represent object properties and relations

For example:

if x(y(z)) is a well-formed ground formula of first-order classical logic where x, y and z are symbols.

X must be a predicate since if it was a function the expression is no longer a formula. y must be a function and z must be a constant.

A term is a constant c, variable X or a function f of arity n applied to an n-tuple of terms.

An atom is a proposition p or predicate r of arity n applied to an n-tuple of terms.

A formula is an atom; a logical constant; a negation of a formula; a conjunction, a disjunction

FINISH THIS SECTION ONCE SLIDES ARE RELEASED

To facilitate the storage of logical formulae in memory and simplify inference procedures it's convenient to transform formulae into some restricted subsets of First-Order Logic (FOL) known as normal forms.