Logic Programming
Implementation

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An **instance of a rule** is a rule in which all variables have been consistently replaced by ground terms.

Rule

$$ r(X,Y) :\!:=\! p(X,Y) \land \neg q(Y) $$

Herbrand Universe

$$ \{a, b\} $$

Instances

$$ r(a, a) :\!:=\! p(a, a) \land \neg q(a) $$
$$ r(a, b) :\!:=\! p(a, b) \land \neg q(b) $$
$$ r(b, a) :\!:=\! p(b, a) \land \neg q(a) $$
$$ r(b, b) :\!:=\! p(b, b) \land \neg q(b) $$
Given a rule $r$ and a dataset $\Delta$, we define $\nu(r,\Delta)$ to be the set of every $q$ such that (1) $q$ is the head of an instance $r'$ of $r$, (2) every positive subgoal of $r'$ is a member of $\Delta$, and (3) no negated atom in $r'$ is in $\Delta$.

Data: $\{p(a,b), p(a,c), p(b,a), q(c)\}$

Rule: $r(X,Y) :- p(X,Y) \& \neg q(Y)$

Result: $\{r(a,b), r(b,a)\}$
Ruleset

\[
p(X) :\text{ :- } \text{edge}(X,Y)
\]

\[
q(X,Y) :\text{ :- } \text{edge}(X,Y)
\]

\[
q(X,Y) :\text{ :- } \text{edge}(Y,X)
\]

\[
r(X,Y) :\text{ :- } \text{edge}(X,Y) \& \text{edge}(Y,X)
\]

\[
s(X,Y) :\text{ :- } \text{edge}(X,Y)
\]

\[
s(X,Z) :\text{ :- } \text{edge}(X,Y) \& s(Y,Z)
\]

\[
t(X,Y) :\text{ :- } p(X) \& p(Y) \& \sim s(X,Y)
\]

Dataset

\[
\text{edge}(a,b)
\]

\[
\text{edge}(b,c)
\]

\[
\text{edge}(c,d)
\]

\[
\text{edge}(d,c)
\]