Exercises for the Course

Logic Programming Engineering

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Practical 1

Introduction: Facts, Database Questions, Negation as Failure, Rules, Trace

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Exercise 1.1

The following facts are given as a database in the file family.pl:

```
male(ali).      male(carl).    male(ed).      male(frank).   male(hugo).
male(kurt).     male(rene).    male(vico).    male(tino).

female(berta).  female(dora).  female(guna).  female(ina).   female(jane).
female(laura).  female(mia).   female(olga).  female(wera).  female(susan).
female(uta).

father(ali, guna).   father(ali ,hugo).   father(carl, ina).   father(carl, jane).
father(ed, kurt).    father(frank, mia).  father(frank, olga). father(hugo, wera).
father(hugo, rene).  father(hugo, vico).  father(kurt, tino).  father(kurt, uta).

mother(berta, guna). mother(berta, hugo). mother(dora, ina).   mother(dora, jane).
mother(guna, mia).   mother(guna, olga).  mother(ina, wera).   mother(ina, rene).
mother(ina, vico).   mother(jane, susan). mother(laura, tino). mother(laura, uta).
```

You can get this database as a file from the homepage of Logic Programming Engineering. Save this file into your local directory.

1) Ask the database questions like

   a) *"Who is daughter of ina?"*,
   solution: ?- mother(ina, Child), female(Child). gives Child = wera
   b) *"Who has a male and a female child"*,
   c) *"Is there a person who is sister of a male person?"*,
   d) *"Is ina not a child of ali?"* and
   e) *"Is there a child whose father is not ali?"*.

2) Define rules for

   a) parent(X,Y) - X is part of parents of child Y.
   Example: $? - parent(X, vico)$. gives $X = hugo$; and $X = ina$ (and $X = ina, Y = hugo$).

   b) parents(X,Y,Z) - X is the father and Y is the mother of Z.
   Example: $? - parents(X, Y, vico)$. gives $X = hugo$, $Y = ina$.

   c) brother(X,Y) - X is brother of Y.
   Example: $? - brother(hugo, X)$. gives $X = guna$.

   d) grandpa(X,Y) - X is grandpa of Y.
   Example: $? - grandpa(X, rene)$. gives $X = ali$ and $X = carl$.

   e) aunt(X,Y) - X is aunt of Y.
   Example: $? - aunt(X, susan)$. gives $X = ina$.

   f) cousin(X,Y) - X is cousin of Y.
   Example: $? - cousin(X, rene)$. gives $X = mia$, $X = olga$, and $X = susan$.

   We assume that a father and a mother with the same child are married.

Exercise 1.2

Assume that a, b, $c, \ldots$ are points in a plane. Some of these points are joined by a line. This is described by facts $line(X, Y)$ if there is a line from point X to point Y.

A possible database for lines is:

```
line(a, b).  line(c, b).  line(d, a).
line(b, d).  line(d, c).  line(d, e).
```

Define a rule which proves if the following is in the plane:

a) a triangle,

b) a quadrangle.

How can we realise this for

c) a triangle,

d) a quadrangle.

if we use terms $point(X, Y)$ instead of names to describe points with coordinates (X, Y)? Which points are jointed with a line is described in a database.

A possible database for lines is:

```
linep(point(1, 2), point(3, 4)).
linep(point(2, 1), point(6, 0)).
linep(point(3, 4), point(2, 1)).
linep(point(6, 0), point(3, 4)).
linep(point(2, 1), point(1, 2)).
```