

Exercises for the Course
Logic Programming Engineering

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Practical Session 8

Backtracking III: Finding all Solutions of a Goal, Cut, Breadth-First Search

Exercise 8.1

Consider again the facts and results of exercise 2.1.

a. Define a predicate

fathers(Fathers) which gives the list *Fathers*, the set of all persons who are fathers.

Example: `?- fathers(Fathers).` yields $Fathers = [ali, carl, ed, frank, hugo, kurt]$.

b. Do the similar with grandpas.

Example: `?- grandpas(Grandpas).` yields $Grandpas = [ali, carl, ed]$.

Hints for realization in Prolog:

You find the above database as file *lfamily.pl* at the homepage of Logic Programming Engineering. For the realization of predicates *fathers* and *grandpas* use the built-in predicate *setof* and the existence operator $\hat{.}$. Read about built-in predicate *setof*, *bagof*, and *findall* in chapter 11 of book K. Apt: From Logic Programming to Prolog.

See the differences between *bagof*, *setof*, and *findall* in the file *bagof_setof_findall.pl* at our homepage.

Exercise 8.2

Define a predicate *split(L, P, N)* which for a list of numbers *L* returns a list of non-negative numbers in *P*, and a list *N* of the negative numbers in *L*.

a. without cut,

b. using cut.

Example: `?- split([4, -7, 2, 0, -6], P, N)` yields $P = [4, 2, 0]$, and $N = [-7, -6]$.

Use the trace command to count the numbers of Calls and Redos before and after optimization.

Exercise 8.3

For the given maze of exercise 7.1 find shortest ways from one room to another using the breadth-first search strategy.

Example: `?- maze(c, d, W).` yields

$W = [c, e, d]$;

$W = [c, b, d]$;

$W = [c, f, e, d]$;

false.

Hints for realization in Prolog:

Download the file *bf.pl* from homepage of LPE, and use this implementation of breadth-first search strategy in your program.

Exercise 8.4

Download solution of exercise 7.3 from our homepage. Find now a solution with minimal number of moves using breadth-first search.