Practical "Introduction to Artificial Intelligence"

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Block 1: Prolog

Sheet 7: Cuts and Negation

Hints:

- *In Block 1 (Prolog) you do not have to submit your solutions to me. Just solve the excercies and discuss your problems and solutions.The aim of Block 1 is that you become familiar with the prolog programming.*
- *If you do not succed with a task, just delay it and try it again later. Some constructs need time to settle in the brain and will become easier as you get more experienced.*

Preparation (at home):

Read Chapter 10 of LearnPrologNow!.

Excercise 7.1

Reproduce the examples from the chapters of LearnPrologNow! on your machine and solve the excercises.

Excercise 7.2

The following program ist given:

```
a(X, Y) :- b(X, Y).
a(1, 1).
b(X, X) :- c(X).
b(X, Y) :- c(X), !, c(Y).
b(X, Y) :- c(X), c(Y).
c (2) .
c (3) .
```

Draw the search tree for the following query:

```
?- a(X, Y).
```

Excercise 7.3

The Fibonacci numbers are recursively defined as follows:

fib(1) = 1
fib(2) = 1
fib(N) = fib(N-2) + fib(N-1) for *N > 2*

Now consider the following prolog program that should be used to compute the Fibonnacci-numbers:

```
fib(1,1).
fib(2,1).
fib(N,F):-
     N2 is N-2,
     fib(N2,F2),
     N1 is N-1,
     fib(N1,F1),
     F is F2 + F1.
```

a) Does this program compute the Fibonacci numbers? Justify why.

b) If the answer for a) is "no", change the program by inserting cuts so that it works correctly.

Excercise 7.4

Write a predicate `not_member/2`, so that `not_member(X, L)` is true for a term `X` and a list `L` iff `X` can not be unified with any element from `L`.
Don't use any built-in predicates beside cut and `fail/0`. (read the documentation for `fail/0`)

Excercise 7.5

Reconsider Excercise 2.5. Change your program so that it minimizes arbitrary expressions. Especially, your program should only deliver solutions which are really minimal.
Example input: `2 * a + sin(3 * 5 + 6) * a`

Excercise 7.6

Look through your solutions from the last excercise sheets. For which of these there are unnecessary remaining choicepoints after a successful solution?
Select three of these and improve them by inserting cuts so that they don't leave unnecessary choice points.

Excercise 7.6

Write a program that can solve Sudoku puzzles. Choose one or more of the following meanings:

- Your program creates a sudoku board which is filled completely
- Your program creates a sudoku board which is filled partly (and there exists a solution for ist)
- Your program gets a partly filled Sudoku board as input and creates one/all solutions.