Exercises for the Course

Logic Programming Engineering

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Practical Session 7
Backtracking II, Depth First Search

Exercise 7.1
Given the following maze:

\[ a \rightarrow b \rightarrow c \]
\[ \downarrow \quad \downarrow \quad \downarrow \]
\[ d \quad e \quad f \]

Find a pathway from one given room to another given room, without entering any room twice.

Hints for realization in Prolog:
Define a predicate `maze(Room1, Room2, Way)` which computes the way from room `Room1` to room `Room2`, and returns the solution `Way` as a list of rooms. The existence of a door between two rooms is described as a fact `door(room1, room2)` (e.g. `door(a, b)`).

Example: `?- maze(a, d, W)`. yields
\[ W = [a, b, c, f, e, d] ; \]
\[ W = [a, b, c, e, d] ; \]
\[ W = [a, b, d] ; \]
false.

Exercise 7.2
From a pack of playing-cards we take 4 cards and place them side by side on a desk. Peter has a glance at the order of cards, and later he remembers the following facts:

1. A knight was laying immediately to the left of a heart card.
2. A queen was laying immediately to the right of a spade card.
3. A diamond card was laying immediately to the right of a king.
4. A club card was not laying immediately next to a heart card but immediately to the left of an ace.

Use a Prolog program to find the original arrangement of the cards.
Exercise 7.3

Six coins are laying on a desk in the following order:

head head head tail tail tail

In one move you can flip two coins which are laying side by side.
(flipping means: head → tail, tail → head).

Which sequence of moves is needed for the following arrangement of the coins?

tail head tail head tail head

Write a Prolog program which solves this problem.

Hints for realization in Prolog:

Use the search procedure from exercise 7.1 by changing the predicate maze(Room1, Room2, Way) to coins(From, Goal, Way). The search starts now with coins([h, h, h, t, t, t], [t, h, t, h, t, h], Way) (h - heads, t - tails). Instead of way(From, To) use move(From, To) where the predicate move([X1, X2, X3, X4, X5, X6], [Y1, Y2, Y3, Y4, Y5, Y6]) realizes a move which flips two coins (5 cases). For turning over a coin from X to Y (X and Y have values h or t) define facts for an auxiliary predicate flipcoin(X, Y).