Searching in Prolog

1. Assume we have the following directed edges in the cyclic graph edge(a,b), edge(b,c), edge(a,d), edge(d,e), edge(d,f), edge(f,a), and edge(f,g). Test the predicates go/3, go1/4, and go2/4 defined in Lecture 13. Why does the Prolog answer “no” for the following query:

   ?-go(a,g,X).

   Hint: What is the result of query ?-member(a,X).

2. Consider the following game. There is a board with 3 black counters, 3 white counters and a single empty space.

   The aim is to make a sequence of moves that exactly interchange the black and the white counters. The rules for moving are as follows:

   You must alternate moving a black counter and a white counter.
   Each counter can move horizontally or vertically into the one empty space.
   Each counter can jump horizontally or vertically over one other counter (of either colour) into the empty space (like in checkers/draughts).

   Write a Prolog program to find all possible ways of doing this without looping. For example if we query:

   ?-play(w,s(w,w,w,e,b,b,b),s(b,b,b,e,w,w,w),S,R).

   Prolog should reply e.g:

   S=[s(w,w,w,e,b,b,b),s(w,e,w,b,b,b),...,s(b,b,b,e,w,w,w)]

   R=[[w,2,4],[b,6,2],[w,4,6],...,[w,4,6]].

   Here [w,2,4] denotes the move of white counter from position 2 to 4. Of course instead of “...,” the output should contain pertinent history of visited states.

   What is the upper bound for the maximal number of different possible configurations. Check the query:

   ?-play(_,s(w,w,w,e,b,b,b),s(b,b,e,w,w,b,w),_,_).

   What does this answer mean? Hint: first solve the problem for play/4 with no R variable.

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