

## CS\_125 Logic Programming – Exercises 3 (not assessed)

**Question 1.** Implement the following simple game between two players (Alex and Betti): A player,  $P$ , is given a number  $n$ . If  $n < 10$ , then  $P$  can make a move which consists in adding either 1 or 2 to  $n$  and passing the result to the other player. A player has lost if he cannot make a move.

Implement this game as follows:

- (a) Represent a configuration of the game by a term `conf(N,P)`, where  $N$  is number and  $P$  is either `a` (Alex) or `b` (Betti). `conf(N,P)` is the configuration where it is  $P$ 's turn to play.
- (b) Define a predicate `move/2` such that `move(C,D)` means that it is a correct move to pass from configuration  $C$  to configuration  $D$ .
- (c) Implementing a winning strategy: Define a predicate `won` such that `won(C)` holds iff  $C$  has a winning strategy, that is, there is winning strategy for the player at configuration  $C$ . Use the following idea:

$C$  has a winning strategy iff

- $C$  has not terminal lost, and
  - $C$  can make a move to some  $D$  such that  $D$  does *not* have a winning strategy.
- (d) Selecting the next move: Define a predicate `select_move` that computes from a configuration  $C = \text{conf}(N,P)$ , where player  $P$  has not terminal lost, the configuration  $D$  obtained from  $C$  by the action taken by  $P$ :
    - if Alex plays, the action is to be entered from the keyboard (use `read`).
    - Betti, however, searches for a move from  $C$  to a configuration  $D$  where Alex doesn't have a winning strategy. If she is unsuccessful she asks for help (entered through the keyboard).
  - (e) Running the game: The game starts with Alex and number 0. To run the game at configuration  $C$  do the following:
    - if  $C$  has terminal lost then stop and write a corresponding message;
    - otherwise, select the next move  $D$  and run the game with  $D$ .

**Question 2.** Use the predicates `findall`, `bagof`, `setof` to implement the following:

- (a) Computing a list of all permutations of a given list.
- (b) The intersection of two finite sets sets of numbers, where sets are resented as ordered lists.
- (c) The difference of two finite sets sets of numbers, where sets are resented as ordered lists.