

Question 2. (“The Bet”)

Consider the following game: A group of players is asked to submit a natural number between 1 and 1000. The lowest number which is submitted exactly once will win. The player who has submitted the winning number will be the winner.

Because the members of the group all like Prolog very much they agreed to submit their bets as Prolog-facts in the form

`bet(< id > , < number >).`

You as a skilled Prolog programmer are asked to help the group to determine the winning number and the winner. A file containing all bets can be found under

http://www.cs.swan.ac.uk/~csarnold/CS_125/list_of_bets.pl

For solving this task, proceed in the following way:

1. Define a predicate `min_in_list/2` which computes the minimal element of a list of numbers: e.g. the query `min_in_list([3,2,7],M)` should produce the answer `M = 2`.
2. Define a predicate `list_of_singletons/2` such that `list_of_singletons(K,L)` succeeds if and only if `L` is the list of elements of list `K` which occur exactly once.
E.g., the query `?- list_of_singletons([a,3,a,3,4,b],L)`. should produce `L = [4,b]`, where `?- list_of_singletons([a,a,a,a],[a])`. and also `?- list_of_singletons([a,a,a,a,b],b)`. should produce `No`.
3. Define a predicate `winning_number/1` which determines the winning number.

Hint: Make sure that the list of bets from the above mentioned file is loaded into your database. You may then consider to use one of Prolog’s predefined predicates for collecting data.

Using the auxiliary predicates defined above, determine the winning number and the id of the winner in the game. [30 Marks]

Question 3. (Pascal’s Triangle)

Define a predicate `pascal/0` which asks to input a natural number and then outputs Pascal’s triangle of that height. E.g., the input 5 should produce an output similar to

```
      1
     1 1
    1 2 1
   1 3 3 1
  1 4 6 4 1
 1 5 10 10 5 1
```

Hint: The k th number in the n th line of Pascal’s triangle is given by the binomial coefficient $\binom{n}{k}$. Pascal’s formula says $\binom{n}{k} = \binom{n-1}{k} + \binom{n-1}{k-1}$, which means that one way of defining the inner numbers of a line is to build the sum of the two neighbours diagonally above them. E.g.

```
      1   3   3   1
     \ / \ / \ /
      +   +   +
       |   |   |
      1   4   6   4   1
```

[30 Marks]