Programming Paradigms Fall 2022 — Problem Sets

by Nikolai Kudasov

November 17, 2022

1 Problem set №12

1. Implement the following variations of a predicate that can find a minimum/maximum:

   (a) Write down predicate `minimum/2` that finds the minimum number in a list of numbers.

   ```
   ?- minimum([3, 6, 2, 5, 4, 7], X)
   X = 2
   ```

   (b) Write down predicate `leastSpecific` that finds the term that is least specified (i.e. it can be unified individually with all terms in the list):

   ```
   ?- leastSpecific(T, [t(a, b), t(X, b), t(a, X), t(X, X), t(X, Y)])
   T = t(X,Y)
   ```

2. Implement the following variations of a predicate that can remove elements from a list:

   (a) Without using negation or `fail`, implement predicate `remove/3` that removes all occurrences of a given element from a list:

   ```
   ?- remove(e, [a,p,p,l,e, p,i,e], X)
   X = [a, p, p, l, p, i]
   ```

   (b) Implement predicate `removeU/3` that removes all elements from a list that can be unified with a given term:

   ```
   ?- removeU(t(X), [1, a, A, tb, t(b), tX, t(B)], Y)
   Y = [1, a, tb, tX]
   ```

3. Consider predicates `nat/1` and `nat/2` defined as follows:

   ```
   nat(0).
   nat(N) :- nat(K), N is K+1.

   nat(0, 0) :- !.
   nat(0, Max) :- Max > 0.
   nat(N, Max) :- M is Max-1, nat(K, M), N is K+1.
   ```

   (a) Implement predicate `prime/1` that checks if a given number is a prime number. The implementation should encode the following definition: "a number N is prime if there **does not exist** a pair of numbers $1 < X, Y < N$ such that $X \times Y = N$."

   ```
   ?- prime(29)
   true
   ?- prime(N)
   N = 2
   N = 3
   N = 5
   ...
   ```

   (b) Implement predicate `coprime/2` that checks if two numbers are coprime. The implementation should encode the following definition: "two numbers N and M are coprime if there **does not exist** a pair of numbers $1 \leq K \leq M$ and $1 \leq L < N$ such that $N \times K = M \times L$."

```
?- coprime(6, 35)
true
?- coprime(N, M)
X = 3, Y = 2
X = 4, Y = 3
X = 5, Y = 2
X = 5, Y = 3
X = 5, Y = 4
X = 6, Y = 5
X = 7, Y = 2
X = 7, Y = 3
...
```