

## Homework

We are given the database

$\text{likes}(\text{Drunkard}, \text{Alcohol}), \text{serves}(\text{Pub}, \text{Alcohol}, \text{Cost}),$   
 $\text{visited}(\text{Id}, \text{Drunkard}, \text{Pub}, \text{From}), \text{drank}(\text{Id}, \text{Alcohol}, \text{Quantity}).$

The attribute  $Id$  in relations  $\text{visited}$  and  $\text{drank}$  is the identifier of the visit; every visit concerns exactly one drunkard and exactly one pub. The attribute  $From$  is the start of the visit. In every moment, any drunkard is present in at most one pub.

The attribute  $Cost$  in  $\text{serves}$  is the price of the alcohol in that pub (prices never change). Every pub serves at least one alcohol. The attribute  $Q$  in  $\text{drank}$  is the amount of the alcohol (total amount for the visit; for each visit and alcohol, there is at most one record in  $\text{drank}$ );  $Q$  is always positive. The relation  $\text{drank}$  contains only alcohols served in the pub being visited.

You may assume that the database is consistent (no contradictions).

There are four tasks:

- $\text{answer\_a}(D, P)$

A drunkard is *loyal to a pub*  $P$  if he drank there at least once and for any of the alcohols he ever drank in  $P$ , he never drank it elsewhere during a later visit. Find all pairs  $[D, P]$  such that the drunkard  $D$  is loyal to  $P$ .

- $\text{answer\_b}(D, A)$

We say that a drunkard is *strongly addicted to an alcohol*  $A$  if the amounts of  $A$  he drinks on subsequent visits form a non-decreasing sequence (in other words, if he drank  $x$  on one occasion, he will only drink at least  $x$  in the future whenever he drinks the same alcohol). Find all pairs  $[D, A]$  such that the drunkard  $D$  is strongly addicted to the alcohol  $A$ .

- $\text{answer\_c}(D, A)$

A drunkard is the *sole record holder in drinking an alcohol*  $A$  at one sitting in a pub  $P$ , if he drank  $A$  in  $P$  at least once and during one of his visits to  $P$  he drank more of the alcohol  $A$  than any other drunkard during any other visit. Find all pairs  $[D, A]$  such that the drunkard  $D$  likes the alcohol  $A$  and in every pub serving  $A$ , the drunkard  $D$  is the sole record holder in drinking  $A$  at one sitting.

- $\text{answer\_d}(D)$

A *miser* is a drunkard who

- (1) never drinks anything he does not like and
- (2) during any visit of a pub he drinks only the cheapest alcohols served there, and even in that case only if he has never seen (during his previous visits) the alcohol being served for a lower price elsewhere.

Find all misers that have visited at least one pub.

(A miser might choose not to drink at all during a pub visit. All abstinents are misers, too.)

## Further instructions

- All the rules you use must be safe.