Databases

Suppose we have the following relational schema

```
Person(pid:integer, name:string, street:string, postcode:string)
Car(cid:integer, year:integer, model:string)
OwnedBy(pid:integer, cid:integer)
AccidentReport(rid:integer, damage:integer, details:string)
ParticipatedIn(pid:integer, rid:integer, cid:integer)
```

where the underlined attributes represent the primary keys of the associated relation. The table OwnedBy implements a relationship between persons and cars using foreign keys. The table ParticipatedIn implements a relationship between persons, accident reports, and cars, where tuple \((p, r, c)\) indicates that the person \(p\) was the driver of the car \(c\) associated with the accident report \(r\).

(a) Write an SQL query to return those pid’s of persons driving in at least one accident, with no duplicates. [2 marks]

(b) Write an SQL query to return all tuples \((pid, c)\), where \(c\) is the number of cars owned by person pid (records where \(c = 0\) do not have to be generated). [2 marks]

(c) Write an SQL query to return all tuples \((cid, c)\), where \(c\) is the number of persons owning car cid (records where \(c = 0\) do not have to be generated). [2 marks]

(d) Write a (nested) SQL query to return all tuples \((pid, rid)\) where \(pid\) was driving in the accident reported in \(rid\), but the car driven by \(pid\) is not owned by \(pid\). [4 marks]

(e) Write an SQL query to return all tuples \((rid, c)\), where \(c\) is the number of drivers involved in the accident reported in by \(rid\) (records where \(c = 0\) do not have to be generated). [2 marks]

(f) Write an SQL query to return all tuples \((rid, c)\), where \(c\) is the number of cars involved in the accident reported in by \(rid\) (records where \(c = 0\) do not have to be generated). [2 marks]

(g) Do the functional dependencies implied by the schema imply that the results of queries (e) and (f) will always be the same? Explain. [2 marks]

(h) Perhaps there is something wrong with this schema. How would you fix the schema to ensure that results of queries (e) and (f) would always be the same? [4 marks]