Exercises 3 – Relational Algebra

Bases de Dados, FCT-NOVA

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Grupo 1. Consider the following schema of a database of an airline company (where the attributes that constitute the primary key are underlined):

planeType({Type,Seats,Autom+nomy})
plane({Lic,NameP,Type})
pilots({Name,Address,City,Age})
flights({Num,Lic,Date,Time,From,To,Name})

Express each of the following queries in relational algebra:

1. What are the licences of the planes that have an autonomy greater than 5000Km?
2. What are the names and addresses of the pilots that have piloted a Boeing 737 ate least once?
3. What are the pilots that have piloted planes of every existing types?
4. What are the planes that, in a single day, arrived and departure at least once in any given airport?
5. What is the intuitive meaning of each of the following expressions:
   (a) $\Pi_{From,To}(flights) \div \Pi_{To}(flights)$
   (b) $\Pi_{From,To}(flights) \cup \Pi_{flights.From,v1.To}\left(\sigma_{flights.To=v1.From}\left(flights \times \rho_{v1}\left(\Pi_{From,To}(flights)\right)\right)\right)$

Grupo 2. Consider the following schema of a database (where the attributes that constitute the primary key are underlined):

types({type,PayForm,payTerm})
supplier({NIF,NameS,Add,type})
products({CodP,NameP,Price,Amount})
orders({Num,Date,NIF})
orderLine({Num,CodP})

Express each of the following queries in relational algebra:

1. What is the term of payments of the 1234 order?

2. What are the names and addresses of the suppliers who ever sold the product whose code is XX?

3. What are the names of the suppliers that have sold every types of products ever ordered?

4. What are the suppliers that had more than one order in a single day?

5. What is the intuitive meaning of each of the following expressions:

   (a) $\Pi_{NameS}\,(suppliers \bowtie \Pi_{NIF,CodP}\,(orders \bowtie orderLine) \div \Pi_{CodP}(orderLine))$

   (b) $\Pi_{NameS}\,(suppliers \bowtie \Pi_{NIF,CodP}\,(orders \bowtie orderLine) \div \Pi_{CodP}(products))$

   (c) $\Pi_{NameP}\,(p \bowtie (\Pi_{Amount}(p) - \Pi_{p1.Amount}\,(\sigma_{p1.Amount<p.Amount}(\rho_{p1}(\Pi_{Amount}(p)) \times \Pi_{Amount}(p)))))$

Grupo 3. The organisation of a scientific conference always starts by a process of paper reviewing and selection. For that, the organisers have to find a team of reviewers, and open a call for papers. Each submitted paper is reviewed by several reviewers, and each reviewer assigned an evaluation (from 0 to 10), and a degree of confidence (from 0 to 5). The final evaluation of a paper is the average of the evaluations of reviewers who evaluated it. Only the papers with a final evaluation greater than a given mark can be present at the conference. Here, we will assume that that mark is 8.

To make it easier to deal with the reviews, the organisers of a conference created a database with the following schema (where the attributes that constitute the primary key are underlined):

paper({<u>NumP</u>,Tile})
authors({<u>EmailAu</u>,NameAu,NumPt})
reviewers({<u>Email</u>,Name})
reviews({<u>Email,NumP</u>,Mark,Confidence})

Express each of the following queries in relational algebra:

1. What are the name of the authors of the paper whose title is "Hyper Tableaux"?

2. What are the titles of the papers of which at least one of its authors is a reviewer (not necessarily of the same paper, of course)?

3. What are the names of the reviewers that evaluated all the submitted papers?

4. What are the names of the authors whose papers have no review with a degree of confidence greater than 3?

Grupo 4. Consider the following schema of a database of a clinic (where the attributes that constitute the primary key are underlined):

patient({NumP,NameP,Add})
doctor({NumD,NameD,Hospital})
drugs({CodF,NameF})
appoint({NA,NumP,NumD,Date})
prescr({NA,CodF})

Express each of the following queries in relational algebra:

1. What are the drugs that were prescribed by the doctor Luís at least once?
2. What are the names and addresses of the patients that had at least one appointment with a doctor from Hospital Garcia de Orta?
3. What are the names of the drugs that were prescribed at least once in an appointment in the clinics?
4. What are the doctors that had an appointment with a colleague doctor from the clinic as patient?

Grupo 5. Consider the following schema of a database of a real estate (where the attributes that constitute the primary key are underlined):

houses({NumH,NClient,NRooms,Zone,Price})
clients({NClient,Name,Add})
interest({NumI,NClient,NRooms,Zone})
visits({NClient,NumH,Date})

Express each of the following queries in relational algebra:

1. What are the names and addresses of the owner of houses visited by Luís?
2. In which dates has Maria visited houses?
3. What are the names of the clients that want to sell house with a type (number of Rooms and Zone) in which at least one client is interested in?
4. What are the prices and numbers of the house in which the client Luís might be interested in?
5. What is the intuitive meaning of each of the following expressions:
   (a) $\Pi_{Name}\,(clients \bowtie (\Pi_{NumH,NClient}\,(visits) \div \Pi_{NumH}(houses)))$
   (b) $\Pi_{Name}\,(clients \bowtie (\Pi_{NumH,NClient}\,(houses) \div \Pi_{NumH}(houses)))$

Grupo 6. Consider the following (part of a) schema of a database of a library (where the attributes that constitute the primary key are underlined):

books({CodB,CodT})
readers({NumR,Name,Phone})
descriptors({CodT,NameD})
titles({CodT,NameT,Author})
requisitions({CodB,NumR,dateS,dateE})

In this database, each title has a unique code, and one (and just one!) author. A book has a single code, and an indications of the corresponding title. Each reader has a number, a name, and a Phone. The requisitions relation stores information about present and past book requested by the readers. In it, each tuple indicates that a given book was given to a reader in a date dateS, and was delivered at dateE. If dateE is empty (i.e. with a null value) then the book has not yet been delivered by the reader. A tuple in descriptors stores the information of a descriptor of a title.

Express each of the following queries in relational algebra:

1. What are the phone numbers of the reader that were given books more than a year ago, and have not yet elievered them?
2. What are the books about Databases that have available copies in the library?
3. What are the descriptors for which no title with it has ever bee requested by a reader?
4. Who had the last copy of "Os Maias" on 9/02/2016?
5. What are the reader that requested at least one title more than once?