

Part 1: Relational Algebra:

*Clarification: I have not found the aggregation symbol, so I am going to use the letter G as aggregation symbol during this part, thanks for considering.

1.

ConstructorEmployeeInfo

$\leftarrow \pi_{EID, FirstName, SalaryPerDay}(ConstructorEmployee \bowtie_{EID=EID} Employee)$

ProjectEmployeeInfo

$\leftarrow \pi_{EID, Name, Description}(ProjectConstructorEmployee \bowtie_{PID=PID} Project)$

preResult \leftarrow $ConstructorEmployeeInfo \bowtie_{EID=EID} ProjectEmployeeInfo$

result \leftarrow

$\rho_{(EmployeeName, DailySalary, ProjectName, Description)}(\pi_{FirstName, SalaryPerDay, Name, Description}(preResult))$

2.

OfficialEmployeeInfo \leftarrow

$\rho_{(EID, Department/Project)}(\pi_{EID, Name}(OfficialEmployee \bowtie_{Department=DID} Department))$

ConstructorEmployeeInProjects \leftarrow

$\pi_{EID, PID, EndWorkingDate}(ConstructorEmployee \bowtie_{EID=EID} ProjectConstructorEmployee)$

preConstructorEmployee \leftarrow

$\pi_{EID, PID, EndWorkingDate}(EID, PID, G \text{ Max}_{EndWorkingDate}(ConstructorEmployeeInProjects))$

ConstructorEmployeeInfo \leftarrow

$\rho_{(EID, Department/Project)}(\pi_{EID, Name}(preConstructorEmployee \bowtie_{PID=PID} Project))$

result $\leftarrow ((Employee \bowtie_{EID=EID} OfficialEmployeeInfo) \cup$
 $(Employee \bowtie_{EID=EID} ConstructorEmployeeInfo))$

3.

ApartmentNumber $(NID, NumberOfApartments) \leftarrow (NID(G \text{ Count}_{NID}(Apartment)))$

result $\leftarrow \pi_{Name, NumberOfApartments}(Neighborhood \bowtie_{NID=NID} ApartmentNumber)$

*ORDER BY is non-available in Relational Algebra!

4.

Address $\leftarrow \pi_{(StreetName, Number, Door)}(Apartment)$

NameAndAddress $\leftarrow \pi_{(StreetName, Number, Door, FirstName, LastName)}(Resident)$

result \leftarrow

$(Address \bowtie_{(StreetName=StreetName \text{ AND } Number=Number \text{ AND } Door=Door)} NameAndAddress)$

5.

minPrice_(minimum) $\leftarrow (G \text{ Min}_{MaxPricePerDay}(ParkingArea))$

result $\leftarrow ParkingArea \bowtie_{MaxPricePerDay=minimum} minPrice$

* It's working with more than one minimum!

6.

$\mathbf{minPrice}_{(minimum)} \leftarrow (G \text{ Min}_{MaxPricePerDay}(ParkingArea))$
 $\mathbf{minimalAreas} \leftarrow ParkingArea \bowtie_{MaxPricePerDay=minimum} \mathbf{minPrice}$
 $\mathbf{minimum} \leftarrow \pi_{(AID)}(\mathbf{minimalAreas})$
 $\mathbf{parkingInMinimum} \leftarrow \pi_{CID}(\mathbf{minimum} \bowtie_{AID=AID} CarParking)$
 $\mathbf{result} \leftarrow \pi_{CID,ID}(\mathbf{parkingInMinimum} \bowtie Cars)$

7.

$\mathbf{ParkerAndPark} \leftarrow \pi_{ID,AID}(Cars \bowtie_{CID=CID} CarParking)$
 $\mathbf{ParkerAndNeighborhood} \leftarrow \rho_{(RID,NID)}(\pi_{ID,NID}(\mathbf{ParkerAndPark} \bowtie_{AID=AID} ParkingArea))$
 $\mathbf{ResidentAndNeighborhood} \leftarrow \pi_{FirstName,LastName,RID,NID}(\mathbf{Resident} \bowtie_{StreetName=StreetName \text{ AND } Number=Number \text{ AND } Door=Door} Apartment)$
 $\mathbf{NeighborhoodResidentParkingNeighborhood} \leftarrow \rho_{(FirstName,LastName,ID,from,at)}(\pi_{FirstName,LastName,RID,ResidentAndNeighborhood.NID,ParkerAndNeighborhood.NID}(\mathbf{ResidentAndNeighborhood} \bowtie_{RID=RID} \mathbf{ParkerAndNeighborhood}))$
 $\mathbf{OutsideParkers} \leftarrow \sigma_{from \neq at}(\mathbf{NeighborhoodResidentParkingNeighborhood})$
 $\mathbf{result} \leftarrow \pi_{FirstName,LastName,ID}(\mathbf{NeighborhoodResidentParkingNeighborhood} - \mathbf{OutsideParkers})$

8.

$\mathbf{Parkers} \leftarrow \pi_{ID,AID}(Cars \bowtie_{CID=CID} CarParking)$
 $\mathbf{superParkers} \leftarrow (\mathbf{Parkers} \div \pi_{AID}(ParkingArea))$
 $\mathbf{result} \leftarrow \pi_{FirstName,LastName,ID}(\mathbf{Resident} \bowtie_{RID=ID} \mathbf{superParkers})$

9.

$\mathbf{r_ngbrhd} \leftarrow \sigma_{Name \sim 'r\%' \text{ OR } Name \sim 'R\%'}(Neighborhood)$

Part 2:

1. It shows the car id, start time and end time of the parkings which was not paid because of expired credit card.
2. Not For solving!
3. It shows the names of neighborhoods which have projects that was assigned to **all** constructor employee who their ages are until 50 together per project.
4. It shows all residents' ids who has not a car.
5. It shows information of every resident that his birthdate is before the latest birthdate of the city's workers and lives in street that contains the letter 'e' in its name.
6. It shows neighborhood's ids and names of projects' which were assigned to constructor employee who has the max number of projects

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