Laborotory work 1

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1. Consider the employee database of figure below. Give an expression in the relational algebra to express each of the following queries:
   Employee(person_name,street,city)
   Works(person_name,company_name,salary)
   Company(company_name,city)

a) Find the ID and name of each employee who works for “BigBank”.

ANSWER: $\Pi_{(id,person\_name)}(\sigma_{(company\_name) = \text{“BigBank”}}(works))$

b) Find the ID, name, and city of residence of each employee who works for “BigBank”.

Answer: $\Pi_{id,person\_name,city}(employee \bowtie (\sigma_{company\_name = \text{“BigBank”}}(works)))$

c) Find the ID, name, street address, and city of residence of each employee who works for “BigBank” and earns more than $10000.

Answer: $\Pi_{id,person\_name,\ street,\ city}(\sigma_{(company\text{-}name = \text{“BigBank”} \wedge salary > 10000)} works \bowtie employee)$

d) Find the ID and name of each employee in this database who lives in the same city as the company for which she or he works.

Answer: $\Pi_{person\_name}(employee \bowtie works \bowtie company)$

2. Consider the employee database of figure above. Give an expression in the relational algebra to express each of the following queries:

   a) Find the ID and name of each employee who does not work for “BigBank”.

   Answer: $\Pi_{id,person\_name}(\sigma_{company\_name \neq \text{“BigBank”}}(works))$

   b) Find the ID and name of each employee who earns at least as much as every employee in the database.

Answer: $\Pi_{person\_name}(works) - (\Pi_{works.person\_name}(works \bowtie (works.salary \leq works2.salary \wedge works2.company\_name = \text{“BigBank”}) \rho_{works2}(works)))$

3. Consider the foreign-key constraint from the dept_name attribute of instructor to the department relation. Give examples of inserts and deletes to these relations that can cause a violation of the foreign-key constraint.

   Answer:
   • Inserting a tuple: (10111, Ostrom, Economics, 110,000) into the instructor table, where the department table does not have the department Economics, would violate the foreign key constraint.
   • Deleting the tuple: (Biology, Watson, 90000) from the department table, where at least one student or instructor tuple has dept name as Biology, would violate the foreign key constraint.

4. Consider the employee database of figure above. What are the appropriate primary keys?

   A primary key's main features are: **It must contain a unique value for each row of data**. It cannot contain null values.

   For example, students are routinely assigned unique identification (ID) numbers, and all adults receive government-assigned and uniquely-identifiable Social Security numbers.