

Homework 1

Problem 1 (15 points)

employee (person_name, street, city)
works (person_name, company_name, salary)
company (company_name, city)

Figure 1

Consider the employee database of Figure 1. Give an expression in the **relational algebra** to express each of the following queries:

- Find the name of each employee who works for “BigBank”.
- Find the name and city of residence of each employee who works for “BigBank”.
- Find the name, street address, and city of residence of each employee who works for “BigBank” and earns more than \$10000.
- Find the name of each employee in this database who lives in the same city as the company for which she or he works.

Problem 2 (5 points)

branch(branch_name, branch_city, assets)
customer (ID, customer_name, customer_street, customer_city)
loan (loan_number, branch_name, amount)
borrower (ID, loan_number)
account (account_number, branch_name, balance)
depositor (ID, account_number)

Figure 2: Bank database

Consider the bank database of Figure 2.

Give an expression in the **relational algebra** for each of the following queries:

- Find each loan number with a loan amount greater than \$10000
- Find the ID of each depositor who has an account with a balance greater than \$6000.
- Find the ID of each depositor who has an account with a balance greater than \$6000 at the “Uptown” branch.

Problem 3: (35 points)

Write the following queries in **relational algebra**, using the **university schema** (see schema in Lecture 02, it is published on Canvas).

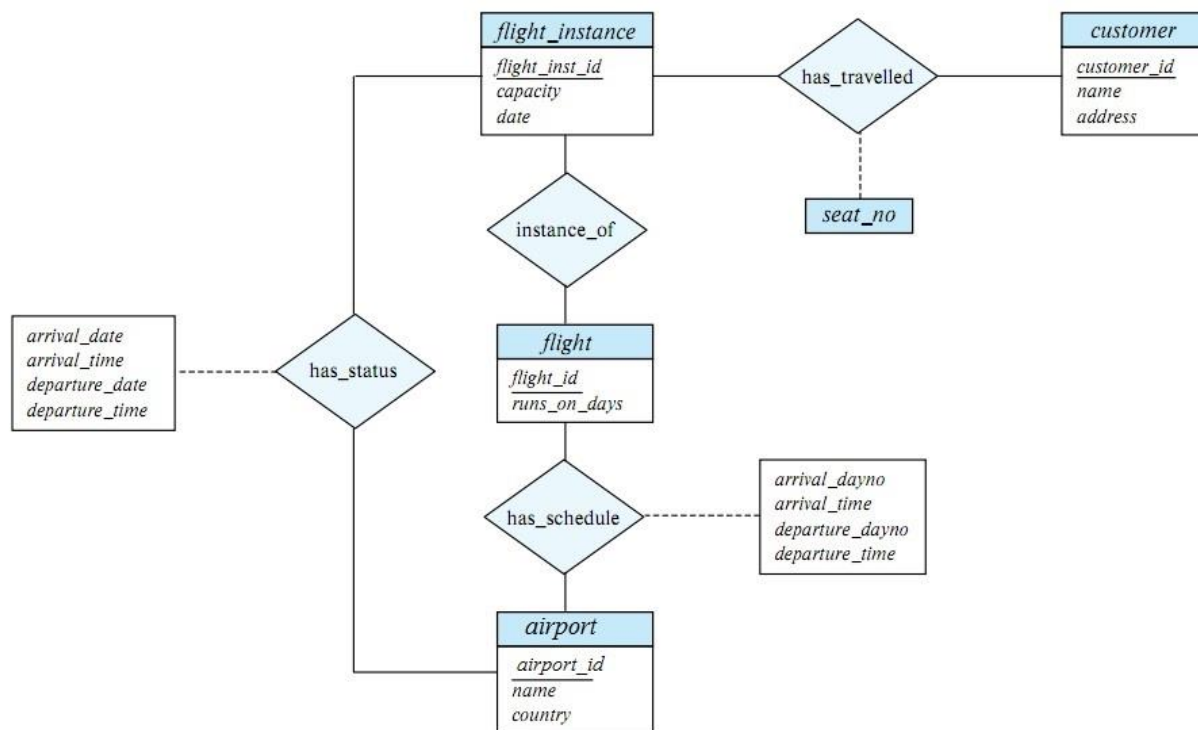
- Find the ID and name of each instructor in the Physics department.
- Find the ID and name of each instructor in a department located in the building “Watson”.
- Find the ID and name of each student who has taken at least one course in the “Comp. Sci.” department.
- Find the ID and name of each student who has taken at least one course section in the year 2018.
- Find the ID and name of each student who has not taken any course section in the year 2018.

Problem 4: (35 points)

The database for an airline keeps track of customers and their reservations, flights and their status, seat assignments on individual flights, and the schedule and routing of future flights.

E-R diagram is below.

Please provide a set of **relational schemas**, and a list of **constraints**, including **primary-key** and **foreign-key constraints**.



E-R diagram for airline databases.