

CS424 ADVANCED DATABASE SYSTEMS

Summer 2024 – LAB #1

Note: Please do create the tables in MySQL and insert at least 15 rows for each table for the following examples.

1- Suppose you are given the following schema:

employee(emp_id, name, salary)
flights(flight_no, from, to, distance, depart_time, arrival_time)
aircraft(aircraft_id, manufacturer, model, range)
certified(emp_id, aircraft_id)

The *certified* relation indicates which employee(s) is/are certified to fly which aircraft. For each of the following expressions, give the equivalent SQL statements.

For example, the following SQL statement would be used to find the names of employees who are certified to fly aircraft manufactured by 'Boeing':

```
SELECT name
FROM aircraft, certified, employee
WHERE aircraft.aircraft_id = certified.aircraft_id
AND aircraft.manufacturer = 'Boeing' AND employee.emp_id = certified.emp_id
```

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a) (3 marks)

Find the flight numbers of all the flights originating from Vancouver which depart after “13:00”.

b) (3 marks)

$\Pi_{emp_id}(\sigma_{manufacturer = 'Boeing'}(aircraft \bowtie certified))$

c) (4 marks)

$\{t \mid \exists a \in aircraft \exists f \in flights (t[aircraft_id] = a[aircraft_id] \wedge f[from] = "Vancouver" \wedge f[to] = "Tokyo") \wedge a[range] > f[distance]\}$

d) (4 marks)

$\{t \mid \exists e \in employee \exists f \in flights \exists c \in certified \exists a \in aircraft (t[flight_no] = f[flight_no] \wedge a[range] > f[distance] \wedge e[salary] > 100,000 \wedge a[aircraft_id] = c[aircraft_id] \wedge e[emp_id] = c[emp_id])\}$

e) (5 marks)

$\{ \langle n \rangle \mid \exists e, a, r, a2, m (\langle e, a \rangle \in certified \wedge \langle a, r \rangle \in aircraft \wedge \langle e, n \rangle \in employee \wedge r > 3000 \wedge \neg (\langle e, a2 \rangle \in certified \wedge \langle a2, m \rangle \in aircraft \wedge m = "Boeing")) \}$

Note: make reasonable assumptions as what the domain variables refer to based on the schema.

f) (5 marks)

$\Pi_{emp_id}(employee) - (\Pi_{e2, emp_id}(employee \bowtie_{employee.salary > e2.salary} \rho_{e2}(employee)))$

2- Suppose you are given the following schema:

authors(author_id, last_name, first_name)
books(book_id, title, num_pages, author_id)
branches(branch_id, branch_name, address, phone_no)
copies(copy_id, branch_id, book_id, cost)
loans(loan_id, copy_id, borrower_id, due_date)
borrowers(borrower_id, name, member_since)

For each of the following SQL statements give the equivalent SQL statements for the following queries:

a) For each book-branch combination, find the number of copies of the book available at the branch. Give the branch name, book title, and count in the results.

b) Find the names of the branches that have no books available for loan.

c) Find the names of branches that hold a copy of a book written by ‘Korth’.

Please do create the tables in MySQL and insert at least 15 rows for each table.

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3- For the following relation schema:

employee(employee-name, street, city)
works(employee-name, company-name, salary)
company(company-name, city)
manages(employee-name, manager-name)

Give an expression in SQL for each of the following queries:

- a) Find the names, street address, and cities of residence for all employees who work for 'First Bank Corporation' and earn more than \$10,000.
- b) Find the names of all employees in the database who live in the same cities as the companies for which they work.
- c) Find the names of all employees in the database who live in the same cities and on the same streets as do their managers.
- d) Find the names of all employees in the database who do not work for 'First Bank Corporation'. Assume that all people work for exactly one company.
- e) Find the names of all employees in the database who earn more than every employee of 'Small Bank Corporation'. Assume that all people work for at most one company.
- f) Assume that the companies may be located in several cities. Find all companies located in every city in which 'Small Bank Corporation' is located.
- g) Find the names of all employees who earn more than the average salary of all employees of their company. Assume that all people work for at most one company.
- h) Find the name of the company that has the smallest payroll.