



## CMPT 354 Assignment 2

Total marks: 70

2000-1

Due: February 16, 2000 by 20:30

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1. Get a copy of the sample *pubs* database using the TA help sheet. The help sheet is found in '\\LARCH\notes\cmpt354\SQL Server Help Sheet.pdf' in the CSIL Lab or on the CMPT 354 website. Make the following changes to the database:
  - a) (4 marks) In the *employee* table, add a new attribute: *supervisor*. An employee's supervisor is himself or herself also an employee, but you do not need to check on this as a constraint. The top-level employee's supervisor is the person himself/herself.

Update the *employee* table with some supervisor names and hand in a copy of the new *employee* table definition and the list of the *employee* table's contents.

- b) (6 marks) Add a new table to the database, *customers*. Customers order books. A customer may make many orders. Customer information should include at least the customer name, phone number, street address, and city. You should define some constraints when creating the table, such as phone numbers must be in the form '(xxx) xxx-xxxx'. Add 2 - 3 additional attributes that you feel should be part of the customer entity.

Hand in a printout of the table that you created, along with a *concise* explanation of your design and any assumptions that you made.

2. 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 statement.

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
```

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)

$$\Pi_{emp\_id}(employee) - (\Pi_{e2.emp\_id}(employee \bowtie_{employee.salary > e2.salary} \rho_{e2}(employee)))$$

3. Let  $R = (A, B, C)$  and  $r_1$  and  $r_2$  both be relations on schema  $R$ . If there are 200 tuples in  $r_1$  and 350 tuples in  $r_2$ , give the minimum and maximum sizes (in tuples) of the resulting relation produced by the following expressions.

a) (2 marks)  $r_1 \cup r_2$

- b) (2 marks)  $r_1 \cap r_2$
- c) (2 marks)  $r_1 - r_2$
- d) (2 marks)  $r_1' \times r_2$
- e) (2 marks)  $\sigma_{A = \text{'Boeing'}}(r_1)$
- f) (2 marks)  $\Pi_A(r_1)$
- g) (2 marks)  $r_1' \div r_2$
- h) (2 marks)  $r_2' \div r_1$
- i) (2 marks)  $\Pi_{AB}(r_1) \bowtie \Pi_{BC}(r_2)$

4. 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, describe, in plain English, what the statements is attempting to accomplish:

- a) (3 marks)
 

```
select title
from book B
where (select count(*)
      from copy C
      where C.book_id = B.book_id) < 10
```

- b) (3 marks)
- ```

select name
from borrowers P
where member_since >= 1998 and not exists
    (select *
     from books B
     where not exists
         (select *
          from copies C, loans L
          where B.book_id = C.book_id
               and C.copy_id = L.copy_id
               and L.borrower_id = P.borrower_id))

```
- c) (3 marks)
- ```

select L.branch_id, L.name, average(pages) pagecount
from branches L, books B
where exists
    (select *
     from copies C
     where L.branch_id = C.branch_id
          and C.book_id = B.book_id)
group by L.branch_id
order by pagecount

```

Now give the equivalent SQL statements for the following queries:

- d) (3 marks)
- 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.
- e) (3 marks)
- Find the names of the branches that have no books available for loan.
- f) (3 marks)
- Find the names of branches that hold a copy of a book written by 'Korth'.