

The University of British Columbia
Computer Science 304

Midterm Examination
March 7, 2007

Time: 50 minutes
Instructor: Rachel Pottinger

Total marks: 35

Name _____ Student No _____
(PRINT) (Last) (First)

Signature _____

This examination has 3 double-sided pages.

Check that you have a complete paper.

This is a closed book, closed notes exam. No books or other material may be used.

Answer all the questions on this paper.

Give very **short but precise** answers.

State any assumptions you make

Work fast and do the easy questions first. Leave some time to review your exam at the end.

Good Luck

Question	Mark	Out of
1.a		5
1.b		5
2.a		5
2.b		5
2.c		5
2.d		5
2.e		5
TOTAL		Out of 35

1. {10 marks}

The marks relation was defined based on the following SQL statement:

```
CREATE TABLE marks
  (studentID CHAR(20) NOT NULL,
   courseID CHAR(20) NOT NULL,
   courseType CHAR(20),
   score REAL,
   PRIMARY KEY (studentID, courseID)
)
```

For each of the following relational calculus queries, determine if there exists an equivalent relational algebra statement. If your answer is positive, give such a statement; otherwise, just state that no such statement exists. (You may get part marks if you write down in English the correct meaning of each query.)

YOU ARE NOT RESPONSIBLE FOR RELATIONAL CALCULUS

a) {5 marks} $\{ \langle N \rangle \mid \exists x, y (\langle N, x, \text{'CPSC'}, z \rangle \in \text{marks} \text{ and } \langle N, y, \text{'CPSC'}, r \rangle \in \text{marks} \text{ and } x \neq y) \}$

b) {5 marks} $\{ \langle N \rangle \mid \forall x (\langle r, x, \text{'CPSC'}, s \rangle \in \text{marks} \Rightarrow \langle N, x, \text{'CPSC'}, t \rangle \in \text{marks}) \}$

2. {25 marks} The following relations keep track of airline flight information:
- Flights: (flno: integer, origin: string, destination: string, distance: integer, departs: timestamp, arrives: timestamp, price: integer)
- Aircraft(aid: integer, aname: string, cruisingrange: integer)
- Certified(eid: integer, aid: integer)
- Employees(eid: integer, ename: string, salary: integer)

Note that the employees relation describes pilots and other kinds of employees as well; every pilot is certified for some aircraft, and only pilots are certified to fly. Write each of the following queries in SQL:

- a. {5 marks} List in reverse alphabetical order all pilots who are certified to fly some Airbus plane
- b. {5 marks} Find the name(s) and salary(salaries) of the pilot(s) who is(are) certified to fly the largest number of planes

A continuation of the same problem; the relations are listed here again to prevent having to look them up

Flights(flno: integer, origin: string, destination: string, distance: integer, departs: timestamp, arrives: timestamp, price: integer)

Aircraft(aid: integer, aname: string, cruisingrange: integer)

Certified(eid: integer, aid: integer)

Employees(eid: integer, ename: string, salary: integer)

c. {5 marks} Compute the difference between the average salary of a pilot and the average salary of all employees (including pilots).

d. {5 marks} For each plane that has at least six pilots, find the name of the plane and the average salary of the pilots who are certified to fly it

e. {5 marks} Find the set of origins and destinations that can be reached by two hops that can't be reached by a direct flight (e.g., list "Pittsburgh" "Honolulu" if there's no direct flight between Pittsburgh and Honolulu *and* there's a flight from "Pittsburgh" to some city "X" and then a flight from "X" to "Honolulu")