5DV021 Obligatory Exercise 2 Fall 2008

Solutions to this assignment are due on November 25, 2008 at 0800 (8am).

If you write the solutions by hand, they must be written on the accompanying answer sheet.

Given is the following relational database schema:

Airport(Code, City, Country, Latitude, Longitude)

Flight(**Airline**, FlightNumber, **Origin**, **Destination**)

Schedule(**Airline, FlightNumber**, Date, DepartureTime, ArrivalTime)

Airline(Name, Abbreviation, HomeCountry, WebSite)

Ticket(Number, **Airline, FlightNumber, Date**, Cost)

In the above schema, note the following conventions:

- The primary key of each relation is underlined.
- Foreign keys are shown in **boldface**. Specifically:
  - The attribute **Airline** in the Flight relation is a foreign key from the Airline relation.
  - The attributes **Origin** and **Destination** in the Flight relation are each foreign keys from the Airport relation.
  - The attribute pair (**Airline, FlightNumber**) in the Schedule relation is a foreign key from the Flight relation.
  - The attribute triple (**Airline, FlightNumber, Date**) in the Ticket relation is a foreign key from the Schedule relation.

Find solutions to each of the following queries in both the relational algebra and the relational tuple calculus. In your solutions you may **not** use functional operators such as count.

1. Find the code and city of each airport which is located in France.
2. Find the names of those airlines which have both flights which depart from the airport with code 'CDG' as well as flights which depart from the airport with code 'ORY'.
3. Find the names of those airlines whose home country is either the country in which the airport with code 'BGO' lies or else the country in which the airport with code 'UME' lies.
4. Find the flights of the airline with the abbreviation 'SK' which are scheduled for December 14, 2008. In addition to the flight number, give the airport codes for both the origin and the destination.

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5. Find the names of those cities which have more than one airport.
6. Find the names of those airlines which do not have flights which depart from an airport in Sweden.
7. Find the codes of those airports which have flights to every airport in France. (Note that no French airport will normally qualify because, for example, there is no flight from 'CDG' to 'CDG'.)
8. Find the names of those countries which have at exactly two home airlines (*i.e.*, airlines whose home is in that country).
9. Find the names of those airports, all of whose departures are *domestic*, in the precise sense that the destination airport is in the same country as the airport of departure.
10. Find the codes of those airports which have flights to every airport, other than itself, which is located in the same country but is not located in the same city. (Hint: The answer requires something which is similar to division. Look at the formula which underlies division, and modify it suitably.)

Notes:

- As stipulated in the course syllabus, this exercise may be done either individually, in a group of two, or in a group of three.
- Remember that there are point penalties for late submission. See the course syllabus.
- It is strongly recommended that you use a text-processing tool to display your results. **If you write them by hand, the solutions must be written on the accompanying answer sheet, and they must be neat and very legible.**
- It is not allowed to copy the work of others. The submission must be the original work of the individual(s) in the working group.
- The grader reserves the right to interview members of the working group about the solution.
- So that solutions may be discussed in a class meeting, students and/or groups that are very late in preparing a solution may be required to solve an alternate problem to receive credit for this exercise.
- The join notation indicated on the slides for queries should be used for joins. If you can not / will not use this notation then you must provide a table defining your notation.
- A test file, compatible with the database system Leap, is provided for your convenience. It is suggested, but not required, that you test your relational file. There is no guarantee that this file will test all queries adequately. Feel free to augment it as you see fit.

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- Remember that a correct solution must work for all instances of the database, and not just for the Leap sample provided.
- If you have solved this problem for a previous offering of the course, you may re-use your old solution, subject to the following conditions: (a) You may not work with any partners, except possibly those with whom you worked to prepare the solution in the previous course. (b) You must explicitly note any partners from the previous course with whom you submitted a joint solution for that course. Note that grading criteria may not be identical between years, so that a solution which was found to be satisfactory last year may not be evaluated similarly this year.

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