5DV021 Principles of Database Systems Fall 2008
Obligatory Exercise 3
Due date: December 2, 2008 at 0800 (8am)

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 PostgreSQL-compatible SQL. Unless stated specifically to the contrary, the soution must eliminate all duplicates from the result. Furthermore, to keep the solutions simple and consistent, the following restrictions apply:

(i) Directives involving the keyword JOIN may not be used. Express the join conditions directly using conditions in the WHERE clause.

(ii) The solution must consist of a single SQL directive. Creation and subsequent use of temporary tables is not permitted.

(iii) Subqueries involving SELECT are allowed only in the WHERE and HAVING fields of queries and subqueries, and in the SET fields of UPDATE commands.

1. Find the code and city of each airport which is located in France.

5DV021, Obligatory Exercise 3, page 2

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.

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.)

11. Display the flight number, carrier, departure time and destination country and airport code for the flights scheduled to depart from the airport with code ARN on December 23, 2008.

12. Find the names of those airlines whose web-site URL begins with `https`.

13. Find the name of that country which has the greatest number of airports. In case of a tie, list all such countries.

14. For each country in the database, find the maximum, minimum, and average latitude over all airports which are located in that country. In the case that a country has no airports, list these values as zero.

15. Find the sum of the ticket costs for each carrier for flights departing in the month of November 2008. Report 0 for those airlines with no ticket sales and order from highest to lowest.

5DV021, Obligatory Exercise 3, page 3

Notes:

- In addition to a hardcopy printout of the solutions, *with each solution clearly marked with the query which it solves*, an electronic version of the solutions containing the SQL code must be submitted, via e-mail, to `lab-5dv021@cs.umu.se`. The file must be in plain-text, orgainzed so that it is easy to extract each query and submit it to PostgreSQL. In the subject line of your mail, put OE3 and the e-mail addresses of all participants in your group. Send an actual copy of your solutions, not just a link to them. Please do not make your solutions publicly readable, as this makes it too easy for unscrupulous students to copy your work. Your work is not considered to have been submitted (for purposes of lateness) until both the paper and electronic versions are received.
- An ODBC program which genearates a test database for this exercise is provided. You are encouraged to test your solutions on this database; however, you need not submit the results of such tests as part of your solutions.
- Remember that a correct solution must work for all instances of the database, and not just for the test database provided.
- 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 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.
- 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.