

5DV119 Introduction to Database Management Spring 2015

Obligatory Exercise 3

Submission deadline to avoid lateness penalty: February 16, 2015 at 0800 (8am)

1 Problem Statement

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 which references the **Airline** relation.
 - The attributes **Origin** and **Destination** in the **Flight** relation are each foreign keys which reference the **Airport** relation.
 - The attribute pair (**Airline**, **FlightNumber**) in the **Schedule** relation is a foreign key which references the **Flight** relation.
 - The attribute triple (**Airline**, **FlightNumber**, **Date**) in the **Ticket** relation is a foreign key which references the **Schedule** relation.

Find solutions to each of the queries in Section 2 in both the relational algebra and the relational tuple calculus. Use of functional operators such as **count** is **not** allowed.

2 Queries to Be Solved

1. Find the code of each airport which is located either in Greece or else in Germany.
2. Find the name and abbreviation of each airline which has a flight with destination the airport with code 'TXL' but no flight with destination the airport with code 'SXF'.
3. Find the name and abbreviation of those airlines which do not have any flights to an airport in Germany or France.
4. 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'.)
5. Find the codes of those airports which have departures (*i.e.*, flights with origin at that airport) for exactly two distinct airlines.

3 Submission Rules

1. All solutions must be typeset. Handwritten solutions will not be accepted. Either a markup language such as L^AT_EX (recommended) or a word processor such as LibreOffice may be used. Solutions in plaintext ASCII will not be accepted, because there are many special symbols which are required but which are unavailable in that character set.
2. In L^AT_EX \Join is `\Join`; this requires the AMS symbol package, which may be invoked by including the directive `\usepackage{amssymb}` in the preamble. If another system is used which does not include the join symbol, the asterisk symbol `*` may be used instead. All other special symbols, including in particular π , σ , ρ , \leftarrow , \leq , \geq , \neq , \vee , \wedge , \neg , \Rightarrow , \forall , and \exists are available in the symbol fonts of most systems and must be used without substitution when needed. In addition, subscripts and superscripts must be used when appropriate.
3. Solutions which deviate from these guidelines risk losing points or not being corrected at all.
4. All submissions must be in the form of a single PDF file. Along with each solution using both the relational algebra and the relational tuple calculus, the statement of the query which it solves must also be given.
5. A printout of the PDF submission must be placed in the submission mailbox for the course on the fourth floor of MIT-huset.
6. The PDF file must also be uploaded using the submission system found at the following URL:

<https://www8.cs.umu.se/kurser/5DV119/VT15/handin/>

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7. The PDF file must include a cover sheet which lists the names and `cs.umu.se` user IDs of all partners.
8. Remember that a correct solution must work for all instances of the database, and not just for the test database provided.
9. This exercise may be done either individually or in a group consisting of no more than four (4) individuals.
10. A test file, compatible with the database system Leap, is provided for your convenience. It is suggested, but not required, that solutions in the relational algebra be tested using Leap and this file. There is no guarantee that this file will test all queries adequately. Feel free to augment it as you see fit.

4 Further Notes

- 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.