

LAB 4

Lab Overview

Part of good database practice is to keep a strong database integrity. The scenario in this lab revolves around the client needing the database to be constrained to avoid some bad data making its way into the database. In the previous lab you were provided with two files containing Create Table statements and insert statements. These were faulty to a degree, lacking constraints and containing bad data and will be the files you work with. In the P+ you will explore a professional database with real world data and create queries for it.

Rules

The installation guide provides students with the proper software needed to complete this lab.

1. The labs must be done in groups of exactly two people. No larger groups are allowed, and if you have extraordinary extenuating circumstances that force you to do the labs alone, you must obtain permission to do so from the course leader. Both students in a group must be able to present all of the lab for the group to pass. Lab assistants do not record partial labs.
2. You must present correct and valid solutions to all the given tasks in order to pass the lab.
3. Presenting P+ assignments are optional for a higher grade if the given tasks are completed and passed.
4. This is a PSQL lab. No other programming languages, either embedded in the database or external to it, are allowed.
5. You are not allowed to remove or alter any insert statements given to you in this lab. A number of insert statements are expected to fail when you attempt to execute them.

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Lab Presentation

Course related terminology is expected during the the lab presentation and make sure you have the following ready to be presented to the TA:

- Code for the database creation showing keys, domains etc.
- Code showing how the constraints were created, either by Alter table statements or directly in the given Create table statements.
- Queries for the Mondial database and run them to show the results. The provided GUI with completed queries, ready to be viewed.
- Motivations for how the solution for each requested task is sensible. (Not all tasks have one answer, but they have to be good enough for e.g. a client to accept.)
- As usual all queries can run in the KTH servers

Before you start

As usual you should save everything you write so that we can grade you. PostgreSQL uses the “.psql” fileformat. You can use your preferred text editing software or DataGrip by JetBrains which has database specific features.

Part 1: Adding constraints to keep the database clean

The following tasks for constraining a database are to be completed and should show a satisfactory result. All required constraints should comply with the LMS Case Study.

1. Add foreign key constraints.
2. Add not null constraints.
3. Add the following Check constraints.
 - a. No negative fines, pages or editions.
 - b. DOR should always be on the same day or later than DOB.
 - c. All email addresses should end with “@kth.se”.

Important notes:

- *Name the constraints appropriately, it's easier to delete constraints with proper names.*
- *Foreign keys require the existence of a primary key to reference to.*
- *Provided data may conflict with constraints, it is expected for this data to not be accepted by the database when an input is attempted.*
- *Adding functions to aid check constraints can be tempting since they allow for more complex statements. They should be avoided in PostgreSQL unless you can be certain they are absolutely immutable and therefore will not be changed, since a constraint in*

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*PostgreSQL must always evaluate to the same result even after it has been inserted.
See the notes on check constraints in the [psql documentation](#).*

Part 2: Querying someone else's database

You have now completed a complete database on your own. But working with databases is not only about setting up your own database. A computer engineer is expected to be able to gather necessary information by querying foreign databases too, it is in fact the more common type of everyday database interaction. Furthermore, often the information wanted is available only indirectly by combining and calculating different parts of the database. Here, we will query the open source mondial database to learn some cool facts about the world.

Setup the [Mondial Database](#) and complete the queries.

Setup:

- Download the files **mondial-schema.psql** and **mondial-inputs.psql** from the [Mondial website](#).
Note: We are generating the Database under PostgreSQL.
- One file at a time, move the downloaded files from the Mondial DB to a folder in your home catalogue. Suggested methods for doing this remotely is available under "Moving files local → KTH-remote " in the installation guide.
- Run the **psql -h psql-dd1368-ht21.sys.kth.se** command and connect to the database
- Drop everything (if you already have data there).
- Run the **\i <filename>.psql** command with your moved files and remember to create the schema before the inputs.

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Important note: You are forbidden from hardcoding anything in the database

Tip: Here's the [ER diagram](#) for the Mondial database

Queries

1. Of the countries that have land borders with other countries, show a list of those who have the lowest number of bordering land neighbors.

Expected outcome:

name	num
Dominican Republic	1
Ireland	1
San Marino	1

2. Which language is most spoken?

Expected outcome:

language	numberspeaker
Mandarin	1009055036
Hindi	456236494
Spanish	441083420
English	380341922

3. Which bordering countries have the greatest contrast in wealth? We define wealth as GDP.

Tip: Remember to check the difference in wealth in both directions so that you don't end up with just half the results. E.g. Germany and Switzerland but also Switzerland and Germany.

Expected outcome:

country1	gdp1	country2	gdp2	ratio
BHT	2133	CN	9330000	4374
BR	2190000	GF	800	2738
CN	9330000	KG	7234	1290
E	1356000	GBZ	1106	1226
I	2068000	RSM	1866	1108
CN	9330000	TJ	8513	1096
CN	9330000	LAO	10100	924

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P+

1. Present a table of the countries that can be reached from Sweden crossing a land border no more than 5 times, provided you never double back over a border you have already crossed. Your answer should show the country along with the minimal number of crossings required to reach it.

Hint: Recursion.

Expected outcome:

code	name	min
SF	Finland	1
N	Norway	1
R	Russia	2
PL	Poland	3
UA	Ukraine	3
EST	Estonia	3

2. Consider a river system as a main river and all the tributary rivers that flow into it, and their respective tributary rivers a.s.o. Present a table that shows the names of the rivers of the longest branch(es) of each river system and the total length of each shown branch, as well as the number of rivers in each and the rank of the number of rivers in the branch. *Start from the rivers the Nile, Amazon, Jangtse, Rhein, Donau and Mississippi and explore from there.*

Expected outcome:

rank	path	numrivers	totlength
1	Mississippi-Missouri-Platte River-North Platte River	4	9501
1	Mississippi-Missouri-Platte River-South Platte River	4	9118
1	Amazonas-Rio Madeira-Beni-Rio Madre de Dios	4	8038
1	Amazonas-Rio Madeira-Rio MamorÃ©-Rio Guapay	4	7836
1	Amazonas-Rio Madeira-Rio MamorÃ©-Rio GuaporÃ©	4	7658

Hint: Note that rank means sports ranking. If two contestants share the 2nd place, there is no 3rd place.