

Exercise 1: Relational Databases

Introduction to Database Systems

Björn Þór Jónsson

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1 PostgreSQL installation

In order to run the exercise, you must install the PostgreSQL database system (postgresql.org) on your laptop. Installation guides that should work for 90+% of students have been posted on Piazza.

It is best if you can do this before the exercise session, but if you have problems you can bring them up to TAs during the exercise session.

2 Using PostgreSQL

Try downloading the database from Lecture 1. Install it, using psql, and then run the queries, both using pgAdmin and psql. Read through the queries and see whether you can make sense of them.

3 Your First Relational Database

Note: The code needed for this exercise is basically all in the slides, the emphasis here is on working with the database software.

Consider the sample Coffee database used in the first lecture. Your task is to create part of this database. Write SQL commands to create the following relations:

Coffees(name, manufacturer)

Coffeehouses(name, address, license)

Sells(coffeehouse, coffee, price)

The underlined columns should form the primary keys of the relations. Note that there should also be foreign key relationships in the definition of the last tables to the corresponding columns in the first two tables.

Maintain all the SQL commands in a script file, which you can run repeatedly using `psql`. Before creating a table, always drop the table if it exists.

Try running this script from the command prompt—in the final exam you must be able to do this, so you might as well start early. Ask the TAs for help, if needed. With foreign keys, you need to be careful about the order in which you drop tables.

If you have time: Write SQL commands to insert some data into the tables and run some simple SQL queries.

4 A Simple Database—With and Without a DBMS

You will most likely not have time to do the following during the exercises, but it is still a worthwhile thought experiment to do, when you have time.

Suppose that you must implement a system that contains information on the food in a canteen. The following information should be stored:

- Information on the dishes that can be bought. Each dish has a name and a price.
- Each day it is registered which dishes are for sale, and how many of each are sold.
- There is a list of ingredients, each having a name and a supplier. For each dish it is recorded what ingredients go in, and in what quantity.

a) How would you store this information *without using a DBMS*? Sketch an implementation in a language such as Java (or any other object-oriented, imperative language). Think about that the implementation should be flexible and e.g. allow that you change the supplier of milk. You are not supposed to write any code, just give an overall design.

You can imagine many queries on such a database, e.g.:

- Find all dishes containing eggs.
- Find the total sales amount (in DKK) of today.
- Find the most sold dish of today.

b) How would you implement these queries? Sketch a solution. Especially for students who have taken the algorithms class: Think about how the solution scales to large data sets. Can you avoid repeated linear traversals of data?

c) Create a relational data model for the database. Write down the database schema.

In the next two weeks we will see how the above queries can be done with little effort, and high performance, using a DBMS.