Databases Questions
Fragen zu Datenbanken

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Abstract

Here you find questions for practice for the course *Databases*. The course book and all teaching material are provided at `https://thomasweise.github.io/databases`. The questions are provided in both English and German language.

Hier finden Sie Fragen zum Üben für den Kurs *Databases*. Das Kursbuch und alles Lehrmaterial wird auf `https://thomasweise.github.io/databases` zur Verfügung gestellt. Die Fragen sind in Englisch und Deutsch bereitgestellt.

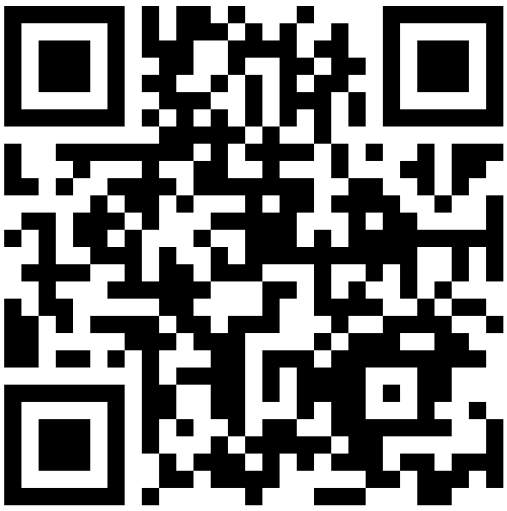
Contents

Preface

In this document, we provide questions to support your understanding and self-studying for the subject of databases. These questions accompany the book *Databases* [49], which is freely available at `https://thomasweise.github.io/databases`. The questions are provided both in English and German.

In diesem Dokument stellen wir Fragen zur Verfügung, um Ihr Verstehen und Selbst-Lernen des Themas Datenbanken zu unterstützen. Die Fragen begleiten das Buch *Databases* [49], welches unter `https://thomasweise.github.io/databases` frei zur Verfügung steht. Die Fragen stehen in Englisch und Deutsch bereit.

Visit the course website / Besuchen Sie die Kurswebseite:



Chapter 1

Basics / Grundlagen

1.1 Three-Schema-Architecture / Drei-Schema-Architektur

EN Name the components of the three-schema-architecture and their different purposes.

DE Nennen Sie die Komponenten der Drei-Schema-Architektur und ihre verschiedenen Zwecke.

1.2 ACID

EN Name the four ACID properties that a DBMS must enforce for transactions. For each of these four properties, describe its meaning and purpose.

DE Nennen Sie die vier ACID-Eigenschaften, die ein DBMS für Transaktionen sicherstellen muss. Beschreiben Sie die Bedeutung und den Zweck jeder dieser vier Eigenschaften.

1.3 Security / Sicherheit

EN Describe the importance of *security* in the context of databases. Give two examples of a scenarios where security aspects need to be considered and possible measures that could be taken in them.

DE Beschreiben Sie die Wichtigkeit von Datenschutz und Datensicherheit im Kontext von Datenbanken. Geben Sie zwei Beispiele von Szenarien, wo Datenschutz und Datensicherheit beachtet werden muss und die Maßnahmen, die in ihnen getroffen werden könnten.

1.4 Concurrency / Gleichzeitigkeit

EN Give three examples for concurrent access to a database. For each scenario, outline one possible error that could occur if the ACID principles are not enforced.

DE Geben Sie drei Beispiele für gleichzeitigen Zugriff auf eine Datenbank. Für jedes Szenario, geben Sie einen möglichen Fehler an, der entstehen kann, wenn die ACID-Prinzipien nicht durchgesetzt werden.

1.5 Networks / Netzwerke

EN What role do computer networks play in the context of today's database applications?

DE Welche Rolle speilen Computer-Netzwerke im Kontext heutiger Datenbankapplikationen.

1.6 Software

EN Name two open source AND two commercial relationale DBMSes.

DE Nennen Sie zwei Open-Source UND zwei kommerzielle relationale DBMSe.

1.7 Software

EN Which DBMS are we using in our course?

DE Welches DBMS benutzen wir in unserem Kurs?

Chapter 2

SQL

2.1 SQL

EN What is SQL? For which kind of database is it used?

DE Was ist SQL? Für welche Art von Datenbank wird es benutzt?

2.2 Create a User / Benutzer Erstellen

EN Write down the SQL (PostgreSQL) command for creating a new user "otto".

DE Schreiben Sie das SQL (PostgreSQL) Kommando, um einen neuen Benutzer "otto" zu erstellen.

2.3 Create a Database / Datenbank Erstellen

EN Write down the SQL (PostgreSQL) command for creating a new database "production" for user "anna".

DE Schreiben Sie das SQL (PostgreSQL) Kommando, um eine neue Datenbank "production" für Benutzer "anna" zu erstellen.

2.4 Create a Table / Tabelle Erstellen

EN Provide the general syntax and structure of the command for creating a table using SQL (PostgreSQL). Explain each element, such as table name, column names, datatypes, and constraints.

DE Geben Sie die generelle Syntax und Struktur des Kommandos zum Erstellen von Tabellen mit SQL (PostgreSQL) an. Erklären Sie jedes Element, wie Tabellenname, Spaltenname, Datentyp, und Einschränkungen.

2.5 Datatypes / Datentypen

EN Name UND explain four different datatypes of SQL (PostgreSQL). Provide one use case for each of these datatypes.

DE Nennen UND erklären Sie vier verschiedene Datentypen von SQL (PostgreSQL). Geben Sie jeweils eine Anwendung für jeden der dieser Datentypen an.

2.6 Create a Table / Tabelle Erstellen

EN Provide the SQL (PostgreSQL) command to create a table "cars" with the following columns:

- "name": a character string of reasonable length (must be unique),
- "price": the costs of one such car in RMB (must always be provided),
- "top_speed": the maximum speed.

DE Geben Sie das SQL (PostgreSQL) Kommand an, um eine Tabelle "cars" mit den folgenden Spalten zu erstellen:

- "name": ein Text vernünftiger Länge, der eindeutig/einmalig sein muss,
- "price": die Kosten eines solchen Autos in RMB (muss immer angegeben werden),
- "top_speed": die Maximalgeschwindigkeit.

2.7 Command Understanding / Kommando Verstehen

Listing 2.1: Das SQL (PostgreSQL) script create_table_01.sql (src)

```
CREATE TABLE food (
    id            INT GENERATED BY DEFAULT AS IDENTITY PRIMARY KEY,
    name          VARCHAR(100)   NOT NULL UNIQUE,
    is_vegetarian BOOLEAN        NOT NULL,
    price         DECIMAL(10, 2) NOT NULL,
    CONSTRAINT price_ok CHECK (price > 0)
);
```

EN What does the above SQL (PostgreSQL) command do? Explain each one of its lines.

DE Was macht das SQL (PostgreSQL) Kommando oben? Erklären Sie jede einzelne seiner Zeilen.

2.8 Command Understanding / Kommando Verstehen

Listing 2.2: Das SQL (PostgreSQL) script select_01.sql (src)

```
SELECT name, customer_id, address
    FROM customer WHERE address LIKE '%Hefei%';
```

EN What does the above SQL (PostgreSQL) command do? Which tables and columns must exist for this command to work?

DE Was macht das SQL (PostgreSQL) Kommando oben? Welche Tabellen und Spalten müssen existieren, damit dieses Kommando funktioniert?

2.9 Command Understanding / Kommando Verstehen

Listing 2.3: Das SQL (PostgreSQL) script insert_01.sql (src)

```sql
INSERT INTO team (name, mp, pts, last_game_on)
VALUES ('Shanghai Port',     27, 60, '2025-10-17'),
       ('Chengdu Rongcheng', 27, 58, '2025-10-21'),
       ('Shanghai Shenhua',  27, 57, '2025-10-22'),
       ('Qingdao Hainiu',    27, 18, '2025-10-17');
```

EN What does the above SQL (PostgreSQL) command do? Which tables and columns must exist and which datatypes should they have for this command to work?

DE Was macht das SQL (PostgreSQL) Kommando oben? Welche Tabellen und Spalten müssen existieren und welche Datentypen sollten sie haben, damit dieses Kommando funktioniert?

2.10 Command Understanding / Kommando Verstehen

Listing 2.4: Das SQL (PostgreSQL) script select_02.sql (src)

```sql
SELECT player.name AS player_name, team.name AS team_name FROM player
    LEFT JOIN team ON (player.team = team.id)
    ORDER BY player_name, team_name;
```

EN What does the above SQL (PostgreSQL) command do? Which tables and columns must exist for this command to work?

DE Was macht das SQL (PostgreSQL) Kommando oben? Welche Tabellen und Spalten müssen existieren, damit dieses Kommando funktioniert?

2.11 Command Understanding / Kommando Verstehen

Listing 2.5: Das SQL (PostgreSQL) script create_view_01.sql (src)

```sql
CREATE VIEW food_sales AS
    SELECT food.name as food_name, SUM(food.price * sale.amount) AS total
    FROM food INNER JOIN sale ON (sale.food = food.id)
    GROUP BY food_name ORDER BY food_name;
```

EN What does the above SQL (PostgreSQL) command do? Explain this in detail.Which tables and columns must exist for this command to work?

DE Was macht das SQL (PostgreSQL) Kommando oben? Erklären Sie das im Detail. Welche Tabellen und Spalten müssen existieren, damit dieses Kommando funktioniert?

2.12 Command Understanding / Kommando Verstehen

Listing 2.6: Das SQL (PostgreSQL) script insert_02.sql (src)

```sql
INSERT INTO employee (name, task, since)
VALUES ('Bibbo Bobbson', 'goalkeeper', 2025),
       ('Bebbo Bebbenheimer', 'defender', 2025);
```

EN What does the above SQL (PostgreSQL) command do? Which tables and columns must exist for this command to work?

DE Was macht das SQL (PostgreSQL) Kommando oben? Welche Tabellen und Spalten müssen existieren, damit dieses Kommando funktioniert?

2.13 Command Understanding / Kommando Verstehen

Listing 2.7: Das SQL (PostgreSQL) script select_03.sql (src)

```sql
SELECT name, address FROM passenger;
```

EN What does the above SQL (PostgreSQL) command do? Which tables and columns must exist for this command to work?

DE Was macht das SQL (PostgreSQL) Kommando oben? Welche Tabellen und Spalten müssen existieren, damit dieses Kommando funktioniert?

2.14 Command Understanding / Kommando Verstehen

Listing 2.8: Das SQL (PostgreSQL) script delete_01.sql (src)

```sql
DELETE FROM flight WHERE id = 431;
```

EN What does the above SQL (PostgreSQL) command do? Which tables and columns must exist for this command to work?

DE Was macht das SQL (PostgreSQL) Kommando oben? Welche Tabellen und Spalten müssen existieren, damit dieses Kommando funktioniert?

2.15 Command Understanding / Kommando Verstehen

Listing 2.9: Das SQL (PostgreSQL) script select_04.sql (src)

```sql
SELECT id, name, flight_hrs
    FROM pilot
    WHERE qualification = 'captain';
```

EN What does the above SQL (PostgreSQL) command do? Which tables and columns must exist for this command to work?

DE Was macht das SQL (PostgreSQL) Kommando oben? Welche Tabellen und Spalten müssen existieren, damit dieses Kommando funktioniert?

2.16 Command Understanding / Kommando Verstehen

Listing 2.10: Das SQL (PostgreSQL) script update_02.sql (src)

```
1 UPDATE student
2 SET academic_title = 'MSc'
3 WHERE (name = 'Bibbo Bobbson') AND (academic_title = 'BSc');
```

EN What does the above SQL (PostgreSQL) command do? Which tables and columns must exist for this command to work?

DE Was macht das SQL (PostgreSQL) Kommando oben? Welche Tabellen und Spalten müssen existieren, damit dieses Kommando funktioniert?

2.17 Command Understanding / Kommando Verstehen

Listing 2.11: Das SQL (PostgreSQL) script select_05.sql (src)

```
1 SELECT DISTINCT start, destination, duration
2     FROM flight;
```

EN What does the above SQL (PostgreSQL) command do? Which tables and columns must exist for this command to work?

DE Was macht das SQL (PostgreSQL) Kommando oben? Welche Tabellen und Spalten müssen existieren, damit dieses Kommando funktioniert?

2.18 Command Understanding / Kommando Verstehen

Listing 2.12: Das SQL (PostgreSQL) script update_03.sql (src)

```
1 UPDATE flight
2 SET duration = duration + '1 hour'
3 WHERE id = 15;
```

EN What does the above SQL (PostgreSQL) command do? Which tables and columns must exist for this command to work?

DE Was macht das SQL (PostgreSQL) Kommando oben? Welche Tabellen und Spalten müssen existieren, damit dieses Kommando funktioniert?

2.19 Command Understanding / Kommando Verstehen

Listing 2.13: Das SQL (PostgreSQL) script select_06.sql (src)

```
1 SELECT name, address FROM passenger
2     WHERE address LIKE '%Hefei%';
```

EN What does the above SQL (PostgreSQL) command do? Which tables and columns must exist for this command to work?

DE Was macht das SQL (PostgreSQL) Kommando oben? Welche Tabellen und Spalten müssen existieren, damit dieses Kommando funktioniert?

2.20 Command Understanding / Kommando Verstehen

Listing 2.14: Das SQL (PostgreSQL) script update_01.sql (src)

```
1 UPDATE student
2 SET name = 'Bibbo Bobbson'
3 WHERE name = 'Bibbo Bobson';
```

EN What does the above SQL (PostgreSQL) command do? Which tables and columns must exist for this command to work?

DE Was macht das SQL (PostgreSQL) Kommando oben? Welche Tabellen und Spalten müssen existieren, damit dieses Kommando funktioniert?

2.21 Command Understanding / Kommando Verstehen

Listing 2.15: Das SQL (PostgreSQL) script select_07.sql (src)

```
1 SELECT name, birthday FROM pilot
2     WHERE name LIKE 'Bibbo %';
```

EN What does the above SQL (PostgreSQL) command do? Which tables and columns must exist for this command to work?

DE Was macht das SQL (PostgreSQL) Kommando oben? Welche Tabellen und Spalten müssen existieren, damit dieses Kommando funktioniert?

2.22 Command Understanding / Kommando Verstehen

Listing 2.16: Das SQL (PostgreSQL) script select_08.sql (src)

```
1 SELECT start FROM flight
2 WHERE destination IN ('Hefei', 'Beijing');
```

EN What does the above SQL (PostgreSQL) command do? Which tables and columns must exist for this command to work?

DE Was macht das SQL (PostgreSQL) Kommando oben? Welche Tabellen und Spalten müssen existieren, damit dieses Kommando funktioniert?

2.23 Command Understanding / Kommando Verstehen

Listing 2.17: Das SQL (PostgreSQL) script select_09.sql (src)

```
1 SELECT name FROM pilot
2     WHERE qualification != 'chiefpilot' AND (flight_hrs > 1500);
```

EN What does the above SQL (PostgreSQL) command do? Which tables and columns must exist for this command to work?

DE Was macht das SQL (PostgreSQL) Kommando oben? Welche Tabellen und Spalten müssen existieren, damit dieses Kommando funktioniert?

2.24 Command Understanding / Kommando Verstehen

Listing 2.18: Das SQL (PostgreSQL) script select_10.sql (src)

```
1 SELECT id, qualification, flight_hrs FROM pilot
2     WHERE qualification IN ('captain', 'chiefpilot') AND (flight_hrs >
      ↪ 1500);
```

EN What does the above SQL (PostgreSQL) command do? Which tables and columns must exist for this command to work?

DE Was macht das SQL (PostgreSQL) Kommando oben? Welche Tabellen und Spalten müssen existieren, damit dieses Kommando funktioniert?

2.25 Command Understanding / Kommando Verstehen

Listing 2.19: Das SQL (PostgreSQL) script update_04.sql (src)

```
1 UPDATE booking
2     SET price = price * 2, class = 1
3     WHERE passenger IN (
4         SELECT id FROM passenger
5             WHERE name = 'Bebba Coolhaus')
6     AND (class = 2);
```

EN What does the above SQL (PostgreSQL) command do? Which tables and columns must exist for this command to work?

DE Was macht das SQL (PostgreSQL) Kommando oben? Welche Tabellen und Spalten müssen existieren, damit dieses Kommando funktioniert?

Chapter 3

SQL

3.1 PostgreSQL

EN What is the client program shipping with `PostgreSQL`? How can it be used?

DE Was ist das Klientenprogramm, das mit `PostgreSQL` ausgeliefert wird? Wie kann man es benutzen?

3.2 Forms / Formulare

EN What are forms in the context of databases? What is their purpose and how are they used? Name one program that can be used to create forms for databases.

DE Was sind Formulare im Kontext von Datenbanken? Was ist ihr Zweck und wie können Sie benutzt werden? Nennen Sie ein Programm, das benutzt werden kann, um Formulare für Datenbanken zu erstellen.

3.3 Reports / Berichte

EN What are reports in the context of databases? What is their purpose and how are they used? Name one program that can be used to create reports for databases.

DE Was sind Berichte im Kontext von Datenbanken? Was ist ihr Zweck und wie können Sie benutzt werden? Nennen Sie ein Programm, das benutzt werden kann, um Berichte für Datenbanken zu erstellen.

3.4 External Access / Zugriff von Außen

EN Name one library that allows you to access a database from a programming language. Provide both the library and the programming language name.

DE Nennen Sie eine Bibliothek / ein Paket, mit dem Sie auf eine Datenbank aus einer Programmiersprache heraus zugreifen können. Geben Sie sowohl den Name der Bibliothek als auch der Programmiersprache an.

Backmatter

Glossary

Bash is a the shell used under Ubuntu Linux, i.e., the program that "runs" in the terminal and interprets your commands, allowing you to start and interact with other programs [9, 32, 54]. Learn more at https://www.gnu.org/software/bash.

client In a client-server architecture, the client is a device or process that requests a service from the server. It initiates the communication with the server, sends a request, and receives the response with the result of the request. Typical examples for clients are web browsers in the internet as well as clients for database management systems (DBMSes), such as psql.

client-server architecture is a system design where a central server receives requests from one or multiple clients [6, 28, 34, 36, 39]. These requests and responses are usually sent over network connections. A typical example for such a system is the World Wide Web (WWW), where web servers host websites and make them available to web browsers, the clients. Another typical example is the structure of database (DB) software, where a central server, the DBMS, offers access to the DB to the different clients. Here, the client can be some terminal software shipping with the DBMS, such as psql, or the different applications that access the DBs.

DB A *database* is an organized collection of structured information or data, typically stored electronically in a computer system. Databases are discussed in our book *Databases* [49].

DBMS A *database management system* is the software layer located between the user or application and the DB. The DBMS allows the user/application to create, read, write, update, delete, and otherwise manipulate the data in the DB [53].

IT information technology

LAMP Stack A system setup for web applications: Linux, Apache (a web server), MySQL, and the server-side scripting language PHP [10, 23].

Linux is the leading open source operating system, i.e., a free alternative for Microsoft Windows [3, 22, 40, 47, 48]. We recommend using it for this course, for software development, and for research. Learn more at https://www.linux.org. Its variant Ubuntu is particularly easy to use and install.

MariaDB An open source relational database management system that has forked off from MySQL [1, 2, 4, 18, 30, 37]. See https://mariadb.org for more information.

Microsoft Windows is a commercial proprietary operating system [8]. It is widely spread, but we recommend using a Linux variant such as Ubuntu for software development and for our course. Learn more at https://www.microsoft.com/windows.

MySQL An open source relational database management system [7, 18, 38, 46, 52]. MySQL is famous for its use in the LAMP Stack. See https://www.mysql.com for more information.

PostgreSQL An open source object-relational DBMS [19, 33, 35, 46]. See https://postgresql.org for more information.

psql is the client program used to access the PostgreSQL DBMS server.

Python The Python programming language [24, 27, 29, 50], i.e., what you will learn about in our book [50]. Learn more at https://python.org.

relational database A relational DB is a database that organizes data into rows (tuples, records) and columns (attributes), which collectively form tables (relations) where the data points are related to each other [13, 20, 21, 41, 45, 49, 51].

server In a client-server architecture, the server is a process that fulfills the requests of the clients. It usually waits for incoming communication carring the requests from the clients. For each request, it takes the necessary actions, performs the required computations, and then sends a response with the result of the request. Typical examples for servers are web servers [10] in the internet as well as DBMSes. It is also common to refer to the computer running the server processes as server as well, i.e., to call it the "server computer" [26].

SQL The *Structured Query Language* is basically a programming language for querying and manipulating relational databases [11, 14–16, 25, 31, 42–45]. It is understood by many DBMSes. You find the Structured Query Language (SQL) commands supported by PostgreSQL in the reference [42].

terminal A terminal is a text-based window where you can enter commands and execute them [3, 12]. Knowing what a terminal is and how to use it is very essential in any programming- or system administration-related task. If you want to open a terminal under Microsoft Windows, you can press ⊞+R, type in cmd, and hit ↵. Under Ubuntu Linux, Ctrl+Alt+T opens a terminal, which then runs a Bash shell inside.

Ubuntu is a variant of the open source operating system Linux [12, 23]. We recommend that you use this operating system to follow this class, for software development, and for research. Learn more at https://ubuntu.com. If you are in China, you can download it from https://mirrors.ustc.edu.cn/ubuntu-releases.

WWW World Wide Web [5, 17]

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