Open Source Software Development

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Database Management System

MySQL

Contents

Database

Database

- A database is **an organized collection of structured information, or data**, typically stored in a computer system

- A database is usually **controlled by a database management system** (DBMS)

Database

- Data within the most common types of databases in operation today is typically **modeled in rows and columns in a series of tables** to make processing and data querying efficient

- The data can then be easily accessed, managed, modified, updated, controlled, and organized

- Most databases use **structured query language** (SQL) for writing and querying data

What is Structured Query Language?

SQL

- SQL is a **programming language** used by nearly all relational databases to query, manipulate, and define data, and to provide access control.
- SQL was first developed at IBM in the 1970s with Oracle as a major contributor.
- SQL has spurred many extensions from companies such as IBM, Oracle, and Microsoft

Types of Databases

There are many different types of databases:

- **Relational databases**
  - Items are organized as a set of tables with columns and rows
  - Provides the most efficient and flexible way to access structured information

- **Distributed databases**

  The database may be stored on multiple computers, located in the same physical location, or scattered over different networks

Types of Databases

There are many different types of databases:

- **Data warehouses**

  A central repository for data

- **NoSQL databases**

  A NoSQL, or non-relational database, allows unstructured and semi-structured data to be stored and manipulated

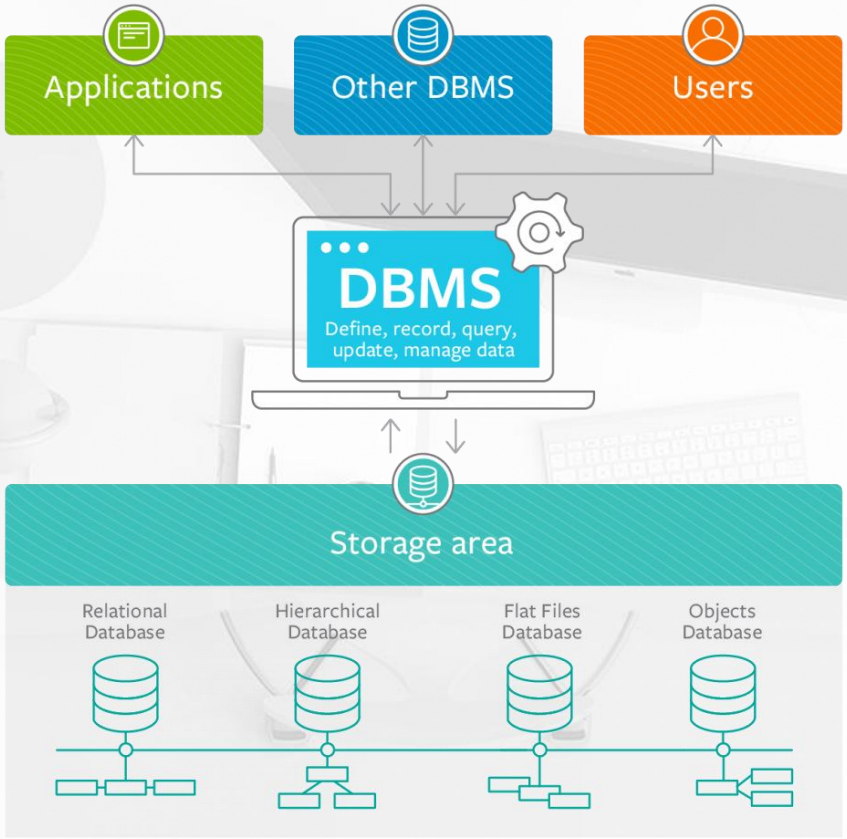
- **Open source databases**

  An open source database system is one whose source code is open source

- **Cloud databases**

  A collection of data, either structured or unstructured, that resides on a private, public, or hybrid cloud computing platform

What is a Database Management System?



What is a Database Management System?

- A database requires a comprehensive database software program known as DBMS

- A DBMS serves as **an interface between the database and its end users or programs**, allowing users to retrieve, update, and manage how the information is organized and optimized

What is a Database Management System?

- A DBMS also facilitates oversight and control of databases, enabling a variety of administrative operations such as performance monitoring, tuning, and backup and recovery.

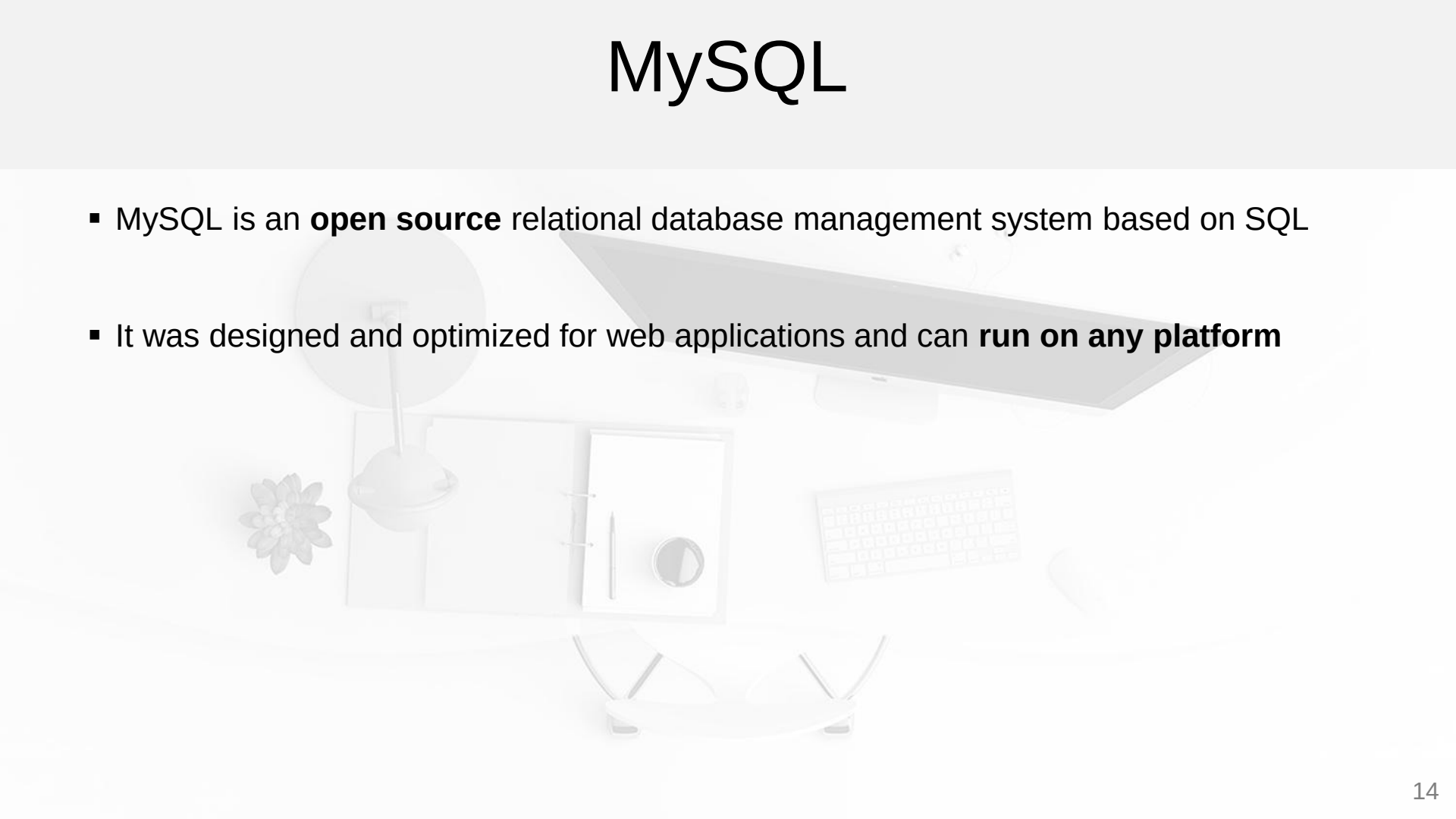
- E.g.: MySQL, Microsoft Access, Microsoft SQL Server, FileMaker Pro, Oracle Database, and dBASE

MySQL™

The world’s most popular open source database

MySQL

- MySQL is an **open source** relational database management system based on SQL
- It was designed and optimized for web applications and can **run on any platform**



MySQL

- MySQL designed to process millions of queries and thousands of transactions

  →MySQL is a **popular choice for ecommerce businesses** that need to manage multiple money transfers

- MySQL is the DBMS **behind some of the top websites and web-based applications** in the world

  Airbnb, Uber, LinkedIn, Facebook, Twitter, and YouTube

MySQL


YouTube
PayPal
LinkedIn
facebook
ebay
cisco
verizon
Uber
TESLA
NETFLIX
GitHub
Walmart
Booking.com
Zappos.com
BANK OF AMERICA
Flipkart
Paytm
Alibaba.com
WeChat
Tencent
腾讯
淘宝网
Taobao.com
airbnb
TOYOTA

MySQL Workbench

MySQL Workbench

- MySQL Workbench is a unified visual tool for database architects, developers, and database administrators
- MySQL Workbench provides data modeling, SQL development, and comprehensive administration tools for server configuration, user administration, backup, and much more
- MySQL Workbench is available on Windows, Linux and Mac OS X

phpMyAdmin

Bringing MySQL to the web

phpMyAdmin

- A free software tool written in **PHP**, intended to **handle the administration of MySQL over the Web**
- phpMyAdmin supports a wide range of operations on MySQL and MariaDB
- Frequently used operations (managing databases, tables, columns, relations, indexes, users, permissions, etc.) can be **performed via the user interface**, while you still have **the ability to directly execute any SQL statement**

phpMyAdmin

- Has a wide range of documentation

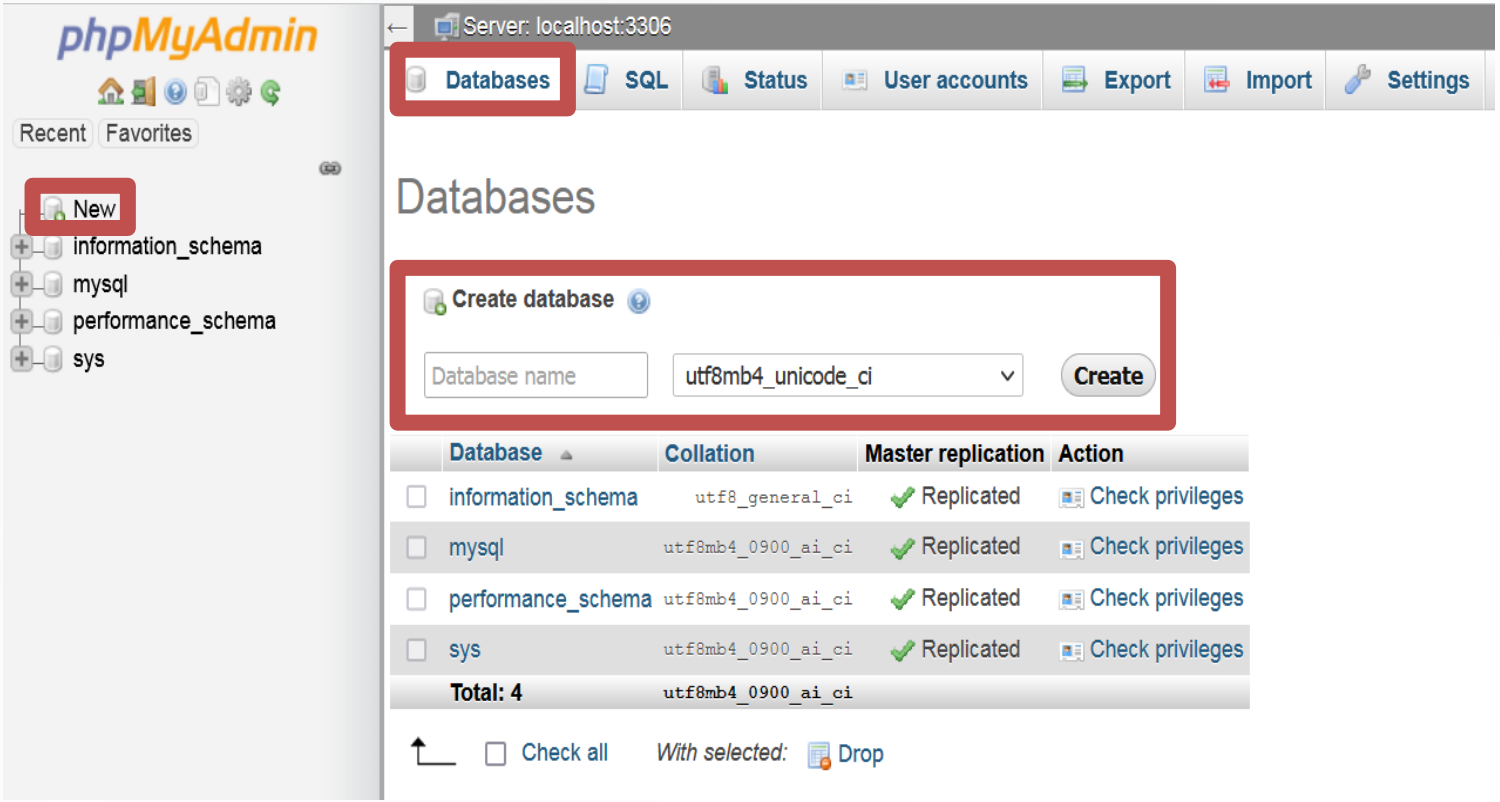
- To ease usage to a wide range of people, phpMyAdmin is being **translated into 72 languages** and supports both LTR and RTL languages

- The phpMyAdmin project is a member of Software Freedom Conservancy

  SFC is a not-for-profit organization that helps promote, improve, develop, and defend Free, Libre, and Open Source Software (FLOSS) projects

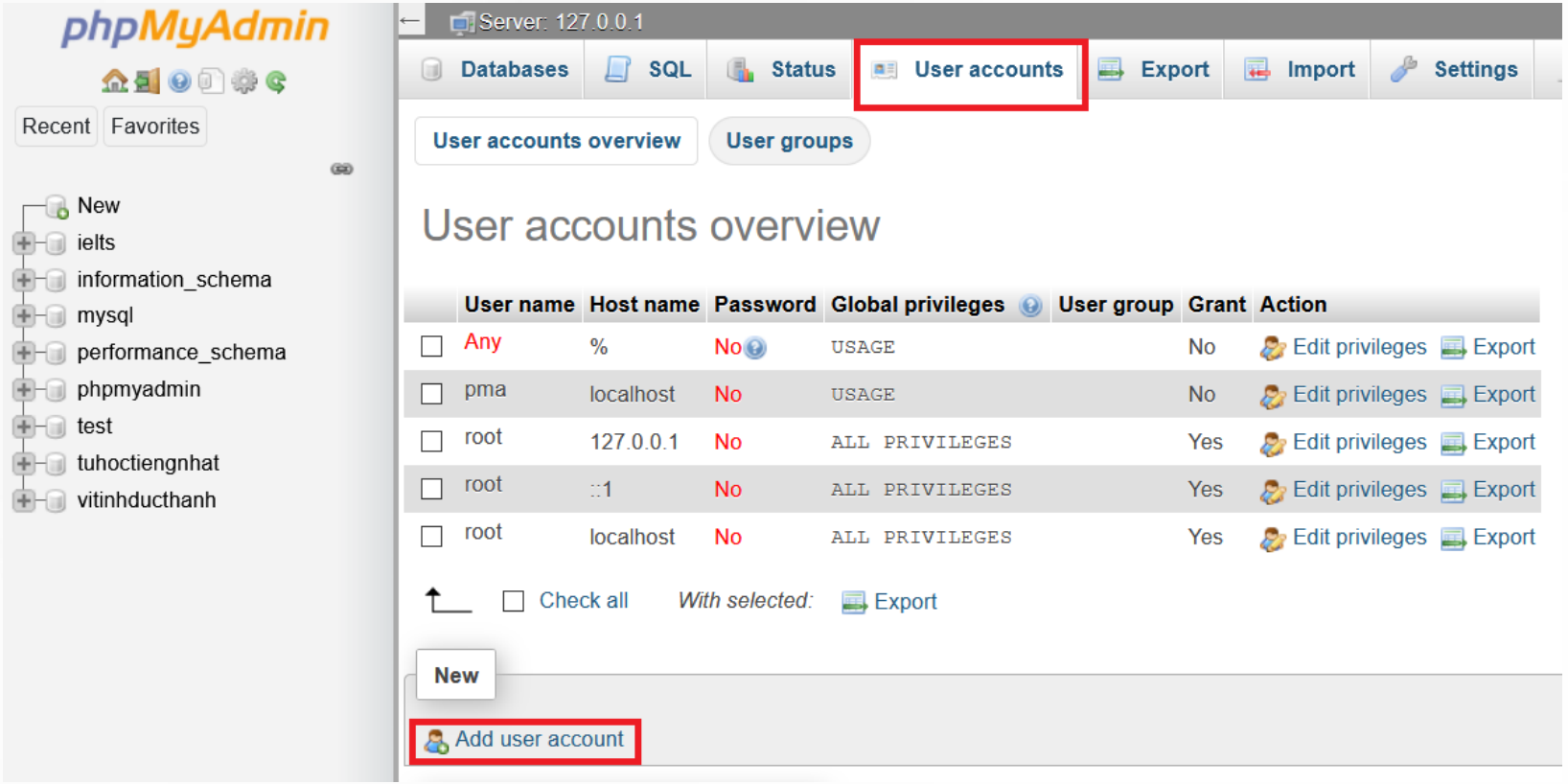
phpMyAdmin

Create DB



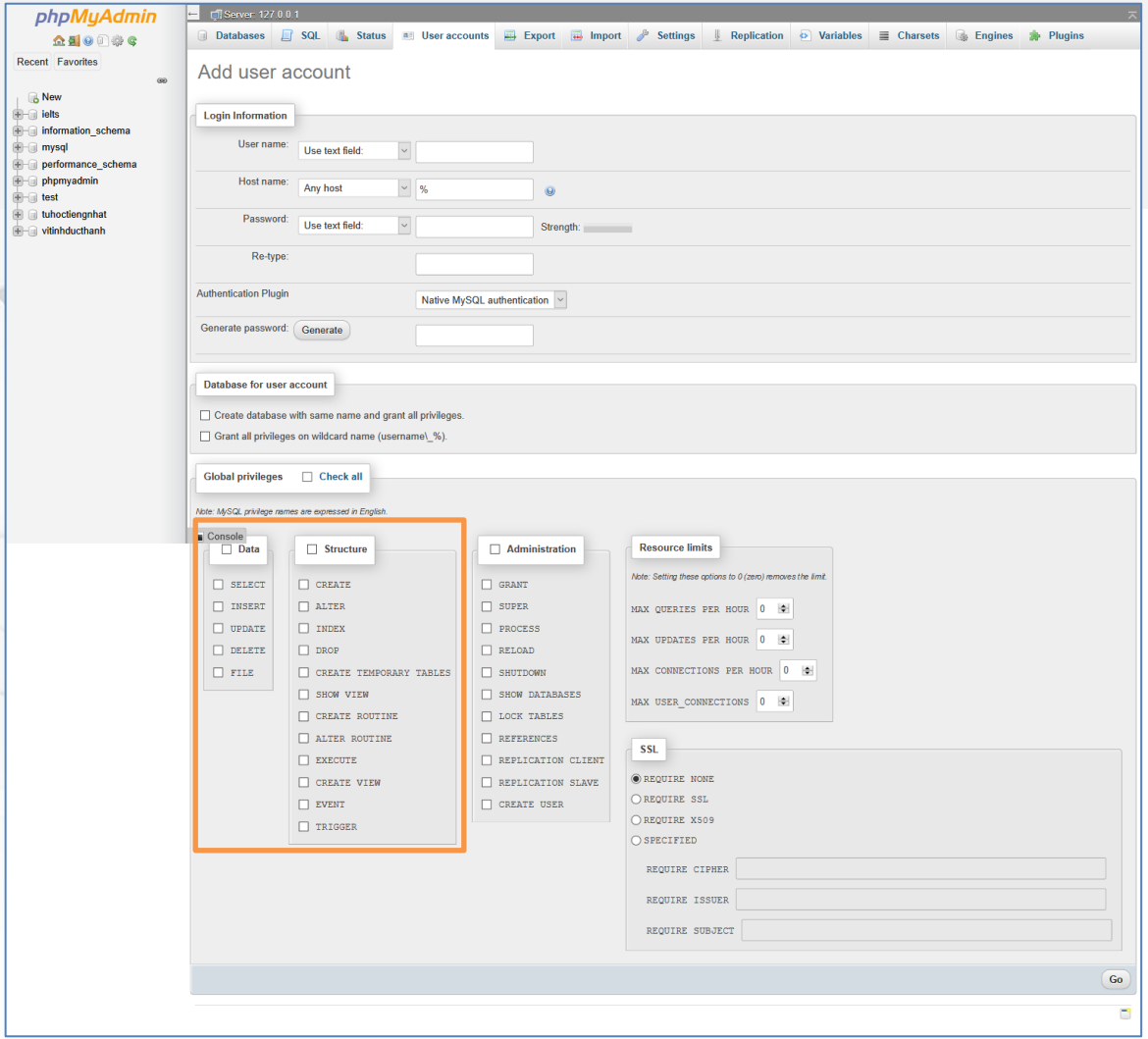
phpMyAdmin

Create user account and assign privileges



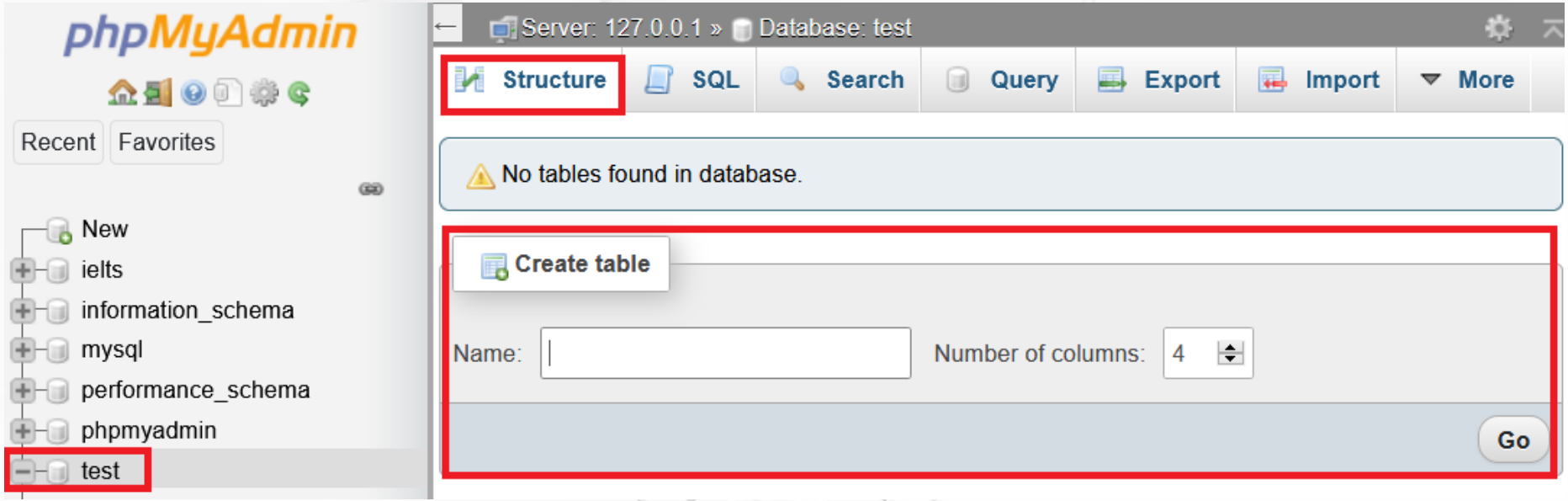
phpMyAdmin

Create user account and assign privileges



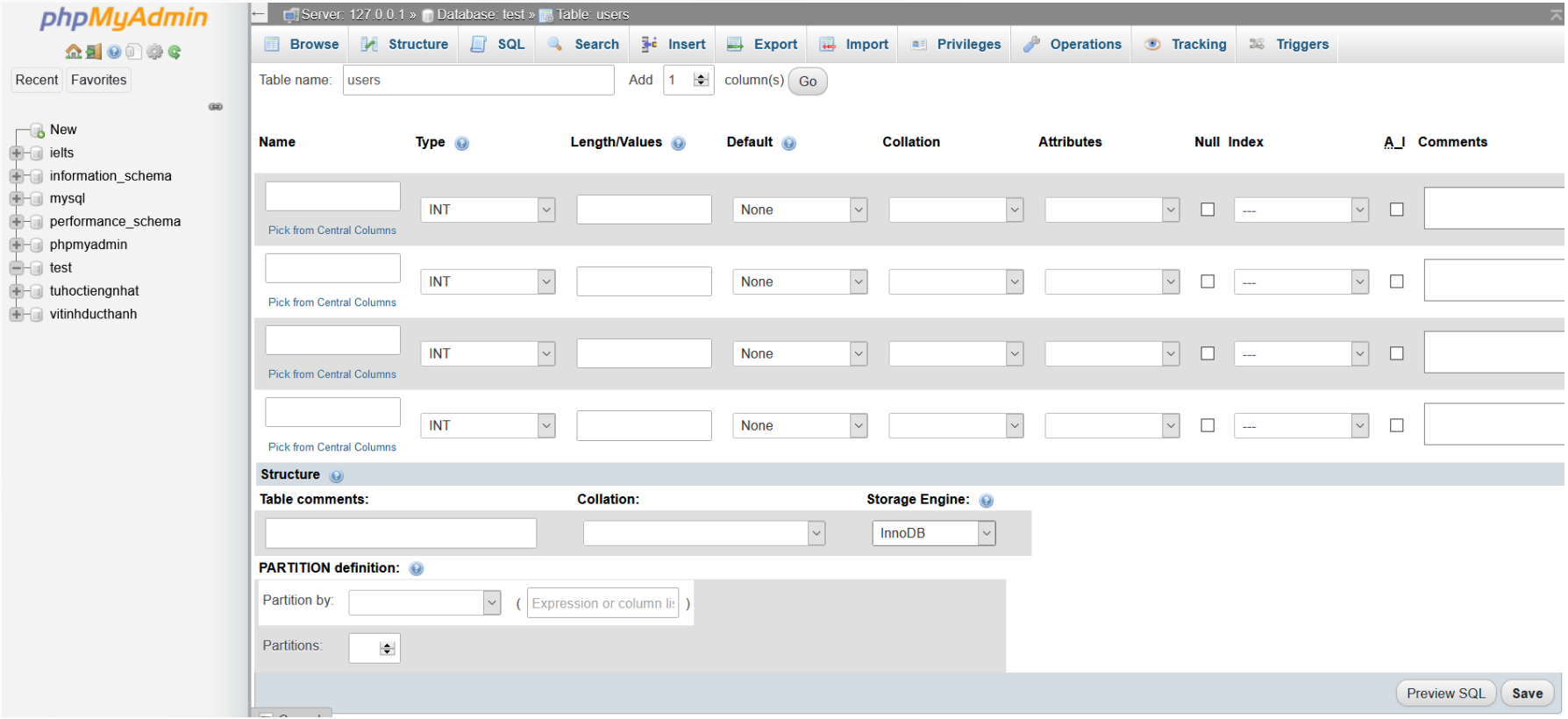
phpMyAdmin

Create table



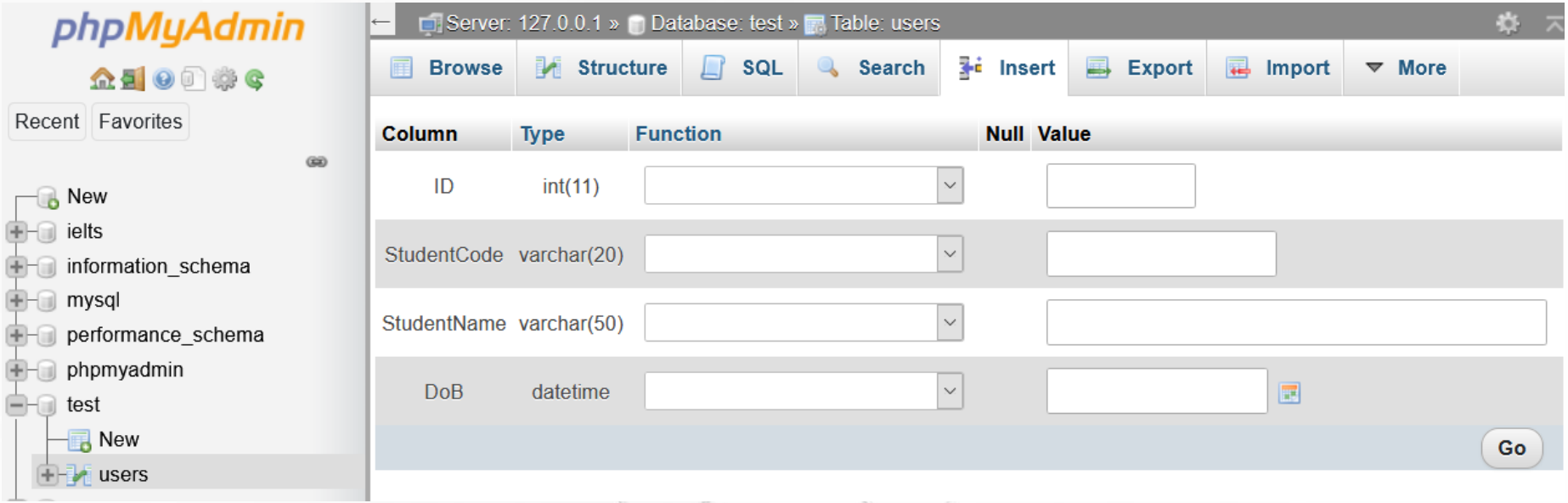
phpMyAdmin

Create table



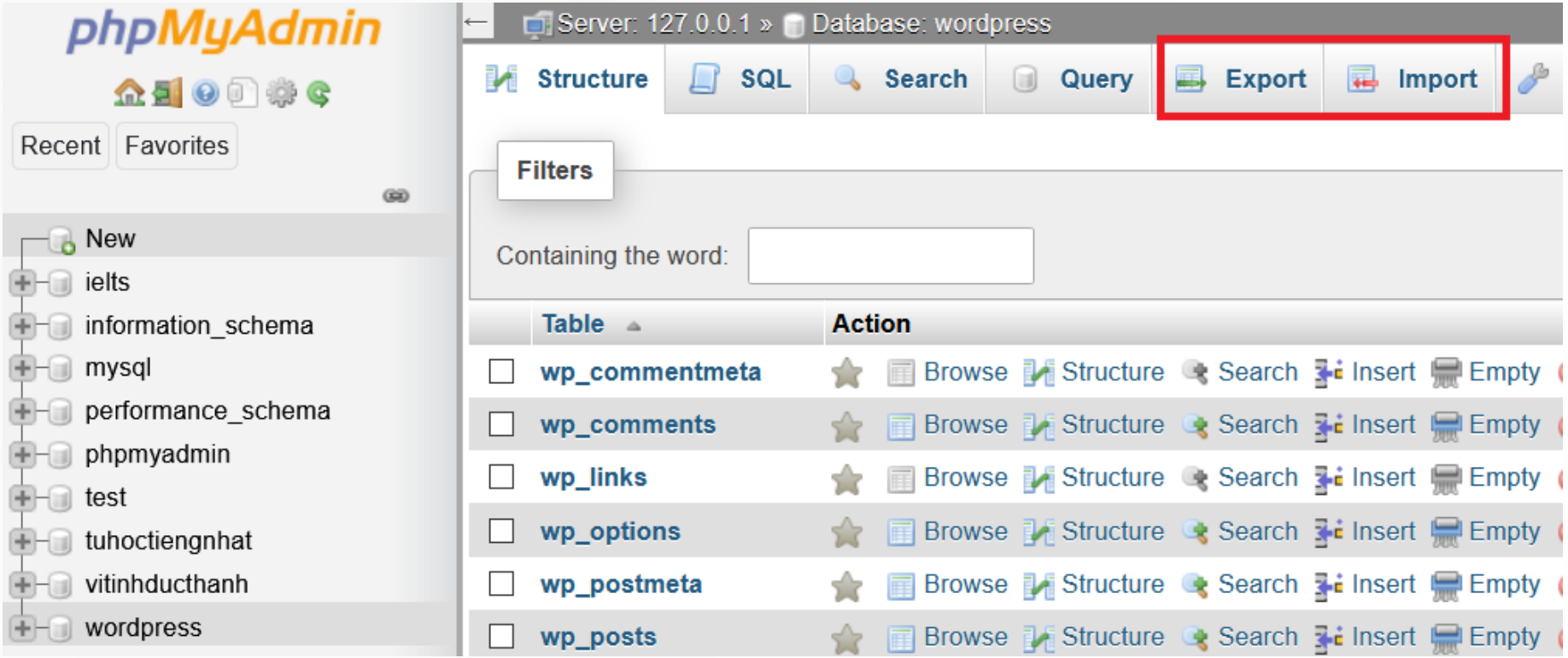
phpMyAdmin

Insert data



phpMyAdmin

Export/Import data



MySQL statements

MySQL INSERT statement

- **Syntax** for **inserting one row** into table

  INSERT INTO table (c1, c2,...) **VALUES** (v1, v2,...);

- **Syntax** for **inserting multiple rows** into table

  INSERT INTO table (c1, c2,...)

  VALUES

  (v11, v12,...),

  (v21, v22,...),

  ...

  (vn1, vn2,...);

MySQL UPDATE statement

- To change the values in one or more columns of a single row or multiple rows

- **Syntax**

```
UPDATE table_name
SET
    column_name1 = expr1,
    column_name2 = expr2,
    ...
[WHERE condition];
```

MySQL DELETE statement

- To delete data from a table

- **Syntax**

  DELETE FROM table_name

  [**WHERE** condition];

- **Note**

To delete all rows in a table without the need of knowing how many rows deleted, you should use the **TRUNCATE TABLE** statement to get better performance

MySQL SELECT statement

- To read data from one or more tables
- **Syntax**

```
SELECT select_list
FROM table_name
[WHERE search_condition]
[ORDER BY
   column1 [ASC|DESC],
   column2 [ASC|DESC],
   ...]
[LIMIT [offset,] row_count];
```

MySQL SELECT statement

- **WHERE** clause to specify a search condition for the rows returned by a query

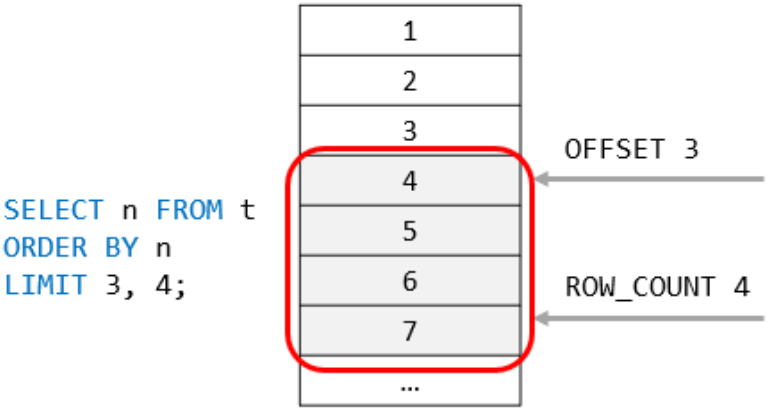
  The **search_condition** is a combination of one or more predicates using the logical operator **AND**, **OR** and **NOT**

- **ORDER BY** clause to sort one or more columns

- **LIMIT** clause to constrain the number of rows to return
  - accepts one or two arguments (0 or positive integers)
  - **offset** specifies the offset of the first row to return
  - **row_count** specifies the maximum number of rows to return

MySQL SELECT statement

- The following picture illustrates the LIMIT clause



- The following picture illustrates the evaluation order of the LIMIT clause in the SELECT statement

MySQL statements for Beginners

Source:
https://www3.ntu.edu.sg/home/ehchua/programming/sql/MySQL_Beginner.html

```
-- Database-Level
DROP DATABASE databaseName                -- Delete the database (irrecoverable!)
DROP DATABASE IF EXISTS databaseName      -- Delete if it exists
CREATE DATABASE databaseName              -- Create a new database
CREATE DATABASE IF NOT EXISTS databaseName -- Create only if it does not exists
SHOW DATABASES                            -- Show all the databases in this server
USE databaseName                          -- Set the default (current) database
SELECT DATABASE()                         -- Show the default database
SHOW CREATE DATABASE databaseName         -- Show the CREATE DATABASE statement

-- Table-Level
DROP TABLE [IF EXISTS] tableName, ...
CREATE TABLE [IF NOT EXISTS] tableName (
   columnName columnType columnAttribute, ...
   PRIMARY KEY(columnName),
   FOREIGN KEY (columnNmae) REFERENCES tableName (columnNmae)
)
SHOW TABLES               -- Show all the tables in the default database
DESCRIBE|DESC tableName   -- Describe the details for a table
ALTER TABLE tableName ...  -- Modify a table, e.g., ADD COLUMN and DROP COLUMN
ALTER TABLE tableName ADD columnDefinition
ALTER TABLE tableName DROP columnName
ALTER TABLE tableName ADD FOREIGN KEY (columnNmae) REFERENCES tableName (columnNmae)
ALTER TABLE tableName DROP FOREIGN KEY constraintName
SHOW CREATE TABLE tableName       -- Show the CREATE TABLE statement for this tableName

-- Row-Level
INSERT INTO tableName
   VALUES (column1Value, column2Value,...)              -- Insert on all Columns
INSERT INTO tableName
   VALUES (column1Value, column2Value,...), ...         -- Insert multiple rows
INSERT INTO tableName (column1Name, ..., columnNName)
   VALUES (column1Value, ..., columnNValue)             -- Insert on selected Columns
DELETE FROM tableName WHERE criteria
UPDATE tableName SET columnName = expr, ... WHERE criteria
SELECT * | column1Name AS alias1, ..., columnNName AS aliasN
   FROM tableName
   WHERE criteria
   GROUP BY columnName
   ORDER BY columnName ASC|DESC, ...
   HAVING groupConstraints
   LIMIT count | offset count

-- Others
SHOW WARNINGS;   -- Show the warnings of the previous statement
```

MySQL shell

MySQL shell

- Access the MySQL shell by typing the following command into terminal:

  mysql -u root -p

- After entering the root MySQL password into the prompt, you will be able to start building your MySQL database

- Disconnect

  Quit or **Exit**

MySQL shell

- Two points to keep in mind:
  - **All MySQL commands end with a semicolon;**

    if the phrase does not end with a semicolon, the command will not execute

  - **MySQL command line is not case sensitive**
    - ✓MySQL commands are usually written in uppercase
    - ✓Databases, tables, usernames, or text are in lowercase

Basic MySQL commands

- Check what databases are available

  SHOW DATABASES;

- Create a database

  CREATE DATABASE database_name;

- Delete a database

  DROP DATABASE database_name;

- Set a default (current) database for subsequent statements

  USE db_name;

Basic MySQL commands

- Create a new MySQL User Account

  CREATE USER ‘newuser’@‘localhost’ **IDENTIFIED BY** ‘user_password’;

- To grant access from another host, change the hostname part with the remote machine IP

  CREATE USER ‘newuser’@‘10.8.0.5’ **IDENTIFIED BY** ‘user_password’;

- To create a user that can connect from any host, use the ‘%’ wildcard as a host part

  CREATE USER ‘newuser’@‘%’ **IDENTIFIED BY** ‘user_password’;

Basic MySQL commands

- Change User Password

  ALTER USER ‘user’@‘localhost’ **IDENTIFIED BY** ‘password’;

  or

  ALTER USER ‘root’@‘localhost’ **IDENTIFIED WITH** mysql_native_password **BY** ‘password’;

- Reload the grant tables and put new changes into effect

  FLUSH PRIVILEGES;

Basic MySQL commands

- The most commonly used privileges are:
  - **ALL PRIVILEGES** – Grants all privileges to a user account
  - **CREATE** – The user account is allowed to create databases and tables
  - **DROP** – The user account is allowed to drop databases and tables
  - **DELETE** – The user account is allowed to delete rows from a specific table
  - **INSERT** – The user account is allowed to insert rows into a specific table
  - **SELECT** – The user account is allowed to read a database
  - **UPDATE** – The user account is allowed to update table rows

Full list of privileges: https://dev.mysql.com/doc/refman/5.7/en/grant.html

Basic MySQL commands

- Grant specific privileges to a user account, use the following syntax:

  GRANT permission1, permission2 **ON** database_name.table_name **TO** ‘database_user’@‘localhost’;

- Grand all privileges to a user account over a specific database

  GRANT ALL PRIVILEGES **ON** database_name.* **TO** ‘database_user’@‘localhost’;

Basic MySQL commands

- Grand all privileges to a user account on all databases:

  GRANT ALL PRIVILEGES **ON** *.* **TO** ‘database_user’@‘localhost’;

- Grant multiple privileges to a user account over a specific database:

  GRANT SELECT, INSERT, DELETE **ON** database_name.* **TO** database_user@‘localhost’;

- Display User Account Privileges

  SHOW GRANTS FOR ‘database_user’@‘localhost’;

Basic MySQL commands

- Revoke all privileges from a user account over a specific database

  REVOKE ALL PRIVILEGES **ON** database_name.* **FROM** ‘database_user’@‘localhost’;

- Delete a MySQL user account

  DROP USER ‘user’@‘localhost’;


Q&A

References

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- **What Is a Database?**

  https://www.oracle.com/database/what-is-database/
- **Connecting to and Disconnecting from the Server**

  https://dev.mysql.com/doc/refman/8.0/en/connecting-disconnecting.html
- **SELECT Statement**

  https://dev.mysql.com/doc/refman/8.0/en/select.html

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