**SQL in Python**

**I. Database Concepts**

**1. What is a Database?**

* A database is a combination of **server and storage**.
* Users interact only with the **server**, which processes queries and retrieves data from storage.

**2. Storage in SQL**

* Data is stored in a **structured format**.
* Organized as **tables and rows**.
* SQL is a **query language, not a programming language**.

**II. SQL and NoSQL Companies**

**1. Companies Providing SQL Solutions**

| **Company** | **SQL Solutions** |
| --- | --- |
| Apache | XAMPP (MariaDB) |
| Microsoft | MySQL, PostgreSQL |
| Oracle | Oracle Database |
| Snowflake | SnowSQL |
| Google | BigQuery |

**2. NoSQL Solutions**

* **MongoDB** - Document-based database.
* **Cassandra** - Distributed NoSQL database.
* **Firestore** - Cloud-based NoSQL database by Google.

**3. Vector Databases (Current Trend for LLMs)**

* **ChromaDB** - Optimized for AI and large language models.
* **SingleStore** - Unified database for transactions and analytics.

**III. Data Storage Types**

| **Storage Type** | **Characteristics** | **Examples** |
| --- | --- | --- |
| **Data Lakes** | Any kind of data, any format, any size | Google Drive, Amazon S3 |
| **Databases** | Structured SQL and NoSQL storage | MySQL, PostgreSQL, MongoDB |
| **Data Warehouses** | High-volume storage for organized and analyzed data | Snowflake, BigQuery |

**IV. SQL Implementation in Python**

**1. Local Host SQL**

* Only **VS Code** supports running SQL locally.
* Requires setting up a local SQL server (e.g., MySQL, SQLite).

**2. Cloud SQL**

* Both **Colab and VS Code** support cloud-based SQL.
* Common cloud providers: Google Cloud SQL, Amazon RDS, Microsoft Azure SQL.

**V. XAMPP Installation and Usage**

**1. What is XAMPP?**

* XAMPP is a free, open-source software package that provides a complete web development environment.
* It includes **Apache (web server), MySQL/MariaDB (database), PHP, and Perl**.
* It simplifies the setup of a local development server.

**2. Installing XAMPP**

1. Download XAMPP from [Apache Friends](https://www.apachefriends.org/).
2. Run the installer and select the components you want to install.
3. Choose the installation directory and complete the setup.
4. Open the XAMPP Control Panel to start/stop services.

**3. Components of XAMPP**

| **Component** | **Function** |
| --- | --- |
| **Apache** | Web server for hosting websites locally. |
| **MySQL/MariaDB** | Relational database management system. |
| **PHP** | Server-side scripting language for dynamic web development. |
| **Perl** | General-purpose scripting language. |
| **FileZilla** | FTP server for transferring files securely. |
| **phpMyAdmin** | Web-based tool for managing MySQL databases. |

**4. Using XAMPP**

* Start **Apache** and **MySQL** from the XAMPP Control Panel.
* Place web files inside the htdocs folder (default web directory).
* Access projects via http://localhost/yourproject.
* Use **phpMyAdmin** to create and manage databases.

**VI. Cloud-Based SQL Usage**

**1. Cloud SQL Services**

* Cloud SQL provides a fully managed database solution with high availability and scalability.
* Examples include **Google Cloud SQL, Amazon RDS, and Microsoft Azure SQL**.

**2. Setting Up Cloud SQL**

1. Choose a cloud provider and create an account.
2. Select a database engine (MySQL, PostgreSQL, etc.).
3. Configure the instance (CPU, memory, storage).
4. Connect to the cloud database via terminal, SQL client, or Python (using libraries like mysql-connector-python or psycopg2).