PostgreSQL with python

Module 1: Introduction to PostgreSQL

- What is PostgreSQL?
- Features of PostgreSQL (open-source, ACID compliance, extensibility)
- PostgreSQL vs MySQL
- Installing PostgreSQL and pgAdmin
- Introduction to SQL basics:
    - DDL, DML, DCL, TCL
- Setting up databases, tables, and users

Module 2: Setting Up Python with PostgreSQL

- Installing psycopg2 or psycopg2-binary
- Alternative libraries: asyncpg, SQLAlchemy, pg8000
- Connecting Python to PostgreSQL
- Cursor and connection objects
- Executing SQL queries from Python

Module 3: Basic SQL Operations via Python

- Creating and deleting tables
- Inserting, selecting, updating, deleting data
- Parameterized queries to avoid SQL injection
- Executing multiple queries
- Committing and rolling back transactions

Module 4: Data Types and Constraints

- PostgreSQL data types: INT, TEXT, BOOLEAN, DATE, UUID, JSONB, etc.
- Constraints: PRIMARY KEY, UNIQUE, NOT NULL, CHECK, DEFAULT, FOREIGN KEY
- Using constraints via Python queries
- Working with special types (JSONB, Arrays)

Module 5: Error Handling and Transactions

- Error types in PostgreSQL (IntegrityError, OperationalError, etc.)
- Handling exceptions in Python (try-except with psycopg2)
- Using transactions (commit(), rollback())
- Setting autocommit mode

Module 6: Working with Complex Queries

- JOINs: INNER, LEFT, RIGHT, FULL
- Aggregations: GROUP BY, HAVING, COUNT(), SUM(), etc.
- Subqueries and CTEs (Common Table Expressions)
- Views and materialized views

Module 7: Working with Files and Bulk Data

- Importing data from CSV, Excel to PostgreSQL using Python
- Exporting query results to CSV/Excel
- Bulk insert using executemany() or COPY command
- File handling and data cleaning before import

Module 8: PostgreSQL Advanced Features

- Indexes and performance optimization
- PostgreSQL sequences and auto-increment
- Triggers and stored procedures (executing via Python)
- Partitioning and inheritance (intro)
- Using EXPLAIN for query performance

Module 9: Using PostgreSQL in Web Applications

- Integrating PostgreSQL with:
    - Flask (using psycopg2 or SQLAlchemy)
    - Django (ORM with PostgreSQL backend)
- Creating API endpoints that interact with PostgreSQL
- Session and user management via database

Module 10: ORM with SQLAlchemy (Optional but Recommended)

- Intro to Object Relational Mapping
- Defining models with SQLAlchemy
- Connecting PostgreSQL with SQLAlchemy
- Performing CRUD operations
- Migrations using Alembic

Module 11: Async PostgreSQL in Python (Optional Advanced)

- Using asyncpg for asynchronous queries
- Performance comparison with sync libraries
- Integrating async PostgreSQL with FastAPI or async frameworks

Module 12: Testing and Maintenance

- Writing test cases for database code (unittest, pytest)
- Creating test databases
- Managing schema migrations
- Backup and restore PostgreSQL databases from Python

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