**1. Purpose and Applications of SQL**

**SQL (Structured Query Language)** is a standard language for managing and interacting with relational databases. It allows developers to:

* **Create databases and tables** to store data.
* **Insert, update, and delete data** in a structured format.
* **Query data** using powerful search criteria to retrieve specific information.
* **Join tables** together to extract meaningful relationships between datasets.

For **web applications**, SQL is crucial because:

* It allows storage of user-generated content (e.g., profiles, posts, comments).
* It supports authentication processes (storing and retrieving login credentials).
* It handles transactions and payment records (e.g., in an expense tracker).
* It ensures data integrity and consistency through ACID (Atomicity, Consistency, Isolation, Durability) principles.

**2. Fundamental Components of a Database**

1. **Tables**:
   * A table is a collection of related data organized in rows and columns.
   * Each table represents an entity (e.g., Users, Expenses, Categories).
2. **Columns**:
   * Columns define the attributes or properties of the entity.
   * Each column has a specific **data type** (e.g., integer, string, date) and represents a field (e.g., username, amount, date).
3. **Data Types**:
   * **Integer**: Whole numbers (e.g., User ID).
   * **Varchar**: Variable-length strings for text (e.g., Username).
   * **Date/Time**: For storing dates and timestamps (e.g., created\_at).
   * **Float/Decimal**: For financial values (e.g., expense amounts).
   * **Boolean**: For true/false values.

**3. Basic Database Schema for Expense Tracker Project**

Here is a simple schema with relationships between tables for your **Expense Tracker**:

**a. Users Table**

Stores user data for login and tracking individual expenses.

sql

Copy code

CREATE TABLE Users (

user\_id INT PRIMARY KEY AUTO\_INCREMENT,

username VARCHAR(50) NOT NULL UNIQUE,

email VARCHAR(100) NOT NULL UNIQUE,

password VARCHAR(255) NOT NULL,

created\_at TIMESTAMP DEFAULT CURRENT\_TIMESTAMP

);

**b. Expenses Table**

Tracks individual expenses by each user, linking the user ID

CREATE TABLE Expenses (

expense\_id INT PRIMARY KEY AUTO\_INCREMENT,

user\_id INT,

category\_id INT,

amount DECIMAL(10, 2) NOT NULL,

payment\_method\_id INT,

description VARCHAR(255),

expense\_date DATE NOT NULL,

created\_at TIMESTAMP DEFAULT CURRENT\_TIMESTAMP,

FOREIGN KEY (user\_id) REFERENCES Users(user\_id),

FOREIGN KEY (category\_id) REFERENCES Categories(category\_id),

FOREIGN KEY (payment\_method\_id) REFERENCES PaymentMethods(payment\_method\_id)

);

**c. Categories Table**

Stores various expense categories (e.g., groceries, rent, entertainment).

sql

Copy code

CREATE TABLE Categories (

category\_id INT PRIMARY KEY AUTO\_INCREMENT,

category\_name VARCHAR(50) NOT NULL

);

**d. Payment Methods Table**

Stores different payment methods (e.g., cash, credit card, bank transfer)

CREATE TABLE PaymentMethods (

payment\_method\_id INT PRIMARY KEY AUTO\_INCREMENT,

method\_name VARCHAR(50) NOT NULL

);

**e. Budgets Table**

(Optional) Users can set monthly budgets for specific categories.

CREATE TABLE Budgets (

budget\_id INT PRIMARY KEY AUTO\_INCREMENT,

user\_id INT,

category\_id INT,

budget\_limit DECIMAL(10, 2),

month VARCHAR(10),

year INT,

FOREIGN KEY (user\_id) REFERENCES Users(user\_id),

FOREIGN KEY (category\_id) REFERENCES Categories(category\_id)

);