Coding Skills Assessment

Instructions:

- You are required to complete three parts of this assignment: **System Design**, **Business Logic Implementation**, and **Database Query Writing**.
- You may use any programming language and database management system you are comfortable with.
- Ensure that your code is modular, scalable, and follows clean coding practices.

Part 1: System Design

Problem Statement:
Design a simplified **e-commerce system** that handles users, products, orders, and payments.

Requirements:

- The system should support multiple users with the ability to create, view, and manage orders.
- Each order can contain multiple products.
- A payment can be made for each order, and an order can have different statuses (e.g., pending, completed, shipped).

Deliverables:

1. **Class Diagram** that outlines the relationships between `User`, `Product`, `Order`, and `Payment`.
2. Write code stubs for each of the main components, ensuring that relationships (e.g., `Order` contains multiple `Products`) are appropriately handled.

Part 2: Business Logic Implementation

Problem Statement:
You are tasked with implementing an **inventory management system** for a warehouse. The system should be able to track stock levels and manage restocking.

Requirements:

1. Implement a function that:

    - Takes a list of products with their current stock levels and a list of incoming sales orders.
    - Reduces the stock levels based on the orders.
    - If the stock level of any product drops below a certain threshold (e.g., 10 units), an alert should be triggered to restock the item.
2. Implement a function to **restock** items. The function should:
    - Take a list of products that need restocking and their required quantities.
    - Update the stock levels accordingly.

Deliverables:

- Provide the code implementation for the two functions: `process_orders()` and `restock_items()`.
- Ensure error handling is in place for invalid input (e.g., trying to process an order when the product is out of stock).

Part 3: Database Query Handling

Problem Statement:
You are given a relational database schema for an online bookstore with the following tables:

Tables:

```
Customers (customer_id, name, email)
Books (book_id, title, author, price)
Orders (order_id, customer_id, order_date)
OrderDetails (order_id, book_id, quantity)
```

Requirements:

1. Write a SQL query to retrieve the top 5 customers who have purchased the most books (by total quantity) over the last year.
2. Write a SQL query to calculate the total revenue generated from book sales by each author.
3. Write a SQL query to retrieve all books that have been ordered more than 10 times, along with the total quantity ordered for each book.

Deliverables:

- Provide the SQL queries for the three requirements.
- Ensure that the queries are optimized for performance, considering indexing where necessary.

Submission Guidelines:

- Submit your code and any necessary files (diagrams, database scripts) in a single archive.
- Include a **README** explaining your solution, how to run it, and any assumptions you have made.

Evaluation Criteria:

- **System Design**: Clarity, scalability, and correctness of the design.
- **Business Logic**: Efficiency, correctness, and robustness of the logic.
- **Database Query**: Correctness, performance, and understanding of SQL.
- **Clean Code**: Adherence to coding best practices, readability, and maintainability.