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Python Assignment:1

TechShop

Task 1: Classes and Their Attributes:

You are working as a software developer for TechShop, a company that sells electronic gadgets. Your task is to design and implement an application using Object-Oriented Programming (OOP) principles to manage customer information, product details, and orders. Below are the classes you need to create:
Customers Class:
Attributes:
• CustomerID (int)• FirstName (string)• LastName (string)• Email (string)• Phone (string)• Address (string)

Methods:
• CalculateTotalOrders(): Calculates the total number of orders placed by this customer.
• GetCustomerDetails(): Retrieves and displays detailed information about the customer.
• UpdateCustomerInfo(): Allows the customer to update their information (e.g., email, phone, or address).
Products Class:
Attributes:
• ProductID (int)• ProductName (string)• Description (string)• Price (decimal)

Methods:
• GetProductDetails(): Retrieves and displays detailed information about the product.
• UpdateProductInfo(): Allows updates to product details (e.g., price, description).
• IsProductInStock(): Checks if the product is currently in stock.
Orders Class:
Attributes:
• OrderID (int)
• Customer (Customer) - Use composition to reference the Customer who placed the order.
• OrderDate (DateTime) • TotalAmount (decimal) Methods:
• CalculateTotalAmount() - Calculate the total amount of the order.
• GetOrderDetails(): Retrieves and displays the details of the order (e.g., product list and quantities).
• UpdateOrderStatus(): Allows updating the status of the order (e.g., processing, shipped).
• CancelOrder(): Cancels the order and adjusts stock levels for products. OrderDetails Class:
Attributes:
• OrderDetailID (int)
• Order (Order) - Use composition to reference the Order to which this detail belongs.

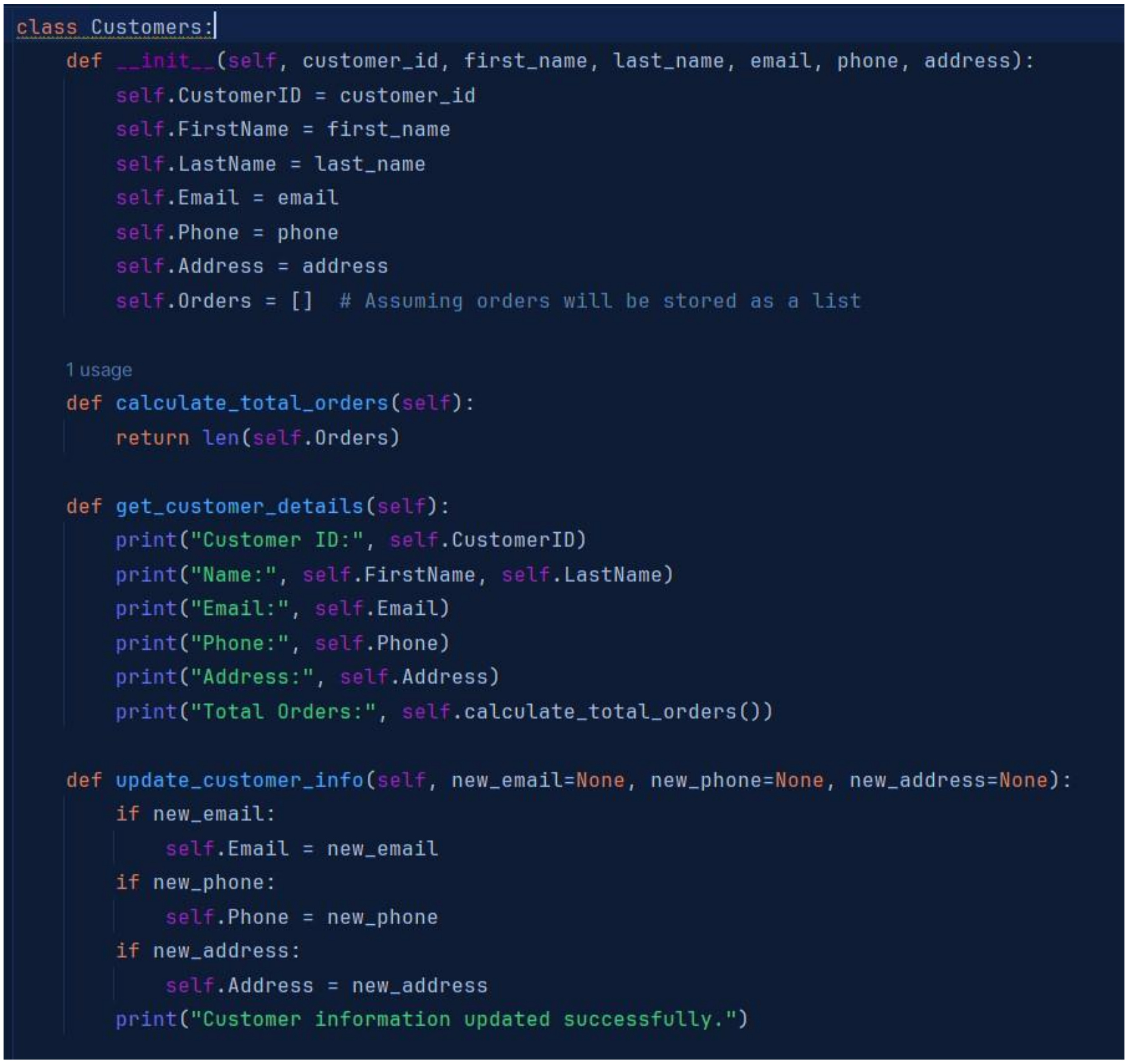
- Product (Product) - Use composition to reference the Product included in the order detail. • Quantity (int) Methods:
- CalculateSubtotal() - Calculate the subtotal for this order detail.
- GetOrderDetailInfo(): Retrieves and displays information about this order detail.
- UpdateQuantity(): Allows updating the quantity of the product in this order detail.
- AddDiscount(): Applies a discount to this order detail.

Inventory class:

Attributes:

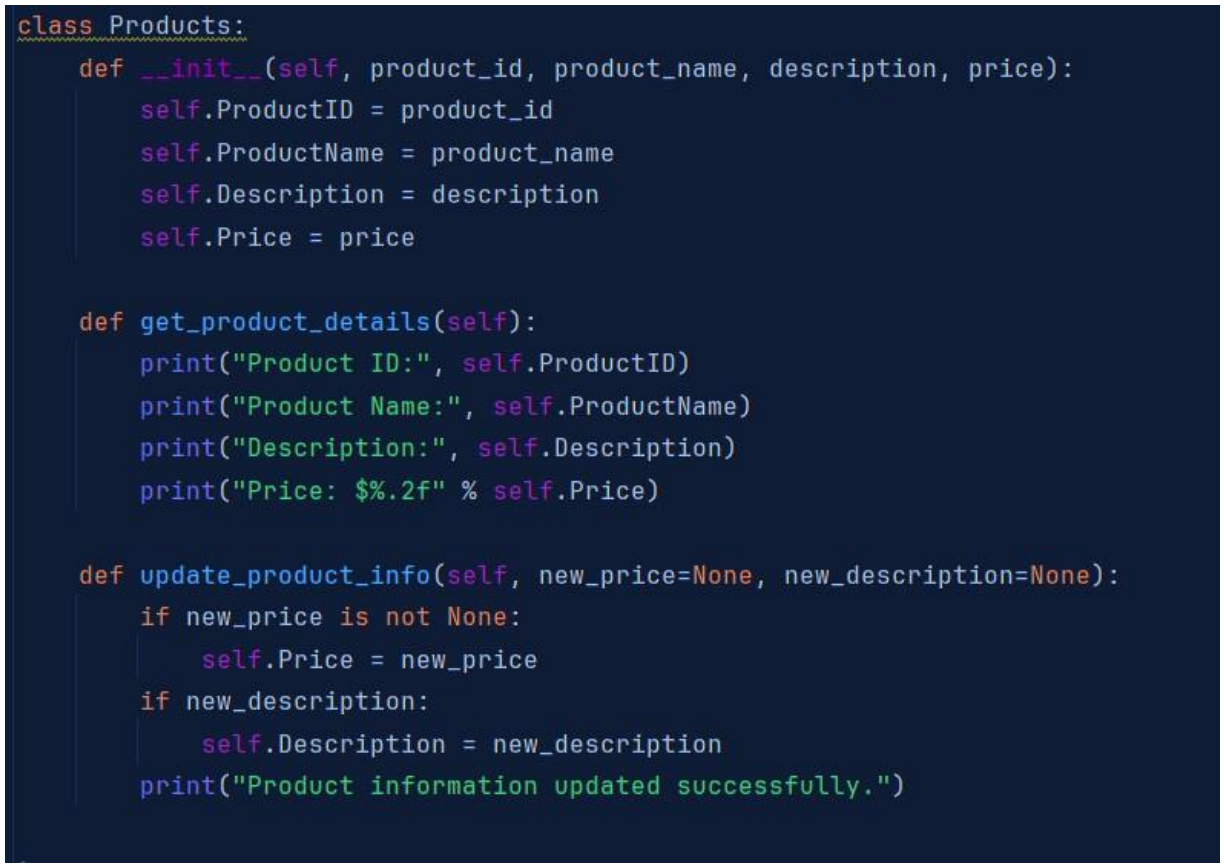
- InventoryID(int)
- Product (Composition): The product associated with the inventory item.
- QuantityInStock: The quantity of the product currently in stock. • LastStockUpdate Methods:
- GetProduct(): A method to retrieve the product associated with this inventory item.
- GetQuantityInStock(): A method to get the current quantity of the product in stock.
- AddToInventory(int quantity): A method to add a specified quantity of the product to the inventory.
- RemoveFromInventory(int quantity): A method to remove a specified quantity of the product from the inventory.
- UpdateStockQuantity(int newQuantity): A method to update the stock quantity to a new value. • IsProductAvailable(int quantityToCheck): A method to check if a specified quantity of the product is available in the inventory.
- GetInventoryValue(): A method to calculate the total value of the products in the inventory based on their prices and quantities.
- ListLowStockProducts(int threshold): A method to list products with quantities below a specified threshold, indicating low stock.
- ListOutOfStockProducts(): A method to list products that are out of stock.
- ListAllProducts(): A method to list all products in the inventory, along with their quantities.

Customer class:

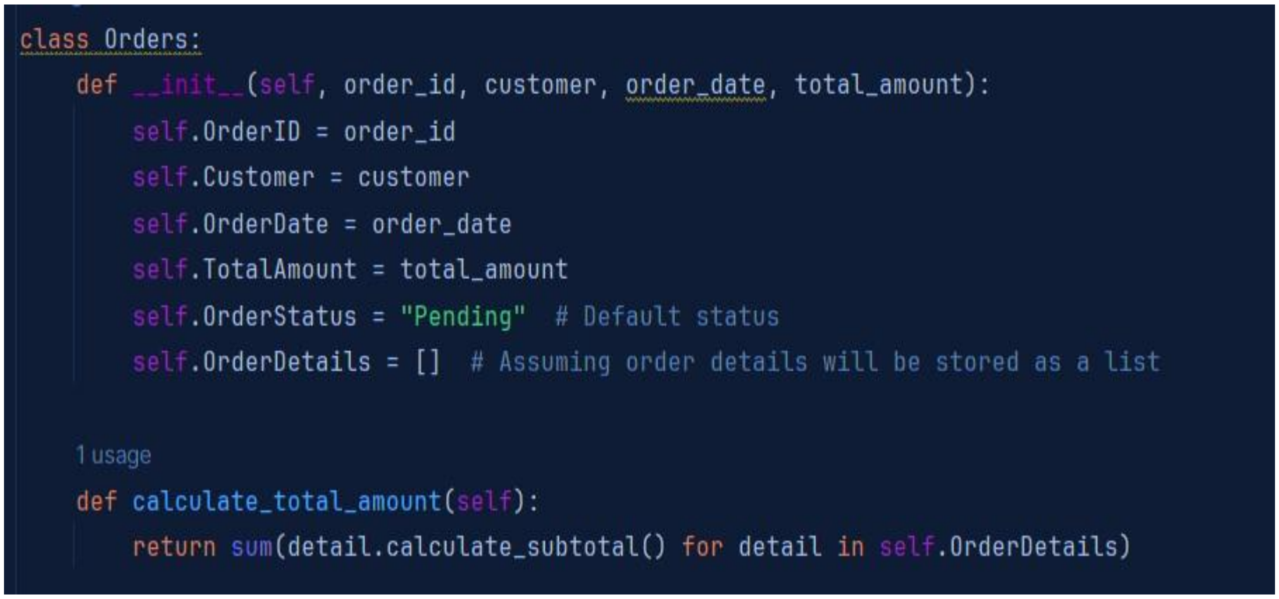


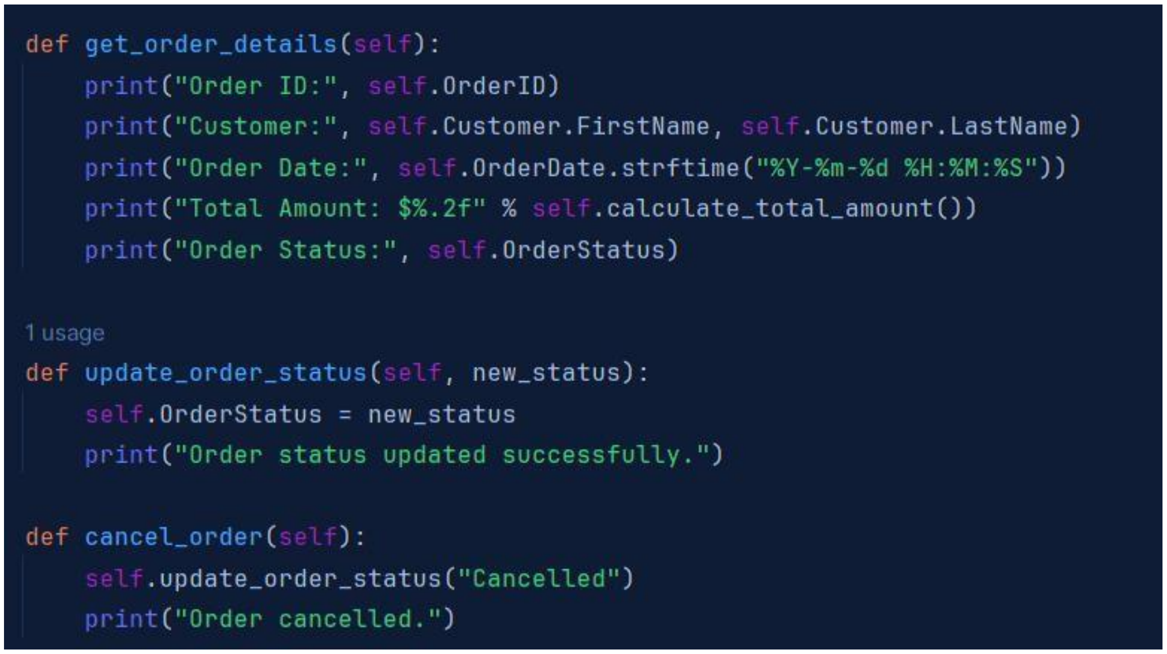
```python
class Customers:
    def __init__(self, customer_id, first_name, last_name, email, phone, address):
        self.CustomerID = customer_id
        self.FirstName = first_name
        self.LastName = last_name
        self.Email = email
        self.Phone = phone
        self.Address = address
        self.Orders = []  # Assuming orders will be stored as a list

    1 usage
    def calculate_total_orders(self):
        return len(self.Orders)

    def get_customer_details(self):
        print("Customer ID:", self.CustomerID)
        print("Name:", self.FirstName, self.LastName)
        print("Email:", self.Email)
        print("Phone:", self.Phone)
        print("Address:", self.Address)
        print("Total Orders:", self.calculate_total_orders())

    def update_customer_info(self, new_email=None, new_phone=None, new_address=None):
        if new_email:
            self.Email = new_email
        if new_phone:
            self.Phone = new_phone
        if new_address:
            self.Address = new_address
        print("Customer information updated successfully.")
```

Product class:


```python
class Products:
    def __init__(self, product_id, product_name, description, price):
        self.ProductID = product_id
        self.ProductName = product_name
        self.Description = description
        self.Price = price

    def get_product_details(self):
        print("Product ID:", self.ProductID)
        print("Product Name:", self.ProductName)
        print("Description:", self.Description)
        print("Price: $%.2f" % self.Price)

    def update_product_info(self, new_price=None, new_description=None):
        if new_price is not None:
            self.Price = new_price
        if new_description:
            self.Description = new_description
        print("Product information updated successfully.")
```

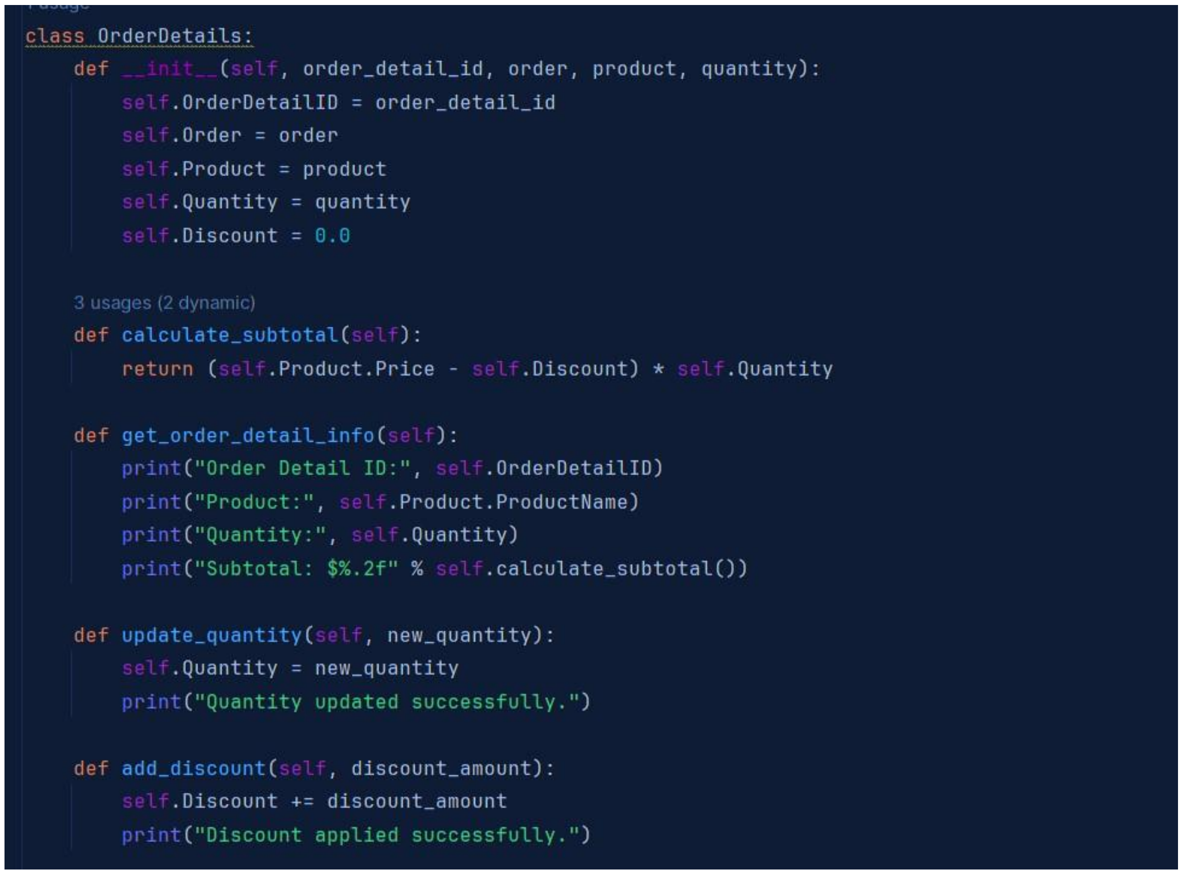
Order class:


```python
class Orders:
    def __init__(self, order_id, customer, order_date, total_amount):
        self.OrderID = order_id
        self.Customer = customer
        self.OrderDate = order_date
        self.TotalAmount = total_amount
        self.OrderStatus = "Pending"  # Default status
        self.OrderDetails = []  # Assuming order details will be stored as a list

    1 usage
    def calculate_total_amount(self):
        return sum(detail.calculate_subtotal() for detail in self.OrderDetails)
```



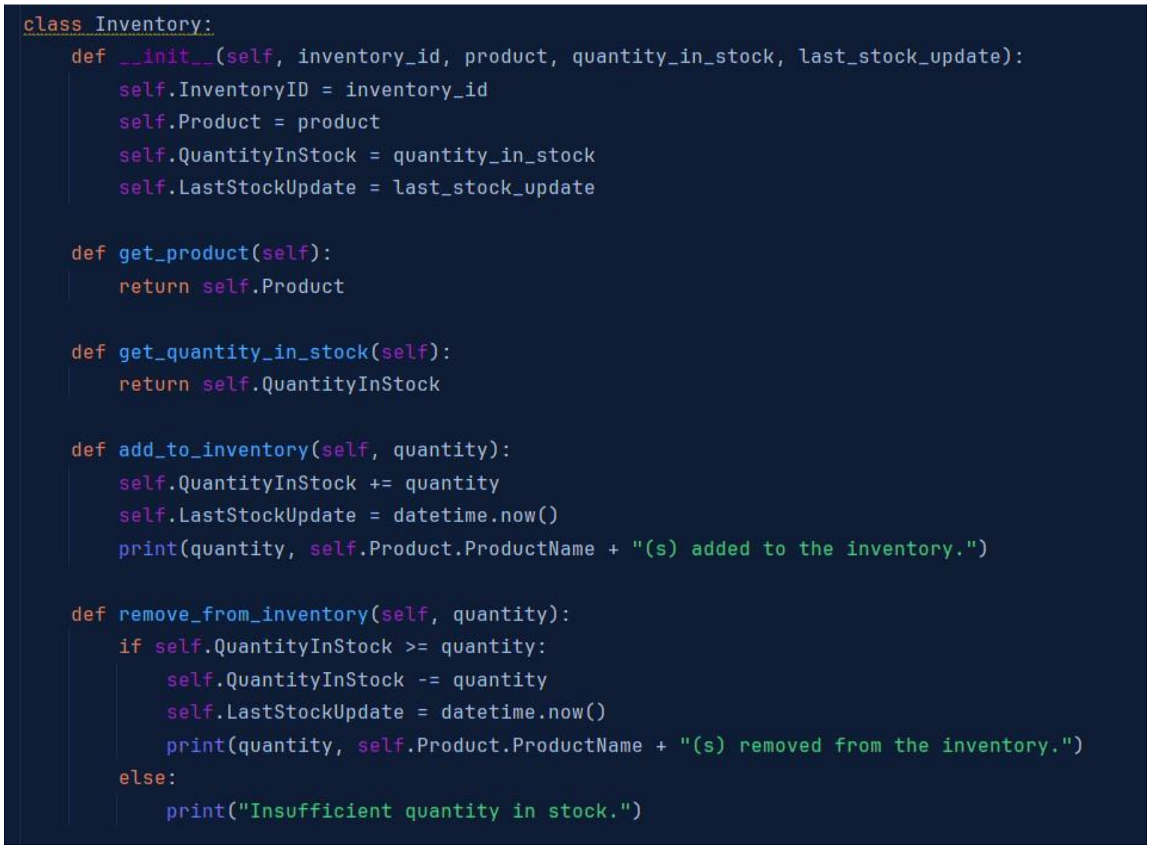
```
def get_order_details(self):
    print("Order ID:", self.OrderID)
    print("Customer:", self.Customer.FirstName, self.Customer.LastName)
    print("Order Date:", self.OrderDate.strftime("%Y-%m-%d %H:%M:%S"))
    print("Total Amount: $%.2f" % self.calculate_total_amount())
    print("Order Status:", self.OrderStatus)

1 usage
def update_order_status(self, new_status):
    self.OrderStatus = new_status
    print("Order status updated successfully.")

def cancel_order(self):
    self.update_order_status("Cancelled")
    print("Order cancelled.")
```

Orderdetails class:

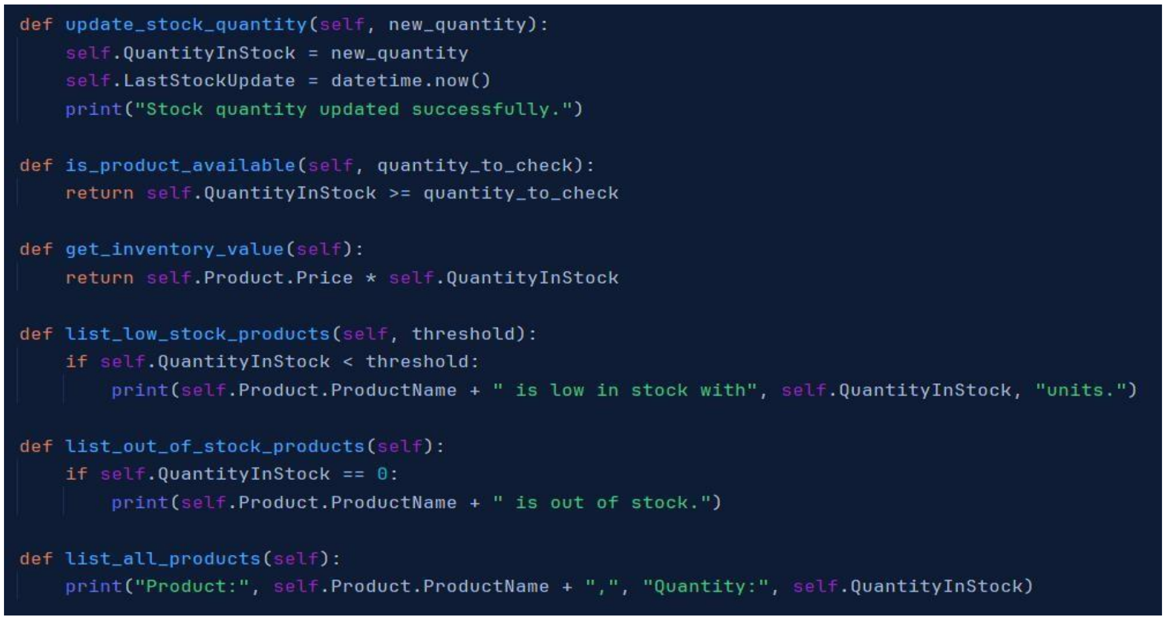


```
class OrderDetails:
    def __init__(self, order_detail_id, order, product, quantity):
        self.OrderDetailID = order_detail_id
        self.Order = order
        self.Product = product
        self.Quantity = quantity
        self.Discount = 0.0

    3 usages (2 dynamic)
    def calculate_subtotal(self):
        return (self.Product.Price - self.Discount) * self.Quantity

    def get_order_detail_info(self):
        print("Order Detail ID:", self.OrderDetailID)
        print("Product:", self.Product.ProductName)
        print("Quantity:", self.Quantity)
        print("Subtotal: $%.2f" % self.calculate_subtotal())

    def update_quantity(self, new_quantity):
        self.Quantity = new_quantity
        print("Quantity updated successfully.")

    def add_discount(self, discount_amount):
        self.Discount += discount_amount
        print("Discount applied successfully.")
```

Inventory class:



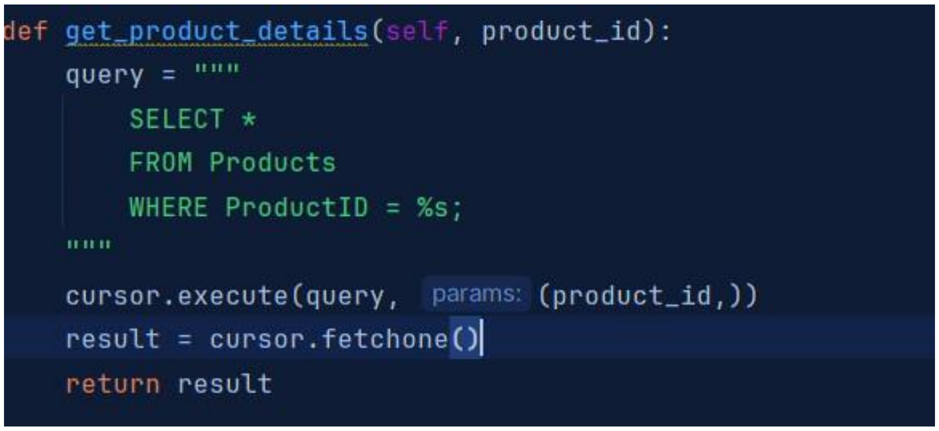
```
class Inventory:
    def __init__(self, inventory_id, product, quantity_in_stock, last_stock_update):
        self.InventoryID = inventory_id
        self.Product = product
        self.QuantityInStock = quantity_in_stock
        self.LastStockUpdate = last_stock_update

    def get_product(self):
        return self.Product

    def get_quantity_in_stock(self):
        return self.QuantityInStock

    def add_to_inventory(self, quantity):
        self.QuantityInStock += quantity
        self.LastStockUpdate = datetime.now()
        print(quantity, self.Product.ProductName + "(s) added to the inventory.")

    def remove_from_inventory(self, quantity):
        if self.QuantityInStock >= quantity:
            self.QuantityInStock -= quantity
            self.LastStockUpdate = datetime.now()
            print(quantity, self.Product.ProductName + "(s) removed from the inventory.")
        else:
            print("Insufficient quantity in stock.")
```



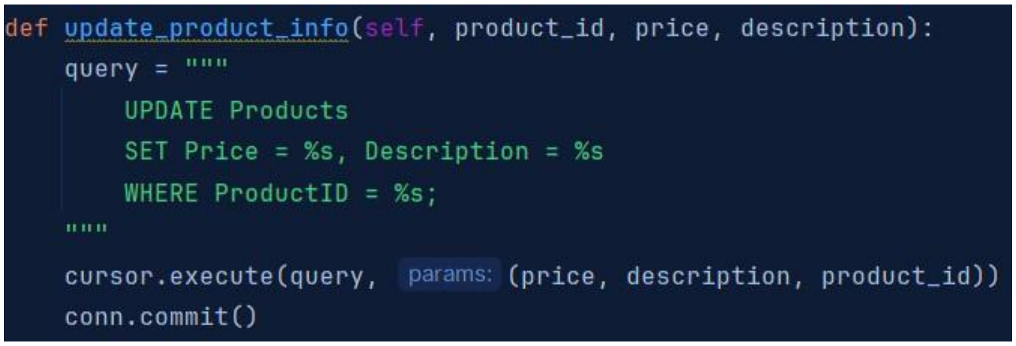
```
def update_stock_quantity(self, new_quantity):
    self.QuantityInStock = new_quantity
    self.LastStockUpdate = datetime.now()
    print("Stock quantity updated successfully.")

def is_product_available(self, quantity_to_check):
    return self.QuantityInStock >= quantity_to_check

def get_inventory_value(self):
    return self.Product.Price * self.QuantityInStock

def list_low_stock_products(self, threshold):
    if self.QuantityInStock < threshold:
        print(self.Product.ProductName + " is low in stock with", self.QuantityInStock, "units.")

def list_out_of_stock_products(self):
    if self.QuantityInStock == 0:
        print(self.Product.ProductName + " is out of stock.")

def list_all_products(self):
    print("Product:", self.Product.ProductName + ",", "Quantity:", self.QuantityInStock)
```

Managing Product list.

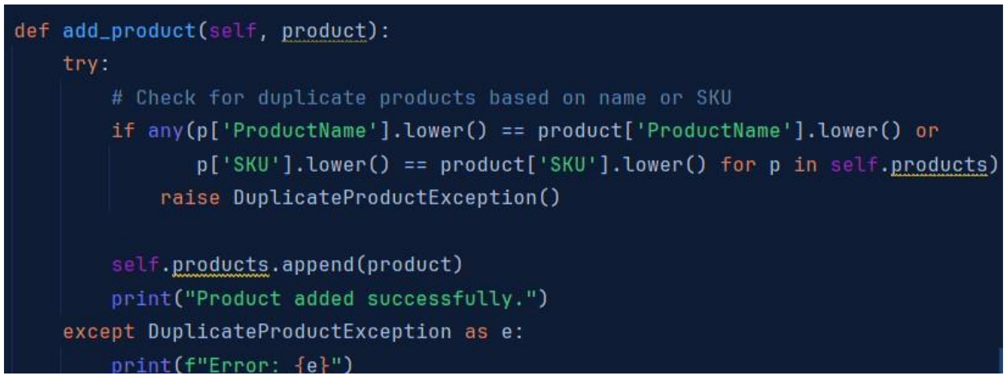
Maintaining a list of products:


```
def get_product_details(self, product_id):
    query = """
        SELECT *
        FROM Products
        WHERE ProductID = %s;
    """
    cursor.execute(query,  params: (product_id,))
    result = cursor.fetchone()
    return result
```

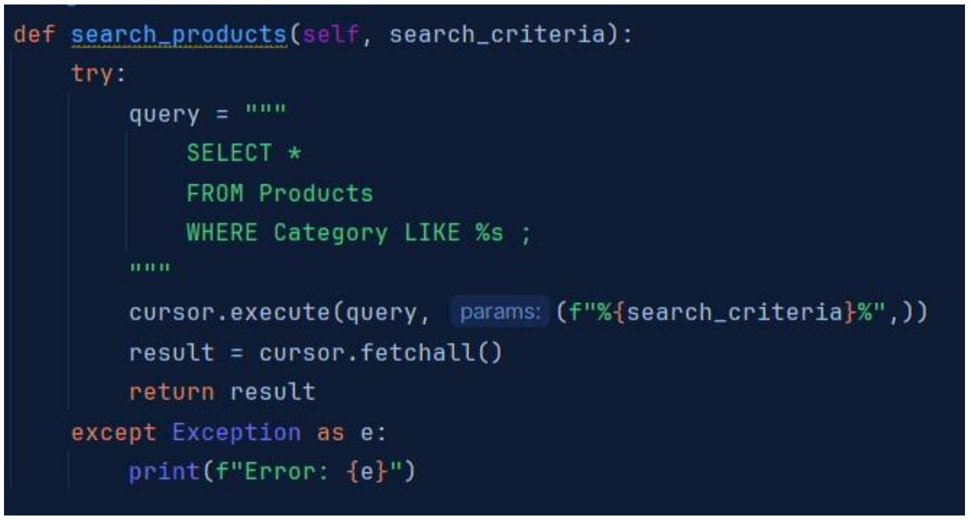
Updating product info:


```
def update_product_info(self, product_id, price, description):
    query = """
        UPDATE Products
        SET Price = %s, Description = %s
        WHERE ProductID = %s;
    """
    cursor.execute(query,  params: (price, description, product_id))
    conn.commit()
```

Adding products:


```
def add_product(self, product):
    try:
        # Check for duplicate products based on name or SKU
        if any(p['ProductName'].lower() == product['ProductName'].lower() or
               p['SKU'].lower() == product['SKU'].lower() for p in self.products)
            raise DuplicateProductException()

        self.products.append(product)
        print("Product added successfully.")
    except DuplicateProductException as e:
        print(f"Error: {e}")
```

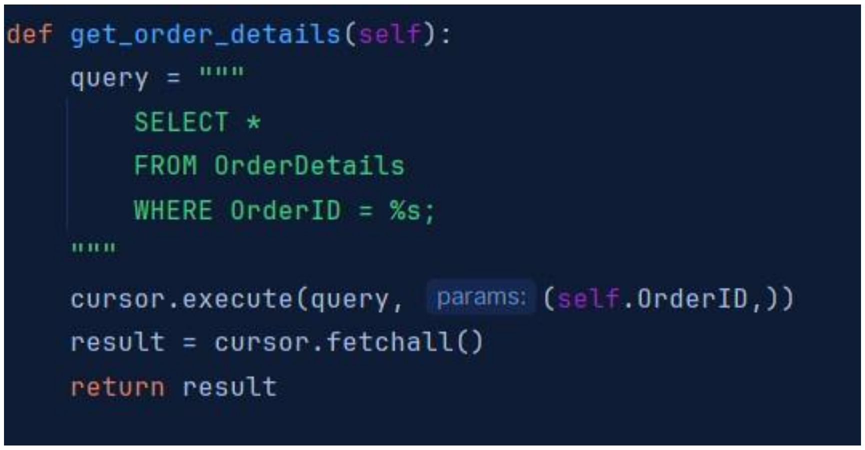
Searching products:



```
def search_products(self, search_criteria):
    try:
        query = """
            SELECT *
            FROM Products
            WHERE Category LIKE %s ;
        """
        cursor.execute(query,  params: (f"%{search_criteria}%",))
        result = cursor.fetchall()
        return result
    except Exception as e:
        print(f"Error: {e}")
```

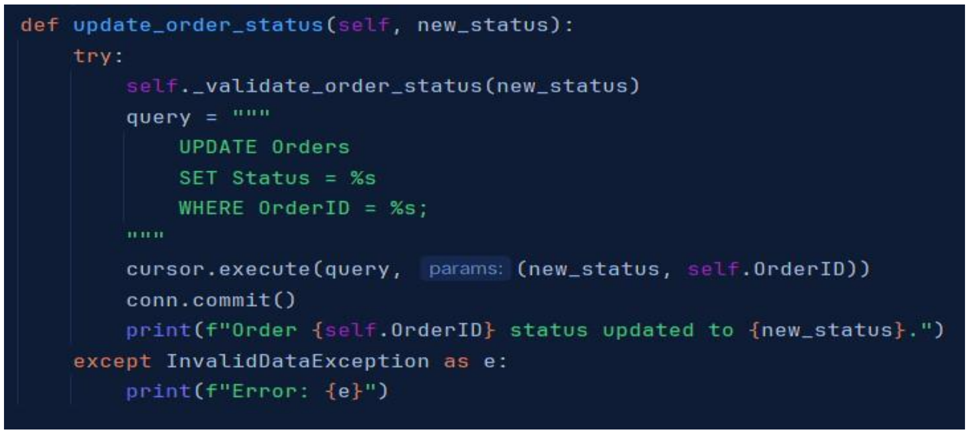
Managing order list.

Get order details:



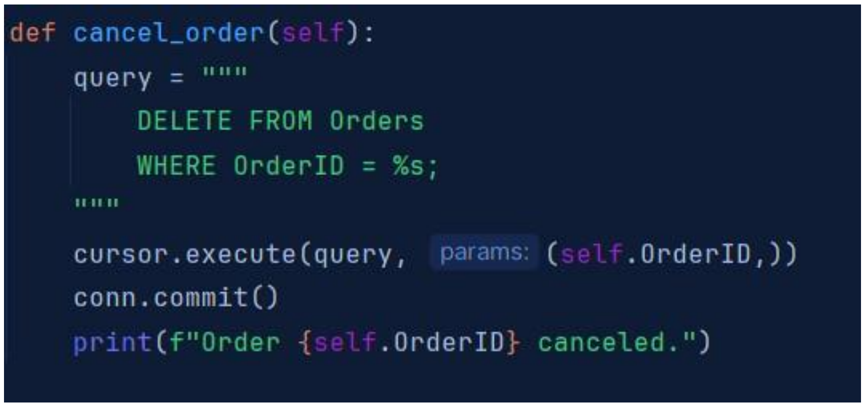
```
def get_order_details(self):
    query = """
        SELECT *
        FROM OrderDetails
        WHERE OrderID = %s;
    """
    cursor.execute(query,  params: (self.OrderID,))
    result = cursor.fetchall()
    return result
```

Order status updation:



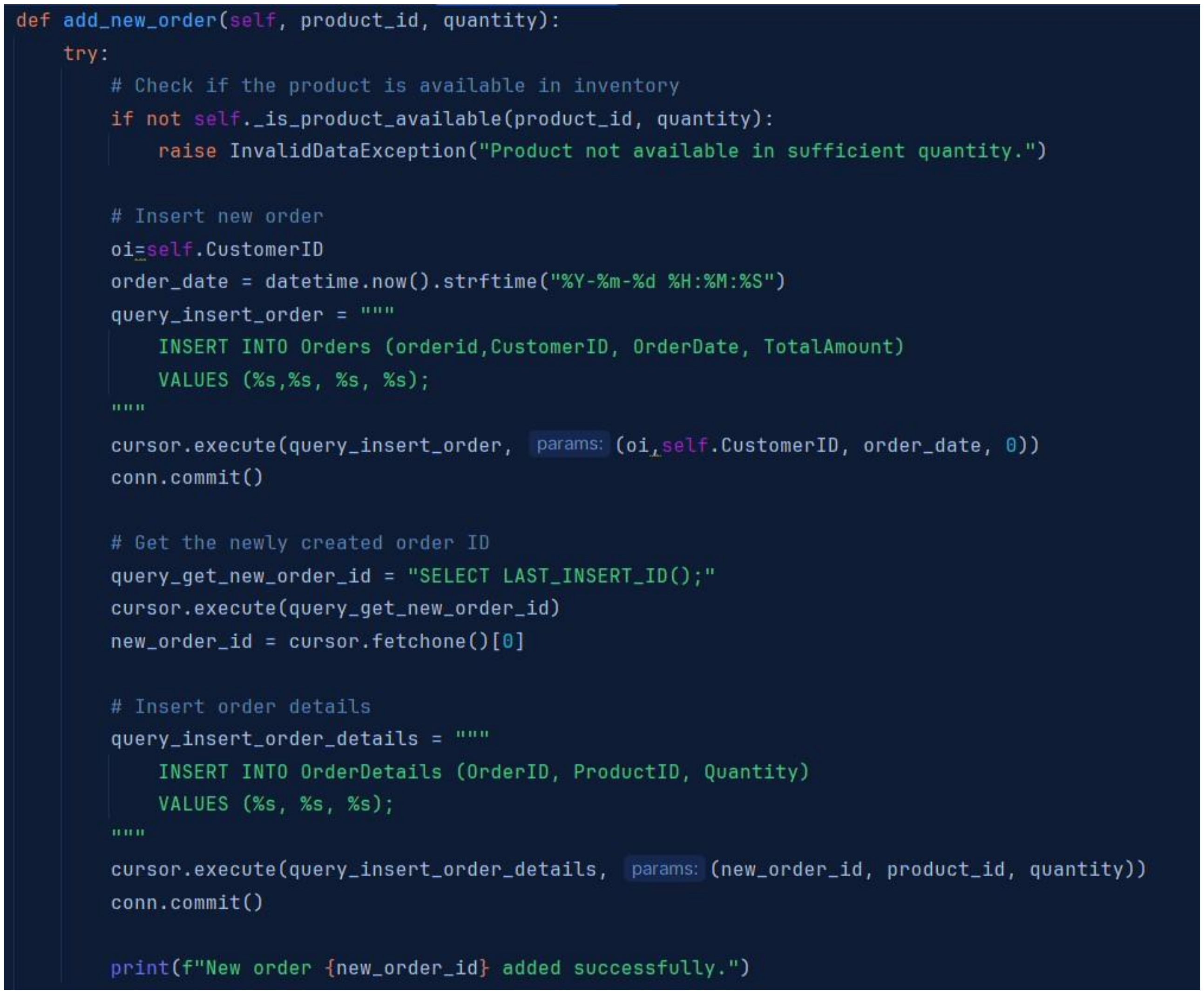
```
def update_order_status(self, new_status):
    try:
        self._validate_order_status(new_status)
        query = """
            UPDATE Orders
            SET Status = %s
            WHERE OrderID = %s;
        """
        cursor.execute(query,  params: (new_status, self.OrderID))
        conn.commit()
        print(f"Order {self.OrderID} status updated to {new_status}.")
    except InvalidDataException as e:
        print(f"Error: {e}")
```

Order cancellation:



```
def cancel_order(self):
    query = """
        DELETE FROM Orders
        WHERE OrderID = %s;
    """
    cursor.execute(query,  params: (self.OrderID,))
    conn.commit()
    print(f"Order {self.OrderID} canceled.")
```

Adding new orders:



```
def add_new_order(self, product_id, quantity):
    try:
        # Check if the product is available in inventory
        if not self._is_product_available(product_id, quantity):
            raise InvalidDataException("Product not available in sufficient quantity.")

        # Insert new order
        oi=self.CustomerID
        order_date = datetime.now().strftime("%Y-%m-%d %H:%M:%S")
        query_insert_order = """
            INSERT INTO Orders (orderid,CustomerID, OrderDate, TotalAmount)
            VALUES (%s,%s, %s, %s);
        """
        cursor.execute(query_insert_order,  params: (oi,self.CustomerID, order_date, 0))
        conn.commit()

        # Get the newly created order ID
        query_get_new_order_id = "SELECT LAST_INSERT_ID();"
        cursor.execute(query_get_new_order_id)
        new_order_id = cursor.fetchone()[0]

        # Insert order details
        query_insert_order_details = """
            INSERT INTO OrderDetails (OrderID, ProductID, Quantity)
            VALUES (%s, %s, %s);
        """
        cursor.execute(query_insert_order_details,  params: (new_order_id, product_id, quantity))
        conn.commit()

        print(f"New order {new_order_id} added successfully.")
```

Task 6: Collections

• **Managing Products List:**

o Challenge: Maintaining a list of products available for sale (List<Products>).

o Scenario: Adding, updating, and removing products from the list.
o Solution: Implement methods to add, update, and remove products. Handle exceptions for duplicate products, invalid updates, or removal of products with existing orders.

• **Managing Orders List:**

o Challenge: Maintaining a list of customer orders (List<Orders>). o Scenario: Adding new orders, updating order statuses, and removing canceled orders. o Solution: Implement methods to add new orders, update order statuses, and remove canceled orders. Ensure that updates are synchronized with inventory and payment records.

• **Sorting Orders by Date:**

o Challenge: Sorting orders by order date in ascending or descending order. o Scenario: Retrieving and displaying orders based on specific date ranges.

o Solution: Use the List<Orders> collection and provide custom sorting methods for order date. Consider implementing SortedList if you need frequent sorting operations.

• **Inventory Management with SortedList:**

o Challenge: Managing product inventory with a SortedList based on product IDs.

o Scenario: Tracking the quantity in stock for each product and quickly retrieving inventory information.

o Solution: Implement a SortedList<int, Inventory> where keys are product IDs. Ensure that inventory updates are synchronized with product additions and removals.

• **Handling Inventory Updates:**

o Challenge: Ensuring that inventory is updated correctly when processing orders.

o Scenario: Decrementing product quantities in stock when orders are placed. o Solution: Implement a method to update inventory quantities when orders are processed. Handle exceptions for insufficient stock.

• **Product Search and Retrieval:**

o Challenge: Implementing a search functionality to find products based on various criteria (e.g., name, category).
o Scenario: Allowing customers to search for products.
o Solution: Implement custom search methods using LINQ queries on the List<Products> collection. Handle exceptions for invalid search criteria.

• **Duplicate Product Handling:**

o Challenge: Preventing duplicate products from being added to the list.
o Scenario: When a product with the same name or SKU is added.
o Solution: Implement logic to check for duplicates before adding a product to the list. Raise exceptions or return error messages for duplicates.

• **Payment Records List:**

o Challenge: Managing a list of payment records for orders (List<PaymentClass>). o Scenario: Recording and updating payment information for each order.

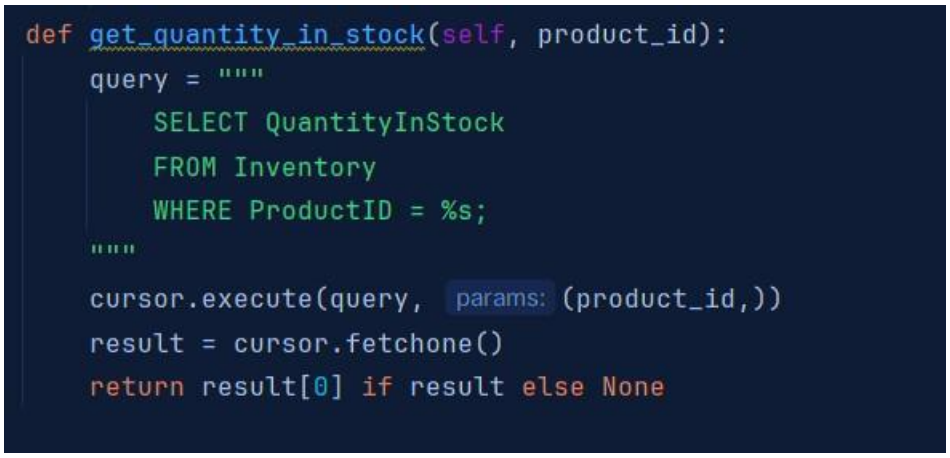
o Solution: Implement methods to record payments, update payment statuses, and handle payment errors. Ensure that payment records are consistent with order records.

• **OrderDetails and Products Relationship:** o Challenge: Managing the relationship between OrderDetails and Products.

o Scenario: Ensuring that order details accurately reflect the products available in the inventory.

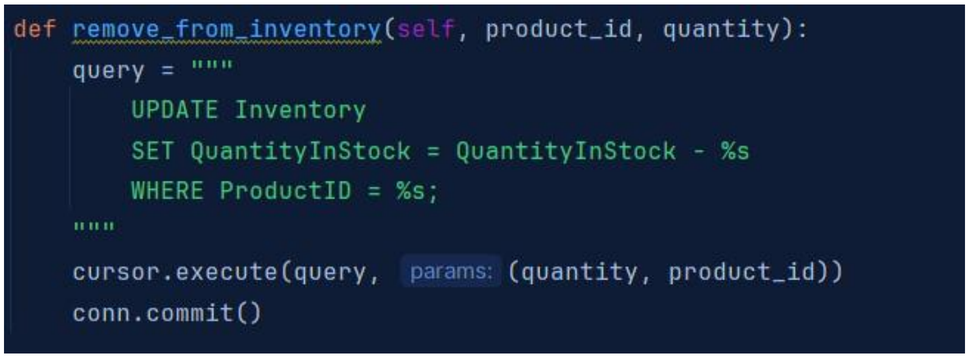
o Solution: Implement methods to validate product availability in the inventory before adding order details. Handle exceptions for unavailable products.

Checking stock quantity:



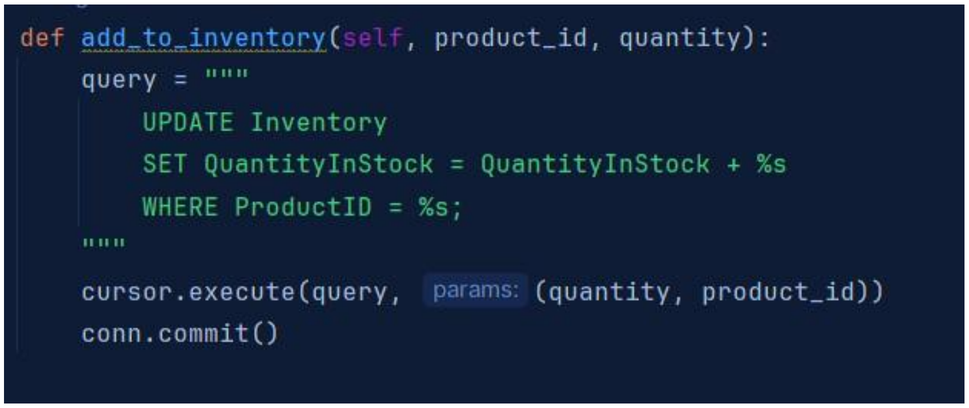
```
def get_quantity_in_stock(self, product_id):
    query = """
        SELECT QuantityInStock
        FROM Inventory
        WHERE ProductID = %s;
    """
    cursor.execute(query,  params: (product_id,))
    result = cursor.fetchone()
    return result[0] if result else None
```

Removing stock from inventory:



```
def remove_from_inventory(self, product_id, quantity):
    query = """
        UPDATE Inventory
        SET QuantityInStock = QuantityInStock - %s
        WHERE ProductID = %s;
    """
    cursor.execute(query,  params: (quantity, product_id))
    conn.commit()
```

Adding stock to inventory:



```
def add_to_inventory(self, product_id, quantity):
    query = """
        UPDATE Inventory
        SET QuantityInStock = QuantityInStock + %s
        WHERE ProductID = %s;
    """
    cursor.execute(query,  params: (quantity, product_id))
    conn.commit()
```

Database Connectivity:

Task 7: Database Connectivity

- Implement a DatabaseConnector class responsible for establishing a connection to the "TechShopDB" database. This class should include methods for opening, closing, and managing database connections.
- Implement classes for Customers, Products, Orders, OrderDetails, Inventory with properties, constructors, and methods for CRUD (Create, Read, Update, Delete) operations. **1: Customer Registration**

Description: When a new customer registers on the TechShop website, their information (e.g., name, email, phone) needs to be stored in the database.

Task: Implement a registration form and database connectivity to insert new customer records. Ensure proper data validation and error handling for duplicate email addresses. **2: Product Catalog Management**

Description: TechShop regularly updates its product catalog with new items and changes in product details (e.g., price, description). These changes need to be reflected in the database.

Task: Create an interface to manage the product catalog. Implement database connectivity to update product information. Handle changes in product details and ensure data consistency. **3: Placing Customer Orders**

Description: Customers browse the product catalog and place orders for products they want to purchase. The orders need to be stored in the database.

Task: Implement an order processing system. Use database connectivity to record customer orders, update product quantities in inventory, and calculate order totals. **4: Tracking Order Status**

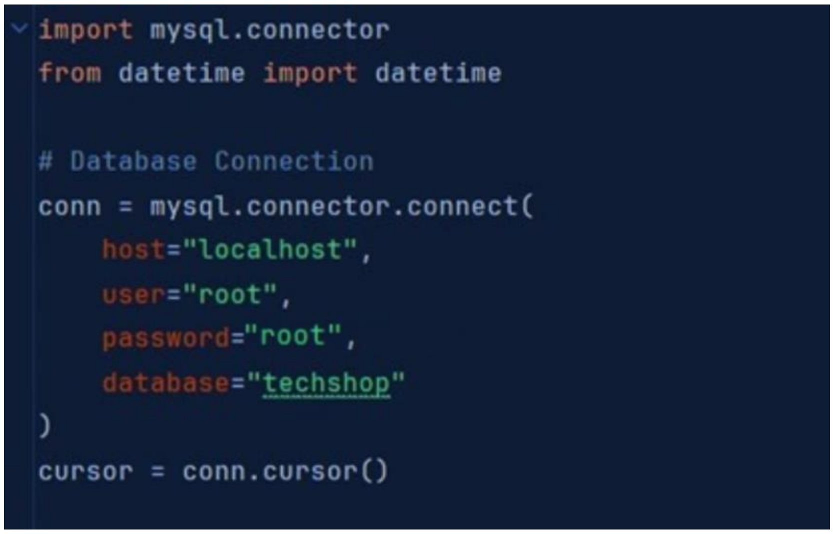
Description: Customers and employees need to track the status of their orders. The order status information is stored in the database.

Task: Develop a feature that allows users to view the status of their orders. Implement database connectivity to retrieve and display order status information.

5: Inventory Management

Description: TechShop needs to manage product inventory, including adding new products, updating stock levels, and removing discontinued items.
Task: Create an inventory management system with database connectivity. Implement features for adding new products, updating quantities, and handling discontinued products.

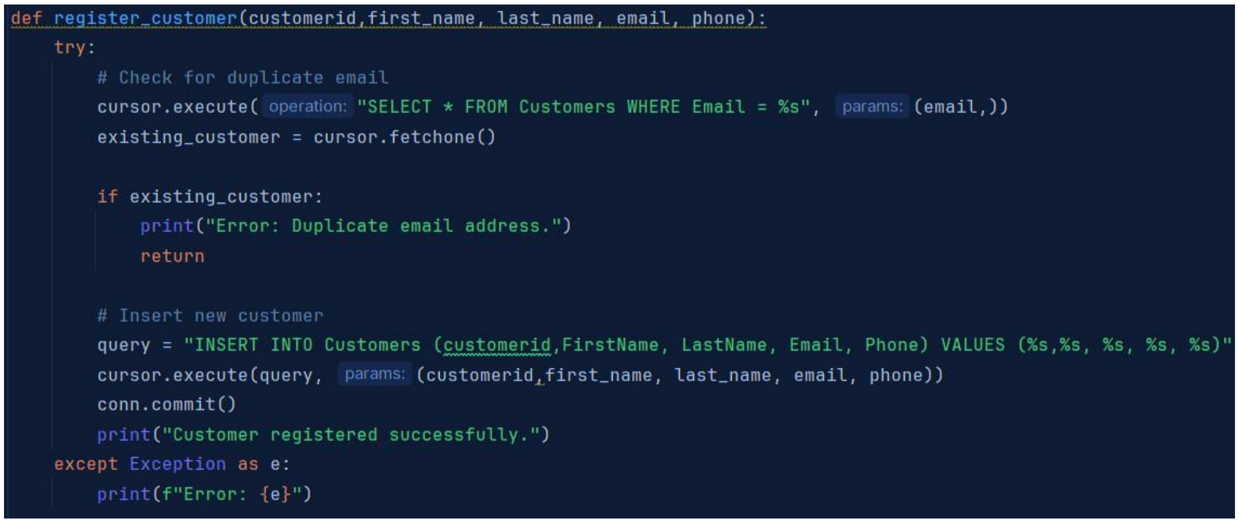
6: Sales Reporting
Description: TechShop management requires sales reports for business analysis. The sales data is stored in the database.
Task: Design and implement a reporting system that retrieves sales data from the database and generates reports based on specified criteria. **7: Customer Account Updates**
Description: Customers may need to update their account information, such as changing their email address or phone number.
Task: Implement a user profile management feature with database connectivity to allow customers to update their account details. Ensure data validation and integrity. **8: Payment Processing**
Description: When customers make payments for their orders, the payment details (e.g., payment method, amount) must be recorded in the database.
Task: Develop a payment processing system that interacts with the database to record payment transactions, validate payment information, and handle errors. **9: Product Search and Recommendations**
Description: Customers should be able to search for products based on various criteria (e.g., name, category) and receive product recommendations.
Task: Implement a product search and recommendation engine that uses database connectivity to retrieve relevant product information.



```
import mysql.connector
from datetime import datetime

# Database Connection
conn = mysql.connector.connect(
    host="localhost",
    user="root",
    password="root",
    database="techshop"
)
cursor = conn.cursor()
```

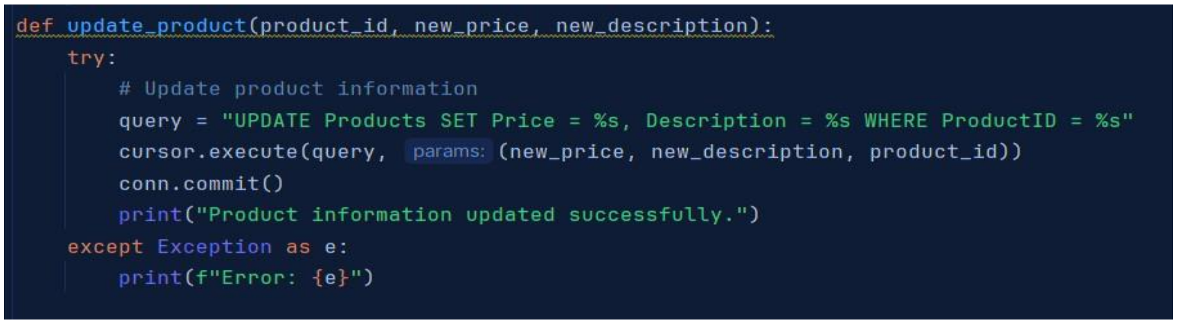
Main app:

Customer Registration:



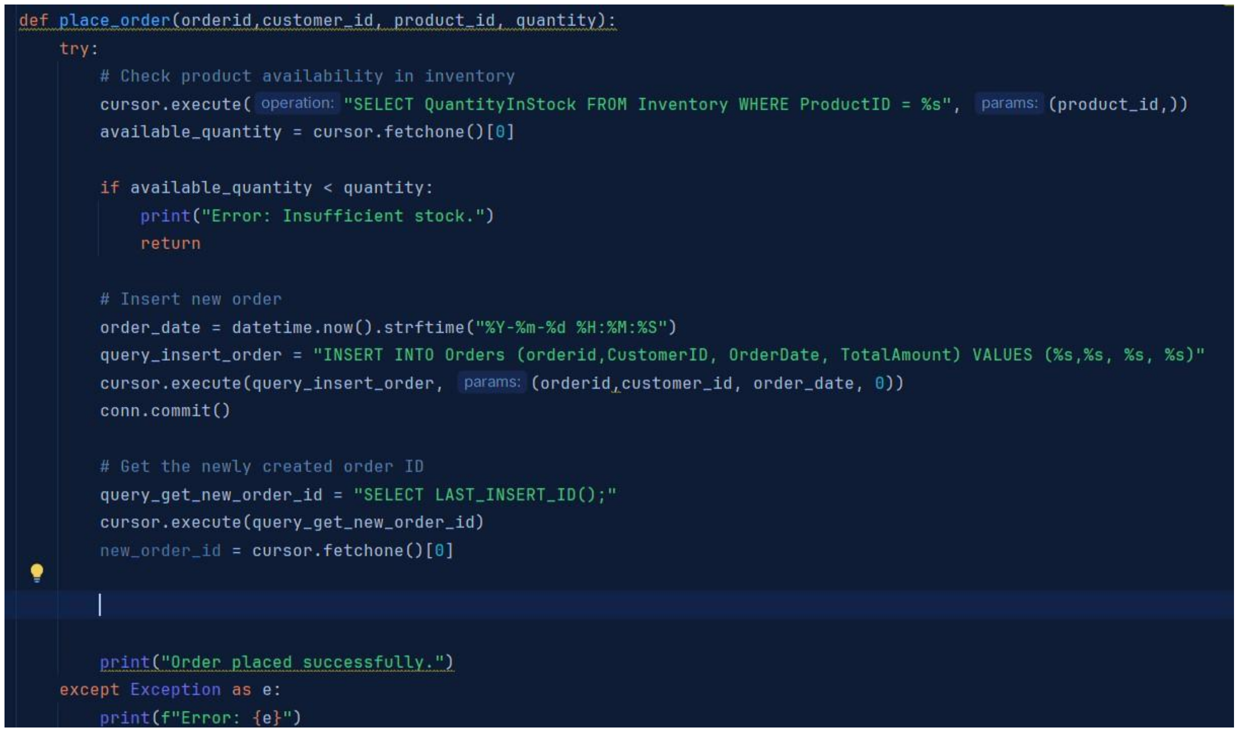
```python
def register_customer(customerid,first_name, last_name, email, phone):
    try:
        # Check for duplicate email
        cursor.execute( operation: "SELECT * FROM Customers WHERE Email = %s",  params: (email,))
        existing_customer = cursor.fetchone()

        if existing_customer:
            print("Error: Duplicate email address.")
            return

        # Insert new customer
        query = "INSERT INTO Customers (customerid,FirstName, LastName, Email, Phone) VALUES (%s,%s, %s, %s, %s)"
        cursor.execute(query,  params: (customerid,first_name, last_name, email, phone))
        conn.commit()
        print("Customer registered successfully.")
    except Exception as e:
        print(f"Error: {e}")
```

Product Catalog Management:

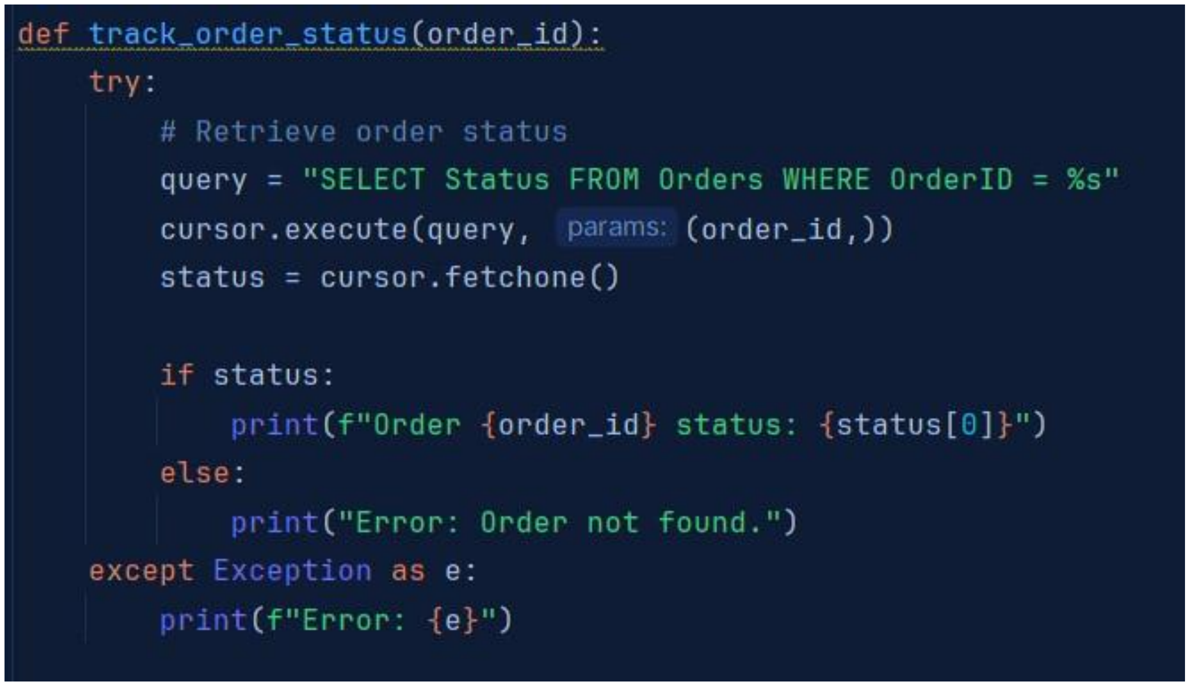


```python
def update_product(product_id, new_price, new_description):
    try:
        # Update product information
        query = "UPDATE Products SET Price = %s, Description = %s WHERE ProductID = %s"
        cursor.execute(query,  params: (new_price, new_description, product_id))
        conn.commit()
        print("Product information updated successfully.")
    except Exception as e:
        print(f"Error: {e}")
```

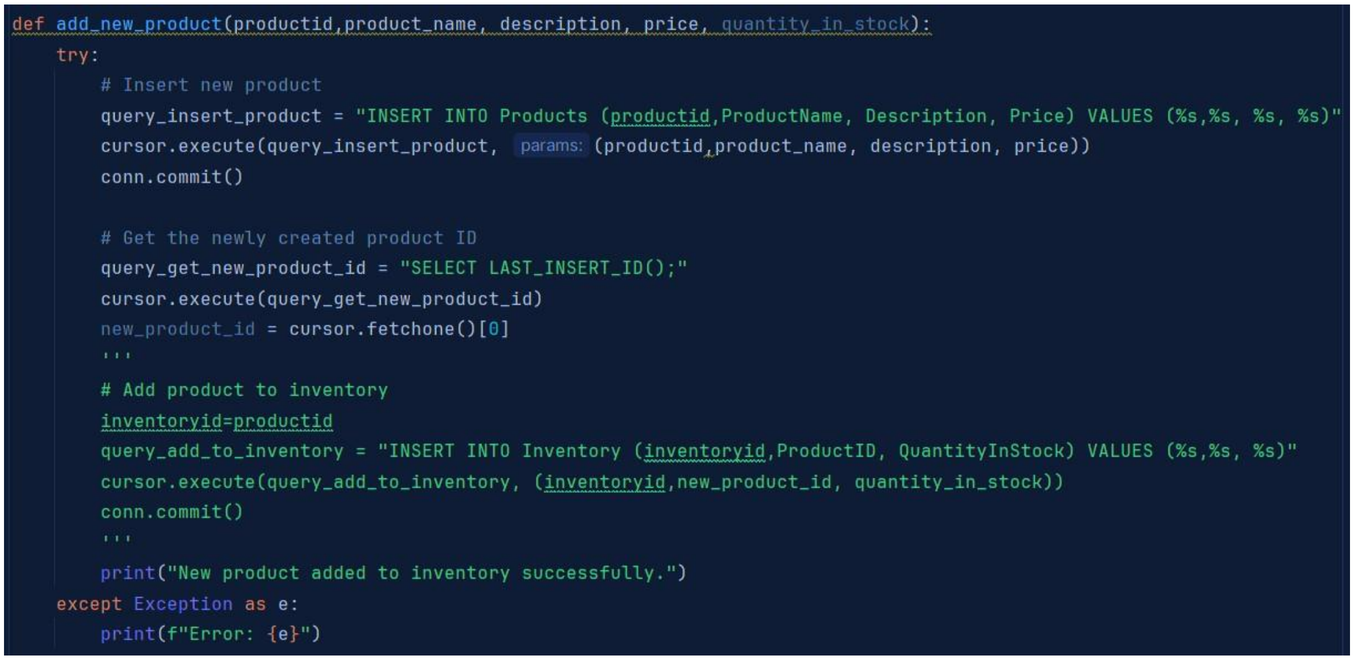
Placing Customer Orders:


```python
def place_order(orderid,customer_id, product_id, quantity):
    try:
        # Check product availability in inventory
        cursor.execute( operation: "SELECT QuantityInStock FROM Inventory WHERE ProductID = %s",  params: (product_id,))
        available_quantity = cursor.fetchone()[0]

        if available_quantity < quantity:
            print("Error: Insufficient stock.")
            return

        # Insert new order
        order_date = datetime.now().strftime("%Y-%m-%d %H:%M:%S")
        query_insert_order = "INSERT INTO Orders (orderid,CustomerID, OrderDate, TotalAmount) VALUES (%s,%s, %s, %s)"
        cursor.execute(query_insert_order,  params: (orderid,customer_id, order_date, 0))
        conn.commit()

        # Get the newly created order ID
        query_get_new_order_id = "SELECT LAST_INSERT_ID();"
        cursor.execute(query_get_new_order_id)
        new_order_id = cursor.fetchone()[0]



        print("Order placed successfully.")
    except Exception as e:
        print(f"Error: {e}")
```

Tracking Order Status:

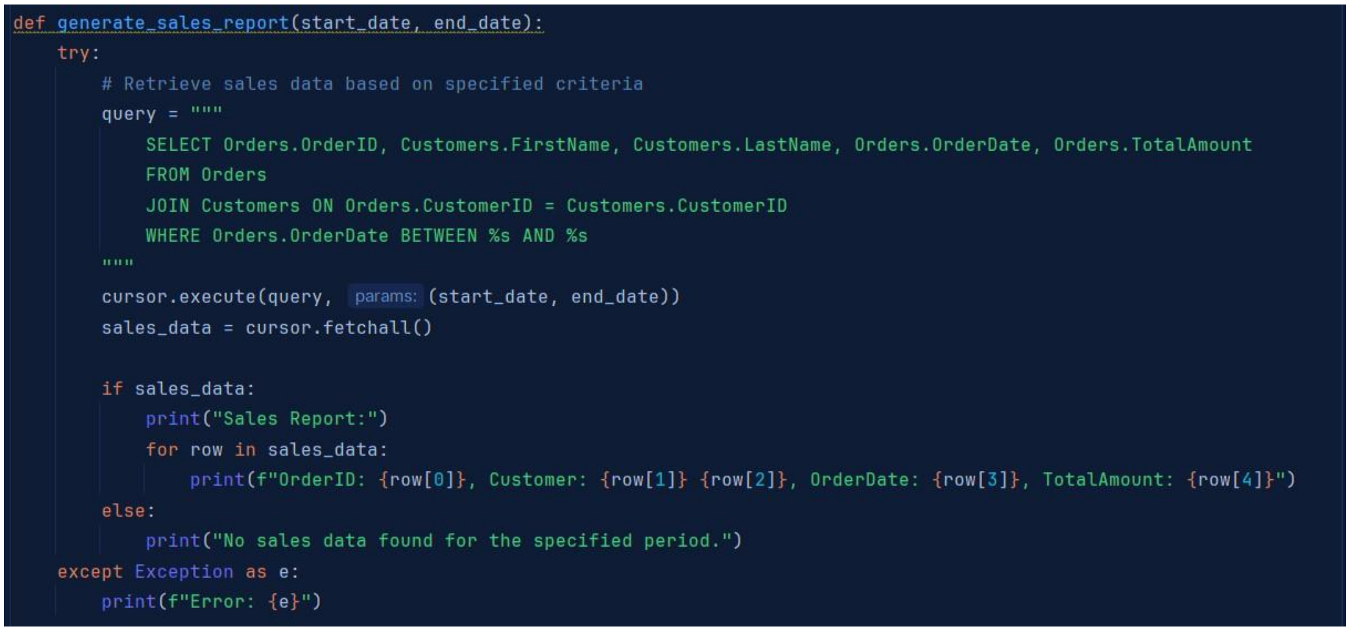

```python
def track_order_status(order_id):
    try:
        # Retrieve order status
        query = "SELECT Status FROM Orders WHERE OrderID = %s"
        cursor.execute(query,  params: (order_id,))
        status = cursor.fetchone()

        if status:
            print(f"Order {order_id} status: {status[0]}")
        else:
            print("Error: Order not found.")
    except Exception as e:
        print(f"Error: {e}")
```

Inventory Management:



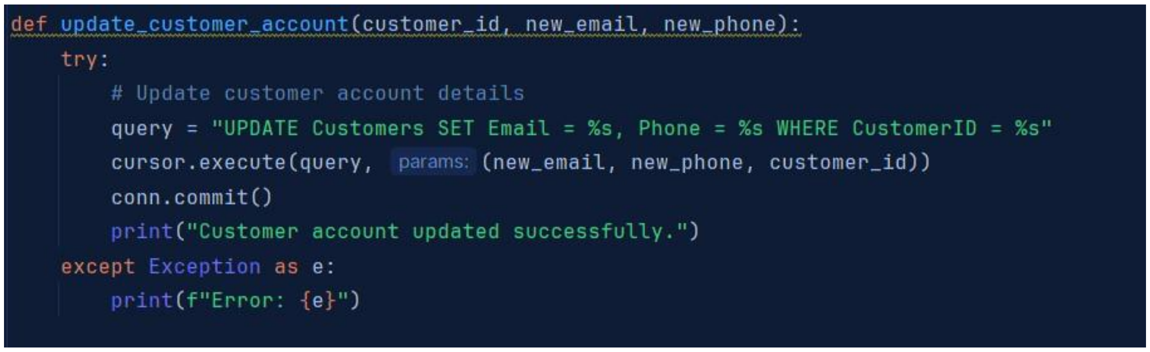
```python
def add_new_product(productid,product_name, description, price, quantity_in_stock):
    try:
        # Insert new product
        query_insert_product = "INSERT INTO Products (productid,ProductName, Description, Price) VALUES (%s,%s, %s, %s)"
        cursor.execute(query_insert_product,  params: (productid,product_name, description, price))
        conn.commit()

        # Get the newly created product ID
        query_get_new_product_id = "SELECT LAST_INSERT_ID();"
        cursor.execute(query_get_new_product_id)
        new_product_id = cursor.fetchone()[0]
        '''
        # Add product to inventory
        inventoryid=productid
        query_add_to_inventory = "INSERT INTO Inventory (inventoryid,ProductID, QuantityInStock) VALUES (%s,%s, %s)"
        cursor.execute(query_add_to_inventory, (inventoryid,new_product_id, quantity_in_stock))
        conn.commit()
        '''
        print("New product added to inventory successfully.")
    except Exception as e:
        print(f"Error: {e}")
```

Sales Reporting:



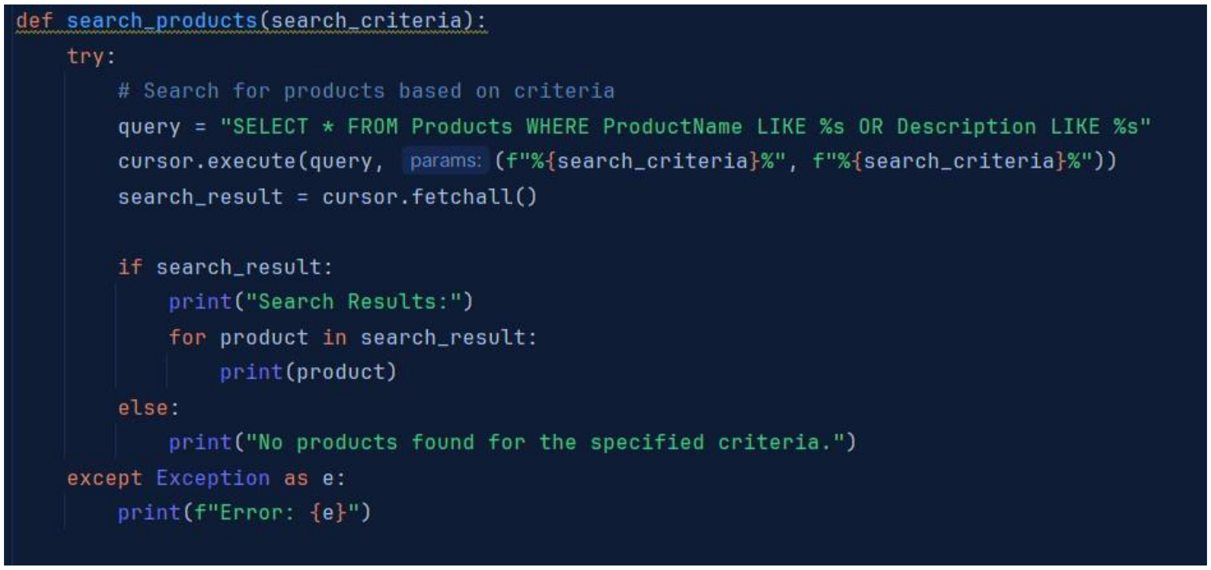
```python
def generate_sales_report(start_date, end_date):
    try:
        # Retrieve sales data based on specified criteria
        query = """
            SELECT Orders.OrderID, Customers.FirstName, Customers.LastName, Orders.OrderDate, Orders.TotalAmount
            FROM Orders
            JOIN Customers ON Orders.CustomerID = Customers.CustomerID
            WHERE Orders.OrderDate BETWEEN %s AND %s
        """
        cursor.execute(query,  params: (start_date, end_date))
        sales_data = cursor.fetchall()

        if sales_data:
            print("Sales Report:")
            for row in sales_data:
                print(f"OrderID: {row[0]}, Customer: {row[1]} {row[2]}, OrderDate: {row[3]}, TotalAmount: {row[4]}")
        else:
            print("No sales data found for the specified period.")
    except Exception as e:
        print(f"Error: {e}")
```

Customer Account Updates:



```python
def update_customer_account(customer_id, new_email, new_phone):
    try:
        # Update customer account details
        query = "UPDATE Customers SET Email = %s, Phone = %s WHERE CustomerID = %s"
        cursor.execute(query,  params: (new_email, new_phone, customer_id))
        conn.commit()
        print("Customer account updated successfully.")
    except Exception as e:
        print(f"Error: {e}")
```

Product Search and Recommendations:



```python
def search_products(search_criteria):
    try:
        # Search for products based on criteria
        query = "SELECT * FROM Products WHERE ProductName LIKE %s OR Description LIKE %s"
        cursor.execute(query,  params: (f"%{search_criteria}%", f"%{search_criteria}%"))
        search_result = cursor.fetchall()

        if search_result:
            print("Search Results:")
            for product in search_result:
                print(product)
        else:
            print("No products found for the specified criteria.")
    except Exception as e:
        print(f"Error: {e}")
```