**题目：**

Design and implement a relational database for an online shopping website. The

basic requirements for the shopping website database are: it should record

customers and products information, as well as purchase/order information and

payment details.

**一、实体（Entities）**：

所有ID都取INT是因为用INT能使用较少的字节来存储，能提示搜索效率。

**Customer**是顾客，**Seller是商家，Product**是产品，**ShoppingCart是购物车，Order**是记录整个订单相关的信息，**OrderDetail**是记录了订单中每个单独商品的具体信息，**Payment**是付款信息, **Coupon**是优惠券信息。

1. **Customer（存所有的顾客）**
   * customerId (PK) INT
   * userName VARCHAR(20)
   * password VARCHAR(20)
   * fName VARCHAR(15)
   * sName VARCHAR(15)
   * phoneNumber INT
   * email VARCHAR(45)
   * address VARCHAR(45)
2. **Seller（存所有的卖家）**
   * sellerId (PK) INT
   * sellerName VARCHAR(45)
   * description VARCHAR(45)
3. **Product(存所有的商品)**
   * productId (PK) INT
   * sellerId (FK) INT
   * productName VARCHAR(45)
   * description VARCHAR(45)
   * price INT
   * stockQuantity INT
   * category VARCHAR(45)
   * salesVolume INT
4. **Shopping****Cart（存所有的顾客的购物车）**
   * cartId (PK) INT
   * customerId INT
   * productId INT
5. **Order（存所有的订单基本信息）**
   * orderId (PK) INT
   * customerId (FK，引用Customer表) INT
   * orderDate DATETIME(3)
   * totalPrice INT
   * paymentStatus VARCHAR(45)
   * shippingAddress VARCHAR(45)
   * createdAt TIMESTAMP(3)
6. **OrderDetail（存所有订单的所有信息，从Order里访问）**
   * OrderDetailId (PK) INT
   * orderId (FK，引用Order表)  INT
   * productId (FK，引用Product表) INT
   * quantity INT
   * priceAtPurchase (记录购买时的价格，以防之后产品价格变动) INT
7. **Payment（存所有的支付信息）**
   * paymentId (PK) INT
   * orderId (FK，引用Order表) INT
   * paymentMethod (例如：信用卡、微信支付、数字人民币等) VARCHAR(45)
   * transactionId (支付网关或银行提供的事务ID) INT
   * paymentDate DATETIME(3)
   * amount (支付金额) INT
   * updatedAt TIMESTAMP(3)
8. **Coupon（存所有的优惠券）**
   * couponId (PK) INT
   * customerId INT
   * productId INT
   * discount FLOAT
   * startDate DATETIME(3)
   * endDate DATETIME(3)
   * usageCondition VARCHAR(45)

**二、关系（Relationships）:**

1. 一名**Customer** 可以下多个 **Order**，一个**Order**只能对应一个**Customer** ，即**1:m**。这可以通过 **Order** 表中的 **CustomerID** 外键实现。
2. 每个 **Order** 可以包含多个 **OrderDetail**，一个**OrderDetail**只能对应一个**Order** ，即**1:m**。这可以通过 **OrderDetail** 表中的 **OrderID** 外键实现。
3. 每个 **OrderDetail** 对应某种 **Product**中的一个，而一种**Product**可以对应多个**OrderDetail** （一个**Customer** 可能买了多个相同的，不同**Customer** 买了相同的），即**m:1**。这可以通过 **OrderDetail** 表中的 **ProductID** 外键实现。
4. 一个 **Order** 可以对应多个 **Payment**(如退款等)，而一个**Payment**也只能对应一个**Order** ，即**1:m**。这通过 **Payment** 表中的 **OrderID** 外键实现。
5. 一个**Customer** 只能有一个**ShoppingCart**，一个ShoppingCart也只能对于一个**Customer** ，即**1:1**。
6. 一个**ShoppingCart**里可以有多种**Product**，一种**Product**也能在不同的**ShoppingCart**里，即**m:m。**
7. 一个**Seller**可以有多种**Product**，一种**Product**只能对应着一个**Seller**，即**1:m。**
8. 一个**Customer** 可以有多个**Coupon**，一种**Coupon**可以对应多个**Customer** ，即**m:m**。
9. 一种**Coupon**只能对应一种**Product**，一种**Product**可以有多个**Coupon**，即**m:1**

**Requirement：**

1. We need to design an online shopping database. it should record customers and products information, as well as purchase/order information and payment details. 2. The core entity sets should contain Customer, Seller, Product, ShoppingCart, Order, OrderDetail, Payment, Coupon.

3. Customer entity has 8 attributes: customerId, userName, password, fName, sName, phoneNumber, Email, Address. Seller entity has 3 attributes: sellerId, sellerName, description. Product entity has 7 attributes: productId, sellerId, productName, description, price, stockQuantity, category. ShoppingCart has 3 attributes: cartId, customerId, productId. Order eneity has 6 attributes: orderId, customerId, orderDate, totalPrice, paymentStatus, shippingAddress. OrderDetail eneity has 5 attributes: OrderDetailId, orderId, productId, quantity, priceAtPurchase. Payment entity has 6 attributes: paymentId, orderId, paymentMethod, transactionId, paymentDate, amount. Coupon entity has 7 attributes: couponId, customerId, productId, discount, startDate, endDate, usageCondition.

4. Each customer could has many orders, and each order only belong to one customer. Each Order can contain many OrderDetails, and one OrderDetail can only correspond to one Order. Each OrderDetail contains one Product, and a Product can exist in many OrderDetails. Each Order can contain many Payments, one Payment corresponding to one Order. Each Customer can only have one ShoppingCart, and a ShoppingCart can only be used for one Customer. One ShoppingCart can have many Products, and one Product can also be in different Shoppingcarts. A Seller can sell many products, and a Product can only be sold by one Seller. A Customer can have many Coupons, and a Coupon can be owned by many Customers. A Coupon can only correspond to one Product, and a Product can have many Coupons.

需求：

1. Customer Management

* The system should allow customers to register and create user accounts.
* Customers should be able to update and modify their personal information such as name, address, phonenumber and email.
* Customers should have the ability to view and manage their order history.
* Users should be able to view their favorites.

2. Seller Management

* The system should allow sellers to register and create user accounts.
* Sellers should have the ability to describe themselves, such as the product category and user reviews
* Sellers should have the ability to manage their products, including adding new products, updating and modifying product information, and tracking product inventory.

3. Product Management

* The system should provide a platform for sellers to add, edit, and remove products.
* Each product should have attributes such as name, description, price, category, and sales volume.
* Customers should be able to view product details, including description, price and seller.
* Customers should be able to search for the product they want
* Customers should have the ability to record their desired product collection for easy search
* Customers should have the ability to see coupons for products they own

4. Order Management

* The system should store the details of the order, including the orderID, the type of products and the quantity purchased, and the price of the products.
* Customers should be able to add products to their shopping orders and proceed to checkout.
* Sellers should receive notifications of new orders and be able to update the order status.
* Customers should be able to track the status of their orders, including shipping and delivery information.
* The customer should have the ability to check the order history.

5. Payment Management

* The system should support secure payment processing for customer orders.
* The system should have the ability to record payment information, including payment time, payment amount, payment method, and transaction ID provided by the bank.
* Customers should be able to choose payment methods.

6. ShoppingCart Management

* The system should record the basic information of the product that the customer puts in the cart, so that the customer can find it quickly
* Customers should have the ability to view, add and remove products from the shopping cart.

7. Coupon Management

* The system should have the ability to record the basic information of the coupon, including the start and end time, the scope of application, the conditions of use, and the discount
* Customers should have the ability to view coupon information
* When the coupon is about to expire, users should be reminded to use it as soon as possible.