

数据库系统和信息管理期末复习

E-R 数据库设计题

2025 年 6 月考试该题分值为 20 分

大概可能问到以下几个问题：

1. 画出对应的 E-R 图
2. 写出上述实体和关系的关系模式 (Relational Schema)，标明主码 (下划线) 和外键 (并注明对应的引用)
3. 联系的主码的选择
4. SQL 代码书写 (见 SQL 专题文档)

1. E-R 图要点：实体，属性，联系，一多关系

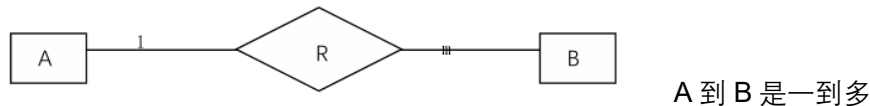
有的时候题目叙述很简洁，需要我们自行判断并添加一些属性，这些属性够用就行，不用添加太多

注意一/多关系的判断

一般情况下，一对一的关系通常是在特意提到一对一或者一对多的关系时才用到，大部分情况下是多对多的关系

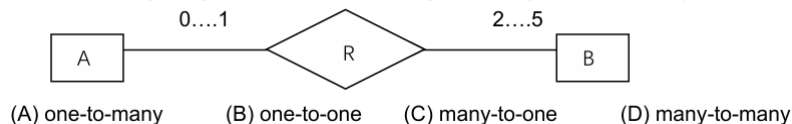
用陈氏画法画 E-R 图 (椭圆表示属性)，要注意给主码加下划线

一多关系，陈氏画法 1/m 靠近谁，谁就是 1/多



下面这种画法，要反过来 A 到 B 是多到一

2. For the E-R diagram given below, the mapping cardinality from A to B is (C)



2. 关系模式答题模版

有时候问的是满足 3NF 的关系模式设计，不要慌，都一样做

Sale=(SupermarketNo, ProductNo, SaleDate, SaleQuantity);

FK1: SupermarketNo→ Supermarket(SupermarketNo)

FK2: ProductNo→ Product(ProductNo)

主码要画下划线，外码 fk 要写出来，格式如上

注意：

联系的关系模式也要写出来，而且联系的主码要有联系两边实体的主码和这个联系的一个属性。(如上题所示，来自陈蓉练习题)

3. 联系的主码选择

一对一联系：两边任意一个实体的主码拎出来就能当关系的主码

一对多或多对一联系：“多”端主码拎出来当关系的主码

多对多联系：两边的主码都拎出来，然后再加上联系的某些属性

考虑“供货商-零件-项目”联系的“供货时间、供货数量”属性

比如说学生和课程的联系是学生上课，上课的一个属性是成绩，如果没有要求，那就是学生一个课程只能修一次，认为上课的主码是学号和课程号。如果有额外的要求，学生一个课程可以修很多次（这时候上课还会有学期这个属性）。这时候的主码就是学号、课程号和学期

也就是说，如果没有其他说明，我们可以认为多对多的联系就是两边实体的主码，如果有了其他的说明，就需要仔细考量一下了。

基础情况（无额外说明）：如果只是说“学生上课”“学生选课”“超市卖商品”，没有特别说明同一组合是否可以重复出现

默认每个实体对组合只能出现一次

主码 = 两边实体的主码的并集

例：StudentID + CourseID 是“上课”的主码

例：StoreNo + ProductNo 是“销售”的主码

额外语义限制时：

比如：“一个学生一门课可以选多次”“每月记录一次销售量”等

表明：实体组合不再唯一，需要增加区分字段（如学期、月份、时间戳等）

所以主码 = 实体主码并集 + 区分字段

如：StudentID + CourseID + Term

如：StoreNo + ProductNo + Month

1. 2023-2024 期末考试题

1. A car insurance company stores important data about customers, vehicles, insurance policies, payments, and accidents. The following entity sets are included in the system:

Each **customer** has a unique `customer_id`, along with attributes such as name and address. Each **car** is identified by a `license_no`, and is associated with a model and a `customer_id` who owns it. Each **insurance policy** is uniquely identified by `policy_id`. A policy may have multiple payments. Each **payment** has a `payment_no`, `due_date`, `amount`, and `received_on`, and is associated with a specific `policy_id`. This records **accident reports**, each identified by `report_id`, with attributes `date` and `place`. This relationship indicates which cars were involved in which accidents, linking `license_no` and `report_id`. This indicates which policies cover which cars, linking `license_no` and `policy_id`.

Note:

- A customer can own multiple cars.
- A car can be involved in multiple accidents and be covered by multiple policies.
- A policy can have multiple payments.
- A car may participate in multiple accidents, each with a corresponding report.

Write the relational schema for each entity and relationship, underlining primary keys and clearly marking foreign key references. (10 points)

2. A package delivery system tracks the sending and receiving of packages between customers. Each **Customer** has a unique `customer_id`, and attributes like name, address, and telephone. Each **Packet** has a unique `packet_id`, and includes attributes like weight and expense.

Customers **send** and **receive** packets. The **Send** relationship tracks which customer sends which packet and includes the attribute `time_send`. The **Receive** relationship records which customer receives which packet and includes the attribute `time_receive`.

Packets are transported **through** various **Places**, each identified by `place_id`, with attributes `place_name`, `city`, and `country`.

Draw the ER diagram based on the description above. Use appropriate cardinalities and attributes. (10 points)

中文译文：

某汽车保险公司需要管理关于客户、车辆、保险保单、缴费记录以及交通事故的信息。系统包含以下实体集：

Customer（客户）：每位客户有唯一的 `customer_id`，以及 `name`（姓名）和 `address`（地址）等属性。**Car**（车辆）：每辆车有唯一的 `license_no`（车牌号），以及 `model`（车型）和所属客户的 `customer_id`。**Policy**（保单）：每份保险保单有唯一的 `policy_id`。**Premium_payment**（保费缴纳）：每份保单可能包含多次缴费记录，每条记录由 `policy_id` 和 `payment_no` 唯一标识，包含 `due_date`（应缴日期）、`amount`（金额）和 `received_on`（实际缴纳时间）等属性。**Accident**（事故）：记录每次事故的 `report_id`（事故编号）、`date`（日期）和 `place`（地点）。**Participated**（参与）：记录哪辆车参与了哪些事故，是一个关联 `license_no` 和 `report_id` 的关系；**Covers**（承保）：记录哪份保单覆盖了哪辆车，是一个关联 `license_no` 和 `policy_id` 的关系。

注意：

每位客户可以拥有多辆车；

一辆车可以参与多次事故、被多个保单覆盖；

一份保单可以对应多次缴费记录；

每次事故可能涉及多辆车。

写出上述实体和关系的关系模式（Relational Schema），标明主码（下划线）和外键（并注明对应的引用）。 （10 分）

某快递系统用来管理客户之间寄送包裹的过程。系统包含以下信息：

Customer（客户）：每位客户有唯一的 **customer_id**，包含属性如 **name**（姓名）、**address**（地址）、**telephone**（电话）。**Packet**（包裹）：每个包裹有唯一标识 **packet_id**，包含属性如 **weight**（重量）、**expense**（费用）。每个包裹有一个发送客户和一个接收客户，分别通过 **Send** 和 **Receive** 两个关系来表示，并记录 **time_send** 和 **time_receive**。每个包裹可能会经过多个中转地点（**Place**），每个地点有 **place_id**、**place_name**、**city**、**country** 等属性。通过一个叫 **through** 的关系表示包裹经过的地点。

画出对应的 E-R 图，包含实体、联系、属性以及适当的多重性。（10 分）

1.

Customer(customer_id, name, address);

Car(license_no, model, customer_id); //Fks: customer_id->customer(customer_id)

Policy(policy_id);

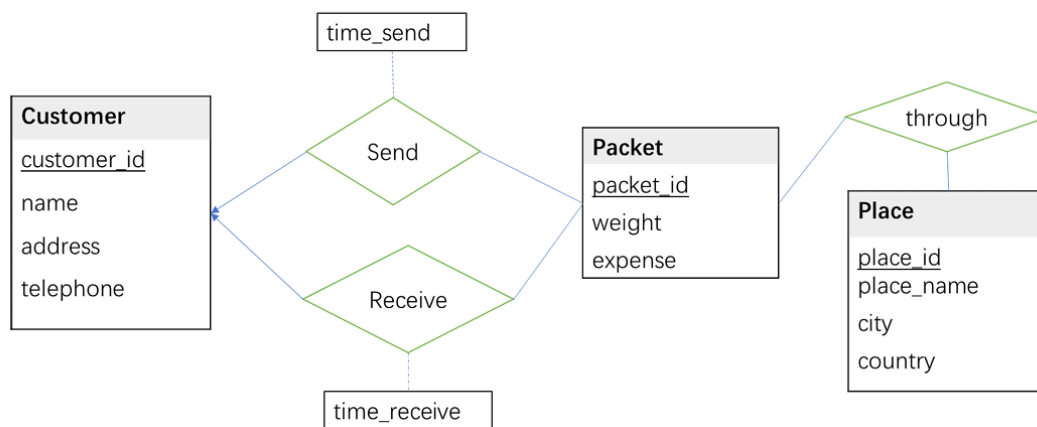
Premium_payment(policy_id, payment_no, due_date, amount, received_on); //Fks: policy_id->policy(policy_id)

Accident(report_id, date, place);

Participated(license_no, report_id); //Fks: policy_id->policy(policy_id), report_id->accident(report_id)

Covers(license_no, policy_id) //Fks: license_no->car(license_no), policy_id->policy(policy_id)

2.



2. From 练习题

For a simplified application on Supermarket Management, there are three entity sets: **Supermarket**, **Product**, and **Warehouse**.

The attributes of Supermarket includes: SupermarketNo, SMName, SMAddress, Telephone, Manager; and the attributes of Product contains: ProductNo, PName, Price, Producer, ProduceDate; and the attributes of Warehouse contains: WarehouseNo, WarehouseName, WAddress, Administrator.

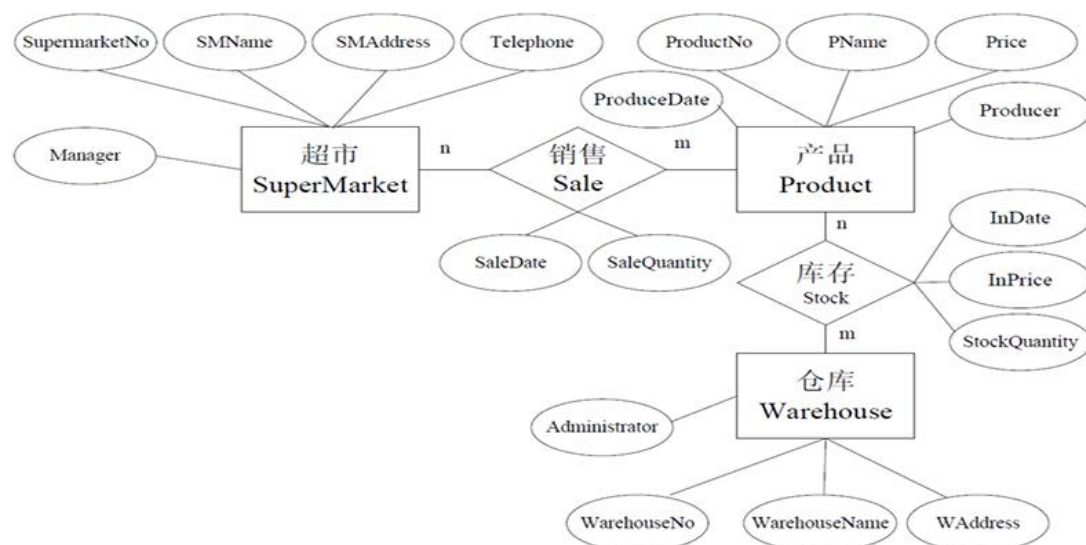
And two relationship sets: Supermarket and Product related through a binary relationship set Sale, Supermarket sales products ,record the product's sale quantities every day ; and Product and Warehouse related through a binary relationship set Stock. **The warehouse only input(store) each product once a day. The supermarket can sale only each product once a day.**

The two relationship sets have the following attributes respectively: Sale has attributes: SaleDate and SaleQuantity; Stock has attributes: InDate, InPrice, and StockQuantity.

1. Please give the corresponding ER diagram. (8 points)
2. Create the corresponding relational schemas, and point out the primary keys and the foreign keys. (8 points)
3. Use SQL statements to define Product table, and give proper integrity constraints.(4 points)

分析：联系的约束是哪种需要考虑，超市可以销售多种产品，产品也可以在多个超市销售， 所以是多对多。The warehouse only input(store) each product once a day. Stock has attributes: InDate, InPrice, and StockQuantity. 根据描述，仓库它可以进多种产品，一个产品也可以进入不同仓库，所以仓库和产品也是多对多。（只能用一种 ER 图的表示法，不能多种混用）注意：销售，库存 这两个联系：多值复合？（下图需要修改联系的属性为多值）

1. Please give the corresponding ER diagram. (8 points)



2. Create the corresponding relational schemas, and point out the primary keys and the foreign keys. (8 points)

Supermarket=(SupermarketNo, SMName, SMAddress, Telephone, Manager)

Product=(ProductNo, PName, Producer, ProduceDate)

WareHouse=(WarehouseNo, WarehouseName, WaAddress, Administrator)

Sale=(SupermarketNo, ProductNo, SaleDate, SaleQuantity);

FK1: SupermarketNo→ Supermarket(SupermarketNo)

FK2: ProductNo→ Product(ProductNo)

Stock=(ProductNo, WarehouseNo, InDate, InPrice, StockQuantity);

FK1: ProductNo→ Product(ProductNo)

FK2: WarehouseNo→ Warehouse (WarehouseNo)

3. Use SQL statements to define Product table, and give proper integrity constraints.(4 points)

Create table Product(

ProductNo char(10), //长度合理即可

PName var char(20) not null,

Price decimal(8,2),

Producer varchar(60),

ProduceDate date,

primary key (ProductNo),

check Price>0

)

3. 陈鹏练习题

To build a database to handle information about a college. Each student can take multiple courses. Each course can be taught by multiple teachers. Each teacher can teach more than one course. Each student can be guided by a teacher. Each teacher guides more than one student.

1. Construct an E-R diagram that captures the information above.
2. Convert the E-R diagram to 3NF relations. Specify keys and referential integrity constraints.
3. In the relationship mode you designed, write out the SQL statement to complete the following query:

Ask for the No and Name of all students who choose "市场营销" taught by "王敏".

4.

为一个医院的住院部建立数据库管理系统，管理如下数据:

- (1) Patient (病人) 包括: ID, name(姓名), age(年龄), gender(性别)
- (2) Nurse (护士) 包括: nurse_no(护士编号), name(姓名)
- (3) Doctor (医生) 包括: doctor_no(医生编号), name(姓名)
- (4) Ward (病房) 包括: ward_no(房号), capacity(容量)

一个病房可容纳多个病人; 一个病房可被多个护士管理, 一个护士可管理多个病房; 一个医生可担任多个病员服的主治医生, 但一个病人只能有一个主治医生。

- 1. 请给出ER图设计 (8 分)
- 2. 根据ER图给出对应的满足3NF的关系模式设计 (通过下划线标记主码) (8 分)
- 3. 使用SQL语句查找被护士“艾美丽”管理的病人姓名和年龄 (4 分)

5.

Entity Store is associated with store number, store name and address etc. Entity commodity(商品) is associated with commodity number, commodity name, specification and price. Entity employee is associated with employee no, employee name, sex and performance. Each commodity can be sold in many stores and each store may sold many kinds of commodity. For each commodity in a certain store, the sale quantity must be recorded per month. For each store, there are many employees. For each employee, he can works for only one store. For each employee who works in a certain store, salary and work period must be recorded.

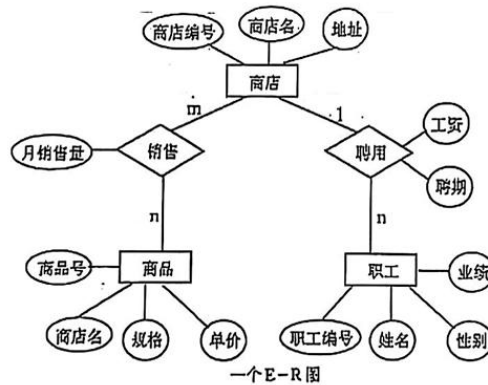
1. Construct an E-R diagram that captures the information above. (10 points)

2. Convert the E-R diagram to 3NF relations. Specify keys and referential integrity constraints. (10 points)

fine

Answer:

1.



2.

Store(Store_number, store_name, address)

Employee(employee_no, employee_name, sex, performance)

commodity(commodity_number, commodity_name, specification, Price)

sale(Store_number, commodity_number, MonthQuatity)

Store_number is a foreign key referring store(store_number).

commodity_number is a foreign key referring commodity(commodity_number).

Hire(employee_no, Store_number, During, salary)

Store_number is a foreign key referring store(store_number).

employee_no is a foreign key referring employee(employee_no).

6.

To build a database to handle information about law firms(律师事务所). Each law firm is identified by a name that is unique within a city. A lawyer is identified by an ID, and have a name, address, and salary. A lawyer may be employed by at most one firm. A customer is also identified by an ID, and have a name, address and phone number. A firm can serve a number of customers, and a customer can have a number of law firm serves. Each lawyer handles a load of cases, which involves different customers, identified by a case number. Cases may be handled by more than one lawyer, even if the lawyers work for different firms.

1. Construct an E-R diagram that captures the information above. (10 points)
2. Convert the E-R diagram to 3NF relations. Specify keys and referential integrity constraints. (10 points)

7.

To develop an employee training database system (员工培训数据库系统) for a company. It involves the following situations about employees, instructors, training projects, and training materials.

Every employee has a unique ID, a name, and his/her date of birth (DOB). An instructor has a unique ID, a name and an address. Each training project has a different training number, content, a start date and an end date. A material has a title and description. An employee can take part in several training projects. Each training project has several instructors and some kinds of materials. A material is written by only one instructor and can be used in different projects.

1. Construct an E-R diagram that captures the information above. **(10 points)**
2. Convert the E-R diagram to 3NF relations. Specify keys and referential integrity constraints. **(10 points)**

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Note:

- A customer can own multiple cars.
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Customers **send** and **receive** packets. The **Send** relationship tracks which customer sends which packet and includes the attribute time_send. The **Receive** relationship records which customer receives which packet and includes the attribute time_receive.

Packets are transported **through** various **Places**, each identified by place_id, with attributes place name, city, and country.

Draw the ER diagram based on the description above. Use appropriate cardinalities and attributes. (10 points)

To build a database to handle information about a college. Each student can take multiple courses. Each course can be taught by multiple teachers. Each teacher can teach more than one course. Each student can be guided by a teacher. Each teacher guides more than one student.

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