

例 题

一. Consider the following information in an airport database

- An **airport** is described by its **name** and the **city** that the airport locates at
- Each **airplane** has an unique **registration number** and also the **date of production** as its descriptive attributes
- Each **airplane model** is identified by a **model number** and has a **capacity** and a **weight**
- A **technician** is characterized by an unique **technician_id**, his **name** and his **phone number**
- Each **airport** **accommodates** a number of airplane **models**, and an airplane model may appears in several airports; but some airports are not suitable for accommodaing several special plane models.
- Each **airplane** **is of** a specific **model**, e.g. Boeing 737; and for **each model**, there are more than one airplane being of it.
- for each airport, there are some technicians working there, and each technician must works **at only one airport**.
- Each **technician** is **responsible for** one or more plane **models**, and each plane model has at least one technician responsible for it
- Each **airplane** is periodically **tested** by a number of **technicians** to ensure that the airplane is still airworthy. A technician may test several airplanes each year, and sometimes a technician has no task

for testing the airplanes.

It is required that when a technician tests an airplane, the airplane model that he is responsible for is just the model that the airplane tested is of.

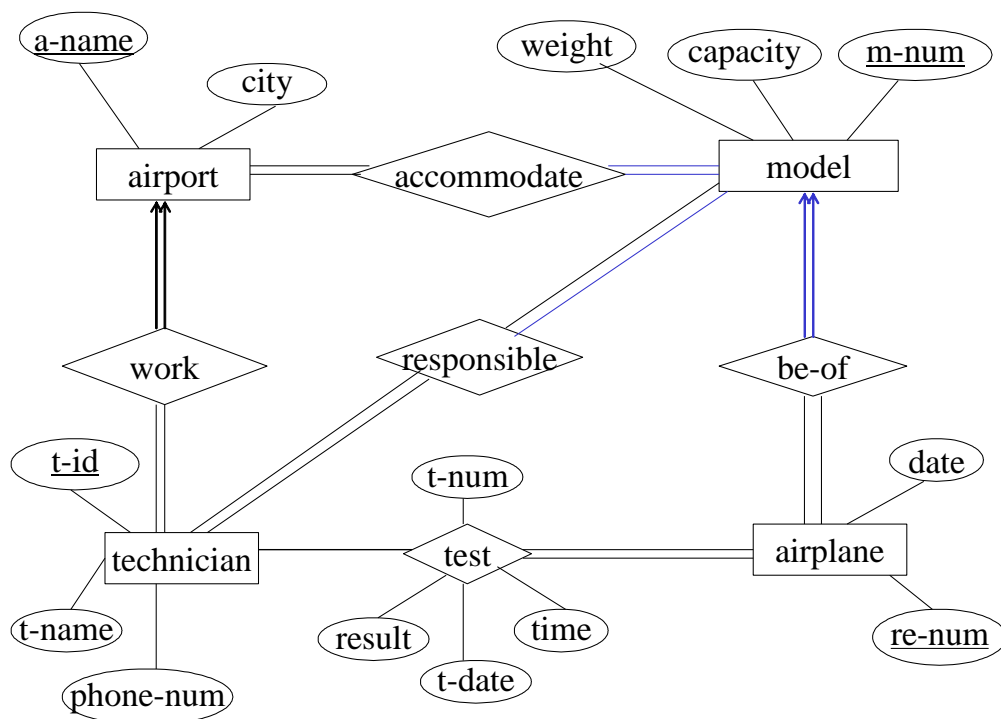
The information, such as the test number, the testing date, the testing result and the time spent on the test, is needed to describe a testing of the airplane

(1) Design the E/R diagram for the airport database on the basis of the information mentioned above

Note: the primary key of the entities, mapping cardinality of each relationship and participation of each entity to the relationship should be described in the diagram. .(10 points)

(2) Convert the E-R diagram to the proper relational schema, and give the primary key of each relation schema by underlines. (10 points)

Answers:



(2) (10 points)

实体 airport 归结为: airport(a-name, city);

实体 model 归结为: model(m-num, weight, capacity);

联系 accommodate 归结为: accommodate(a-name, m-num);

实体 airplane 和联系 be-of 归结为: airplane(re-num, date, **m-num**);

实体 technician、联系 work 归结为:

technician(t-id, t-name, phone-num, a-name)

联系 test 归结为:

test(t-id, re-num, t-num, t-date, time, result)

联系 responsible 归结为: responsible(t-id, m-num)

二. A university student database needs to store information about *students*, *professors*, *projects*, and *departments*. Consider the following information:

- Each student has an SNo, a name, an age, and a degree program (e.g. M.S. or Ph.D.).
- Each professor has a PNo, a name, an age, and a research specialty.
- Each project has a project number, a starting date, an ending date, and a budget.
- Each department has a department number, a department name, and a main office.
- integrity constraints:
 - a. A student *studies* in one (and only one) department
 - b. A Professor works in one (and only one) department
 - c. Each project must be managed by one and only one professor, and each professor must manage at least one project.
 - d. Each project is worked on by some students, more than one student can participate(or work on) the same project, and some students may work on no projects.
 - e. When a student work on a project, the professor managing this project must supervise the student's work. One student may work on several projects, so he may have several supervisors.

(1) Design and draw an E/R diagram for this database that captures the information above .

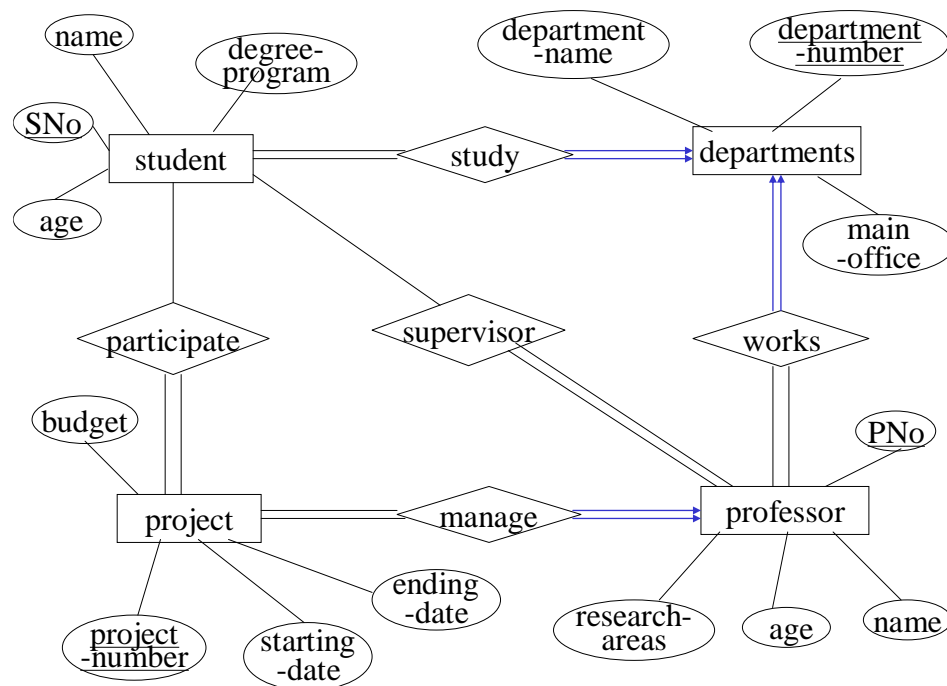
Note: mapping cardinality of each relationship and participation of each entity to the relationship should be described in the diagram.

(2) Convert the E-R diagram to the proper relational schema, and give the primary key of each relation schema by underlines.

Answers:

(1)

E-R diagram is as follows



(2) the reduced tables are as follows:

(a) student (SNo, name, age, degree-program, *department-number*)

Note: relationship **study** is reduced to this table

(b) professor (PNo, name, age, research-area, *department-number*)

Note: relationship **works** is reduced to this table

(c) department (department-number, depart-name, main-officer)

(d) project(project-number, starting-date, ending-date, budget, **PNo**)

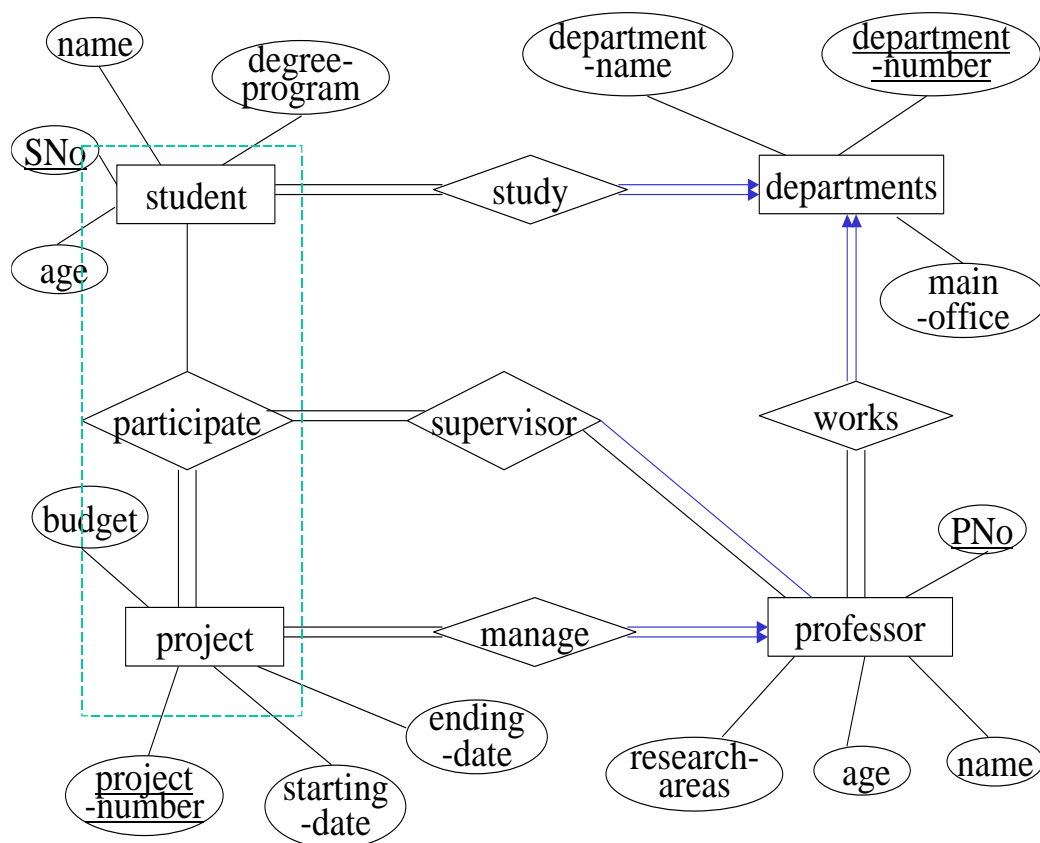
Note: relationship **manage** is reduced to this table

(e) participate (SNo, project-number)

(f) supervisor (SNo, PNo)

solution2:

(1) E-R diagram is as follows



(2) the reduced tables are as follows:

(a) student (SNo, name, age, degree-program, **department-number**)

Note: relationship **study** is reduced to this table

(b) professor (PNo, name, age, research-area, *department-number*)

Note: relationship **works** is reduced to this table

(c) department (department-number, depart-name, main-officer)

(d) project(project-number, starting-date, ending-date, budget, *PNo*)

Note: relationship **manage** is reduced to this table

(e) *participate* (*SNo*, *project-number*)

(f) *supervisor* (*SNo*, *Project-number*, *PNo*)

三. A hospital database needs to store information about doctors, patients, sickroom (病房), and departments (科室). Consider the following information

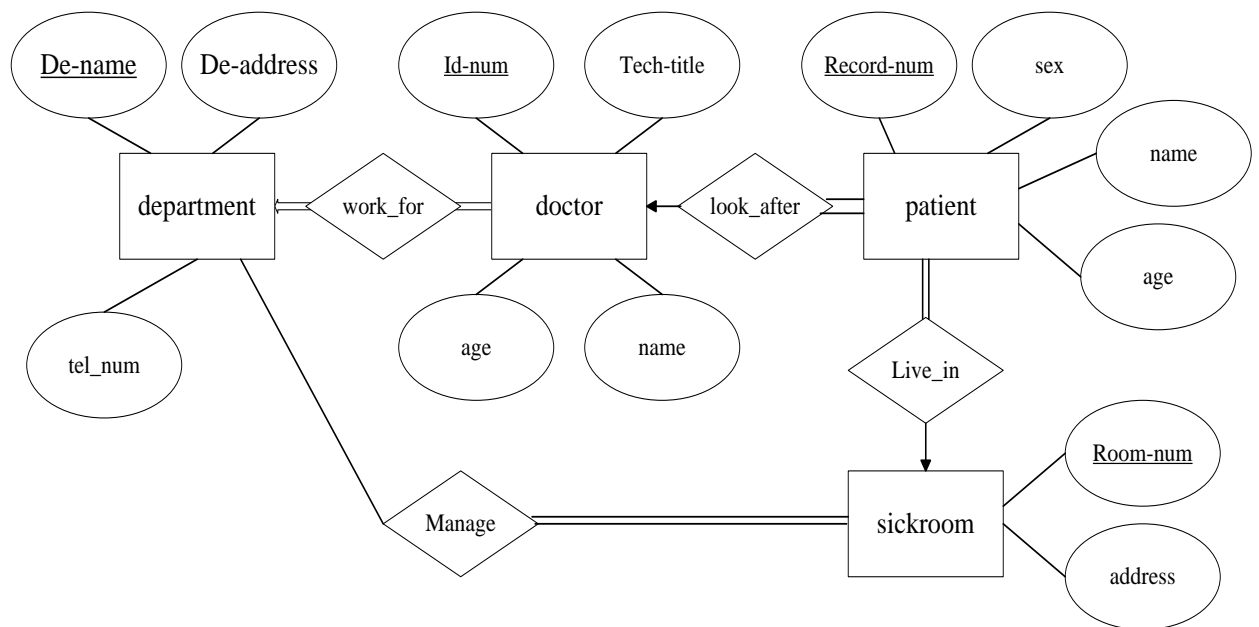
- Each doctor has descriptive attributes of identifier number, name, age, and technical title).
- Each patient has descriptive attributes of the number of medical records(病历) , name, age, and sex
- Each sickroom has descriptive attributes of the number of sickroom, the address
- Each department has descriptive attributes of name, address, telephone-number
- Integrity constraints:
 - a. Each doctor must belong to one (and only one) department; and for each department, there are more than one doctors belonging to it.
 - b. Each patient is taken care of by one and only one responsible doctor; a doctor may be responsible for no patients, or only one patients, or more than one patients
 - c. Each patient lives in one and only one sickroom; a sickroom may contain more than one patients
 - d. Each sickroom can be managed by more than one department; but for some departments, there are no sickrooms managed by them, while for other departments, there are more than one managed sickroom.

(1) Design the E/R diagram for hospital database on basis of the information mentioned above .(10 points)

Note: mapping cardinality of each relationship and participation of each entity to the relationship should be described in the diagram.

(2) Convert the E-R diagram to the proper relational schema, and give the primary key of each relation schema by underlines.
(10 points)

(1) E-R 图 如下



(2) 转换后的关系表如下

department(de-name, de-address, tel-num)

doctor(id-num, name, age, tech-title, de-name)

patient(record-num, name, sex, age, id-num, room-num)

sickroom(room-num, address)

manage(de-name, room-num)

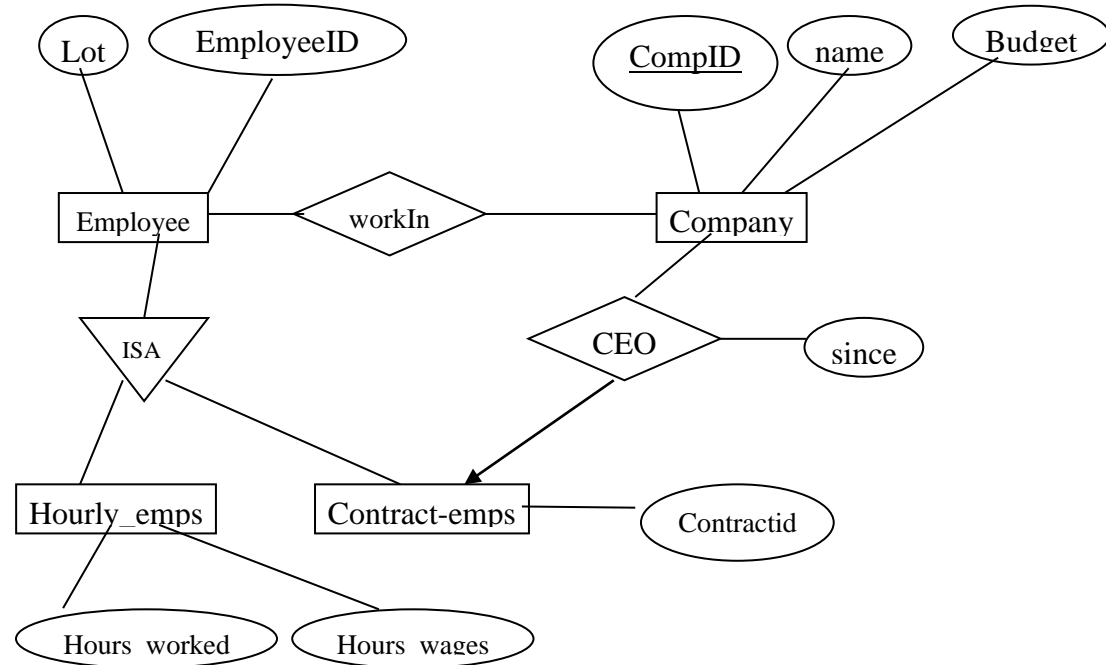
作 业

1. Notown Records company needs to store information about **songs**, **albums** (专辑) and **musicians** who perform on its albums in a database. Consider the following information:
 - Each **musicians** that records at company has an **Id** (which is unique), a **name**, an **address**, and a **phone number**.
 - Each **instrument** used in company has a **name** and an **unique ID**.
 - Each **album** recorded on the Notown label has a **title**, a **copyright date**, a **format**, and an **album identifier**.
 - Each **song** recorded at Notown has a **title** and an **author**, and each song can be identified by **its title**.
 - An **musician** may **play** several **instruments**, and an **instruments** may be played by several musicians.
 - Each **album** **has** a number of **songs** on it, and each song belongs to only one album.
 - Each **song** is **performed** by one or more **musicians**, and a musician may perform a number of songs.
 - Each **album** **has** exactly one **musician** who acts as its **producer**. A musician may **produce** several albums, but some musicians may have no albums.
- (1) Design the E/R diagram for hospital database on basis of the information mentioned above .(10 points)

Note: mapping cardinality of each relationship and participation of each entity to the relationship should be described in the diagram.
- (2) Convert the E-R diagram to the proper relational schemas, and give the primary keys of each relation schemas by underlines. (10 points)

2. A pharmacies database needs to store the information about the pharmaceutical companies (制药公司) and others. The relevant information is as follows:
- Each pharmaceutical company is identified by its name and has a phone number.
 - Each pharmacy (药房) is identified by its name and has an address, and several phone numbers.
 - For each drug, the trade name and formula must be recorded, and the trade name identifies a drug uniquely.
 - Each drug is developed by only one given pharmaceutical company, and one pharmaceutical company can develop several drugs and perhaps develops no drug now.
 - Each pharmacy sells several drugs and has a price for each. A drug could be sold by several pharmacies, and the price may vary from one pharmacy to another.
 - Pharmaceutical companies make contracts with pharmacies, but some pharmaceutical companies may have no contract. A pharmaceutical company can sign contracts with several pharmacies, and a pharmacy can also enter into contracts with several pharmaceutical companies. Each contract is described by a start date, an end date and the content of the contract.
- (1) Design the E/R diagram for hospital database on basis of the information mentioned above. (10 points)
- Note:* the mapping cardinality of each relationship and participation of each entity to the relationship should be described in the diagram.
- (2) Convert the E-R diagram to the proper relational schemas, and give the primary key of each relation schema by underlines. (10 points)

3. Consider the following E/R diagram. Create the relational schema that captures this E/R diagram. For every relation in your schema, specify the primary key of that relation.



4. Convert the following E-R diagram to the relation schemas and identify the primary key of each relation by underlining the primary attributes.

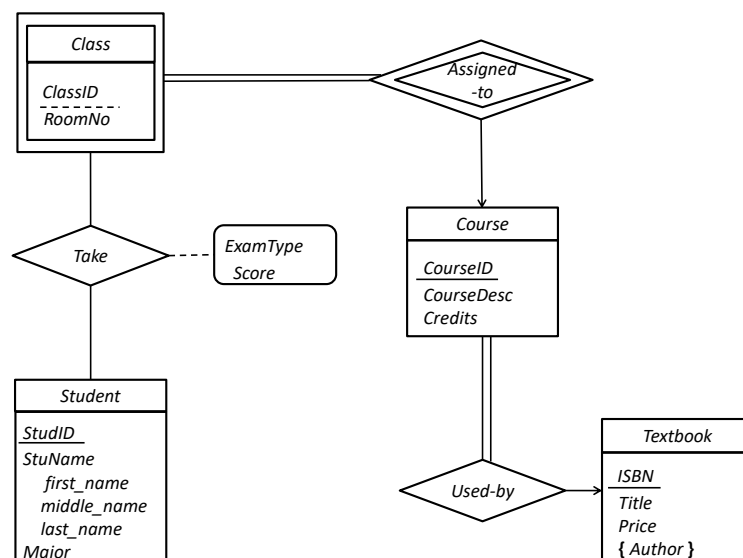


Figure 1 E-R diagram