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# 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

## Question:

### 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.

### Convert the E-R diagram,

and give the primary key of each relation schema by underlines.

## Answers：

### （1）



### （2）

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**);

多对一合并 :模式be of(re-num , m-num) 模式 airplane（re-num , date）

与airplane合并后的模式属性为 包含两个模式所有属性的并集:

airplane(re-num, date, m-num)

合并后的主码为融入关系的那个实体集的主码，即re-num

实体technician、联系work归结为：

technician(t-id, t-name, phone-num, a-name) 多对一合并

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)

# Consider the following information:

A university student database needs to store information about students, professors, projects, and departments.

* 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 student *studies* in one (and only one) department
* A Professor works in one (and only one) department
* Each project must be managed by one and only one professor, and each professor must manage at least one project.
* 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.
* 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.

## Question:

### 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.

### 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) reduced tables are as follows:

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

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

原 student(SNO,age,name,degree-program)

study(SNO,department-number)

多对一关系合并后,关系study 并入student,主码为study的主码：

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

后续的多对一关系合并类同

(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)

# Consider the following information

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

* 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:
  + 1. Each doctor must belong to one (and only one) department; and for each department, there are more than one doctors belonging to it.
    2. 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
    3. Each patient lives in one and only one sickroom; a sickroom may contain more than one patients
    4. 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.

## Question:

### 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.

### Convert the E-R diagram

to the proper relational schema, and give the primary key of each relation schema by underlines.

## Answers:

### E-R图如下



### 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)