

华中科技大学人工智能与自动化学院 2019~2020 学年第二学期

## “数据库技术” 考试试卷(A 卷)

考试方式: 开卷 考试日期: 2020.05.14 考试时长: 150 分钟

专业班级: \_\_\_\_\_ 学 号: \_\_\_\_\_ 姓 名: \_\_\_\_\_

### 一、Database Design (40)

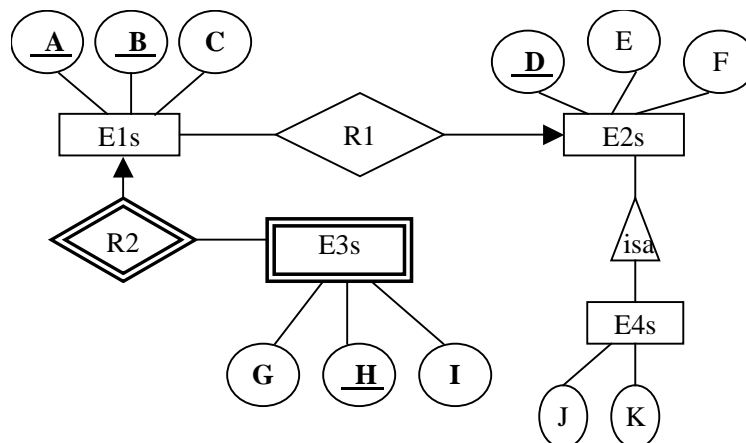
1.1 WUHAN — A plane carrying medical supplies took off at 8:34 pm Friday and left Wuhan, a central Chinese city once hardest hit by COVID-19, for New York. Please give an ODL design for the coronavirus spread, including the following information:

- 1) *Country*: including its **name, population, size and type of social system**.
- 2) *Province*: including its **name, population, size, latitude range** and the **country** that it belongs to.
- 3) *Deceased*: including his/her **ID, name, birthdate, date of death** and the **province** that he/she comes from.

Please select and specify keys for your ODL design and convert your ODL design to relational database schemas.

1.2 Draw an E/R diagram for the former database, using particular constraints when necessary, and convert it to relational database schemas.

1.3 Convert the following E/R diagram to relational database schemas.



## 二、Normal Form of Relational Database (20)

- 2.1 Consider the relation  $R$  with the schema  $R(A,B,C,D)$ , in which  $A \twoheadrightarrow C$ ,  $AB \twoheadrightarrow D$ ,  $B \rightarrow D$  and  $AC \rightarrow B$  hold. Please point out all keys. Is  $R$  in 4NF? If not, decompose it into 4NF beginning with the first violated multivalued dependency.
- 2.2 If the relation  $R(A,B,C,D,E)$  is decomposed into  $S(A,B,C)$  and some other relations. Let the functional dependencies of  $R$  be  $AB \rightarrow DE$ ,  $C \rightarrow E$ ,  $D \rightarrow C$ , and  $E \rightarrow A$ . Please compute all the completely nontrivial functional dependencies that hold in  $S$  and express them in the form of minimal basis.

There is a database used to describe the domestic tourist trip in China. The database schema is:

*Province* ( PCode: char(6), Name: varchar(80), Population: real, Size: real )  
*Tourist* ( ID: char(18), Name: varchar(40), Gender: char(1), PCode: char(6) )  
*Destination* ( DName: varchar(50), Items: varchar(250), PCode: char(6) )  
*TourismRecord* ( ID: char(18), DName: varchar(50), ArrivalTime: datetime, StayDays: int, Expense: real )

The following items 3 and 4 are both based on the above schema.

## 三、Relational Algebra (10)

Write ONE SINGLE expression of relational algebra to answer each of the following queries respectively.

- 3.1 Find out the names of the tourists who come from Hubei.
- 3.2 Find out the names of the tourists who have ever paid more than 3000 RMB for one trip.

## 四、T-SQL (30)

Write ONE SINGLE SQL statement to answer each of the following questions respectively.

- 4.1 Find out the total number of the tourism destinations located in Hubei province.
- 4.2 Find out the total number of trips and the average expense per trip for each tourist respectively. Please show the result in the descending order of the total number, each tourist's Name and ID.
- 4.3 Find out the tourists whose average expense is greater than the whole average expense of all tourists. Please show the information including ID, Name and average expense of each tourist.