

1、 Database Design (40)

1.1 Xinhua News Agency reported on April 1, 2017 that China would establish *Xiongan New Area* in Hebei Province. Please give an ODL design for the *Xiongan New Area* database, including the following information:

- 1) *Administrative Division*: including its *code*, *name*, *population* and *size*.
- 2)
- 3)

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.

2、 Normal Form of Relational Database (20)

2.1 Consider the relation R with the schema $R(A,B,C,D,E)$, in which $A \twoheadrightarrow C$, $AB \twoheadrightarrow D$, $B \twoheadrightarrow E$ and $AC \rightarrow B$ hold. Is R in 4NF? If not, decompose it into 4NF beginning with the first violated multivalued dependency.

2.2 Consider $R(A,B,C,D,E)$ which is decomposed into $S(A,B,C)$ and some other relations. Let the functional dependencies of R be $AB \rightarrow DE$,, 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 *Worldwide Regional Conflicts*. The database schemas are:

Country (CName: varchar(60), *Population*: float, *Size*: float, *GDP*: float, *Continent*: varchar(30))

ConflictArea

Involve

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

3、 Relational Algebra (10)

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

3.1 Find out all the names of the countries belonging to 'Europe'.

3.2 Find out all the names of the countries involved in at least two conflicts.

4、 T-SQL (30)

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

4.1 Find out the countries whose population is greater than one hundred million.

4.2 Find out the total number of the countries for each conflict area respectively. Please show the result in the descending order of the total number followed by *CName*.

4.3 Find out the countries which had been involved in the conflict that killed the largest number of people. Please show the information including *CName*, *Continent*, *GDP*, *CName*.