华中科技大学 人工智能与自动化学院 2019-2020学年
"数据库技术" 考试答题纸

专业班级：自动1801　学号：U201814168　姓名：李子恒

一、Database Design

1.1. ODL

```
interface Country (key name)
{
        attribute string name;
        attribute int population;
        attribute string size;
        attribute string socialSystemType;
        relationship Set<Province> have
                inverse Province::belongTo
}
interface Province (key name)
{
        attribute string name;
        attribute int population;
        attribute string size;
        attribute Struct Range
                { string start, string end } latitudeRange;
        relationship Country belongTo
                inverse Country::have;
        relationship Set<Deceased> govern
                inverse Deceased::comeFrom;
}
```

```
interface Deceased (key ID)
{
        attribute string ID;
        attribute string name;
        attribute string birthdate;
        attribute string dateOfDeath;
        relationship Province ComeFrom
                inverse Province::govern
}
```

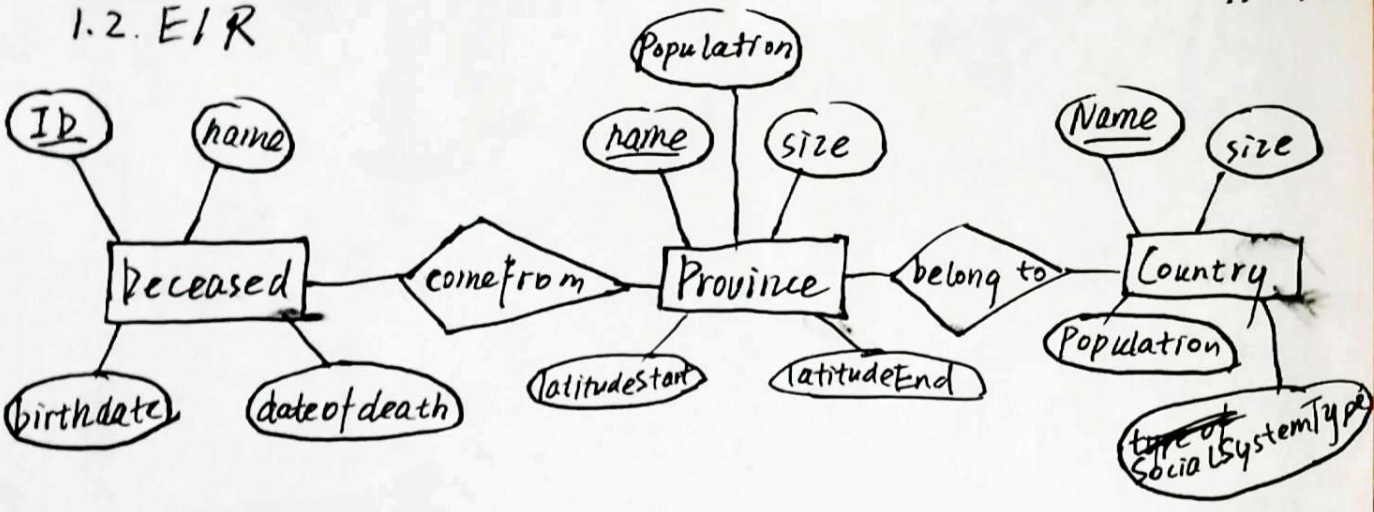
- Relational Schemas:

Country (name, population, size, socialSystemType)

Province (name, populatron, size, latitudeStart, latitudeEnd, countryName)

Deceased (ID, name, birthdate, dateOfDeath, ProvinceName)

1.2. E/R



- Relational ~~Set~~ Schemas:

  Country (Name, population, size, socialSystemType)

  Province (Name, population, size, latitudeStart, latitudeEnd)

  Deceased (ID, ~~D~~name, birthdate, dateOfDeath)

  ComeFrom (ID, ProvinceName)

  BelongTo (ProvinceName, CountryName)

1.3

E_{1s} (A, B, C)

E_{2s} (D, E, F)

E_{3s} (G, H, I, A, B)

E_{4s} (D, J, K)

R1 (A, B, D)

二. Normal Form of Relational Database

2.1. key of R: {A, C}

4NF violations: $A \rightarrow\rightarrow C$, $AB \rightarrow\rightarrow D$, $B \rightarrow D$,

- Decomposition Process:
  1. use $A \rightarrow\rightarrow C$ to decompose R into:

     $R_1(A, C)$ and $R_2(A, B, D)$

     R_1 is in 4NF

     key of R_2: {A, B}

     4NF violations: $B \rightarrow D$

  2. use $B \rightarrow D$ to decompose R_2 into:

     $R_3(B, D)$ and $R_4(A, B)$

     R_3, R_4 are in 4NF.

- Final Result: $R_1(A, C)$ $R_3(B, D)$ $R_4(A, B)$

2.2. b. compute the closure of each subset of $\{A, B, C\}$:

1. $\{A\}^+ = \{A\}$ $\{B\}^+ = \{B\}$ $\{C\}^+ = \{C, E, A\}$
   - add $C \to A$

2. $\{A, B\}^+ = \{A, B, C, D, E\}$ $\{B, C\}^+ = \{B, C, E, A, D\}$
   - add $AB \to C$
   - add $BC \to A$

   $\{A, C\}^+ = \{A, C, E\}$

- All the completely nontrivial functional dependencies:
  $C \to A$
  $AB \to C$
  $BC \to A$
- In the form of minimal basis.
  $\{C \to A,$
  $AB \to C\}$

三. Relational Algebra

3.1

~~$\pi_{Name}(Tourist \bowtie \sigma_{Name='Hubei'}(Province))$~~

$\pi_{Tourist.Name}(Tourist \bowtie_{Tourist.Pcode=Province.Pcode} \sigma_{Name='Hubei'}(Province))$

3.2.

$\pi_{Name}(Tourist \bowtie \sigma_{EXPense>3000}(TourismRecord))$

四. T-SQL.

4.1

```
SELECT COUNT(*) AS totalNumber
FROM Destination D INNER JOIN Province P
ON D.PCode = P.PCode
WHERE P.Name = 'Hubei'
```

4.2.

```
SELECT COUNT(ArrivalTime) as totalNumber,
       MAX(Name) as Name,
       T.ID as ID
FROM Tourist T INNER JOIN TouristRecord TR
ON T.ID = TR.ID
Group BY T.ID
ORDER BY COUNT(ArrivalTime) DESC
```

② -- If show the information of expense 李与怡

```
SELECT COUNT(ArrivalTime) as totalNumber,
       AVG(Expense) as averageExpense,
       MAX(Name) as Name,
       T.ID as ID
FROM Tourist T INNER JOIN TouristRecord TR
ON T.ID = TR.ID
GROUP BY T.ID
ORDER BY COUNT(ArrivalTime) DESC
```

4.3.

```
SELECT ~~MAX(ID)~~ T.ID as ID,
       MAX(Name) as Nome,
       AVG(Expense) as averageExpense
FROM Tourist T INNER JOIN TouristRecord TR
ON T.ID = TR.ID
GROUP BY T.ID
HAVING AVG(Expense) > (SELECT AVG(Expense)
                       FROM TouristRecord)
```

附加题：出题

1. 背景 Back ground

本次大作业正值新冠疫情，积极的队友叶紫瑄已率先将自己的初步想法"关于口罩生产发布于讨论群"，我与另外的队友刘文萌认为这个主题切合热点，有实际价值，便一致同意立足于这个主题。

2. Requirement Analysis

由于初步想法是一张草图，设计的对象和联系较为冗杂。为了贴合实际生产设计，我认为确立一个立足点较为重要，之后再围绕立足点将重要的信息纳入数据模型。"你们想当卫健委呢？还是国药集团的董事长？"一个戏谑的发问，希望能让我们更快拥有用西的代入感——前者是对医疗资源的宏观调度，后者是需要考虑口罩的实际生产。她们认为"卫健委"比较有前途"。我们便在宏观的角度分析口罩资源调配所涉及到的对象/数据：

- 口罩：型号：疫情期间类别很关键
- 工厂：生产能力规模：疫情停工停产/复工时的最大生产力。
- 仓库：口罩储量：停工停产状态下可供给能力。
- 物流公司：运输能力：疫区需求最大，物流业能否支撑
- 购买单位：口罩的消耗方。~~已购买量~~
- 订单：购买信息。

3. 主体 Summary

上述的结果实际是在讨论、建模过程中逐渐完善得出的结果。经过大家的修改，基本符合实际需求。

并且和DL建模时，将工厂、物流公司与购买单位进一步抽象，得到基本单位——包括：地址、联系电话等公共属性。

答题.

1. 且见我们笔记中写到的一条:

"4.6. 我的姐妹们太强了, 今天题目刚出来, 刘又萌一己之力完成了全部解答、并写成了word文档, 叹服.
一个高效率的组织多么重要!"

2. 看来在解题上我是大阴沟之地了, 并是另辟蹊径.
参考到作业中提到的"代码附上".
何妨具体将题目用 SQL 建立数据库并实现呢?
说干就干, 且说无独有偶, 收到的题目也是 cov-19 大背景下的医疗体系.

需求分析 抄录如下.

1. 导入地区数据
2. 注册医院
   ·创建触发器自动默认科室
3. 添加医护人员信息
4. 患者就医 (通过 Procedure 实现)
   a. 注册
   b. 充值
   c. 消费
   d. 注销.