四川大学期末考试试题（闭卷）

（2014~2015 学年第 2 学期）

课程号：**311038040** 课程名称：**数据库系统（A 卷）** 任课教师：**张天庆、龚勋、李川、屈立笳**

适用专业年级：**软件工程 2013 级** 学号：_____ 姓名：_____

**考试须知**

四川大学学生参加由学校组织或由学校承办的各级各类考试，必须严格执行《四川大学考试工作管理办法》和《四川大学考场规则》。有考试违纪作弊行为的，一律按照《四川大学学生考试违纪作弊处罚条例》进行处理。

四川大学各级各类考试的监考人员，必须严格执行《四川大学考试工作管理办法》、《四川大学考场规则》和《四川大学监考人员职责》。有违反学校有关规定的，严格按照《四川大学教学事故认定及处理办法》进行处理。

| 题　　号 | 1 | 2 | 3 | 4 | | | | | 卷面成绩 |
|---|---|---|---|---|---|---|---|---|---|
| 得　　分 | | | | | | | | | |
| 阅卷时间 | | | | | | | | | |

**注意事项：**1. 请务必将本人所在学院、姓名、学号、任课教师姓名等信息准确填写在试题纸和添卷纸上；

2. 考试结束，请将试题纸、添卷纸和草稿纸一并交给监考老师。

| 评阅教师 | 本题得分 |
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## 1. Multiple Choices. (Total marks: 10)

1. Which of the following SQL commands can be used to change, add, or drop column definitions from a table? ___a___

(a) ALTER TABLE (b) CHANGE TABLE (c) UPDATE TABLE (d) MODIFY TABLE

**改变表：** ALTER TABLE

**增加列：**

ALTER TABLE 表名

ADD 新增列名 数据类型 (NOT NULL)

**删除列：**

ALTER TABLE 表名

DROP COLUMN 列名

2. If functional dependences A → C, AB → D and A → B hold, ___d____ does not hold.

(a) AB → C　　(b) AB → CD　　(c) A → D　　(d) B → D

**(a) AB → C 的推导：**

∵ A → C (题目给的条件)
又∵ B → B (自确定性)
∴ AB → BC （增加性）
∴ AB → B 并且 AB → C （可分解性）

**(b) AB → CD 的推导：**

∵ A → C, AB → D (题目给的条件)
∴ AB → CD （增加性）

**(c) A → D 的推导：**

∵ AB → D and A → B (题目给的条件)
∴ AA → D （伪传递性性）
∴ A → D (合并决定方的两个 A 后)

3. In a two-phase locking protocol, what happens when a transaction requests a conflicting lock? __c___

a) The transaction immediately acquires the lock from the current lock-holder.
b) The transaction proceeds without acquiring the lock.
c) The transaction is blocked to acquire the lock.
d) The transaction is aborted immediately.

4. What attributes does a subclass have?__b__

a) Just the attributes from the superclass
b) All the attributes of its superclass, and possibly more
c) A subset of the attributes of its superclass
d) None of the attributes of its superclass

5. An insertion operation will __b__ if the inserted primary key has a NULL value.
(a) succeed with warning (b) fail (c) crash the system (d) succeed without warning

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## 2. Relational Algebra. (Total marks: 10)

Consider the following relations, and write the results of relational algebra expressions.

Relation *r*:

| A | B | C |
|---|---|---|
| A | 2 | A |
| A | 3 | B |
| B | 2 | C |

Relation *s*:

| B | D |
|---|---|
| 2 | 100 |
| 3 | 200 |

1） r × s　　(Marks: 3)

| A | R.B | C | S.B | D |
|---|---|---|---|---|
| A | 2 | A | 2 | 100 |
| A | 2 | A | 3 | 200 |
| A | 3 | B | 2 | 100 |
| A | 3 | B | 3 | 200 |
| B | 2 | C | 2 | 100 |
| B | 2 | C | 3 | 200 |

（行列顺序均可换）

2） r ⋈ s　　(Marks: 3)

| A | B | C | D |
|---|---|---|---|
| A | 2 | A | 100 |
| A | 3 | B | 200 |
| B | 2 | C | 100 |

3） $\Pi_{A,B}(r) \div \Pi_{B}(s)$　　(Marks: 4)

| A |
|---|
| A |

$\Pi_{A,B}(r) \div \Pi_{B}(s)$ =

| A | B |
|---|---|
| A | 2 |
| A | 3 |
| B | 2 |

÷

| B |
|---|
| 2 |
| 3 |

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## 3. Queries. (Total marks: 30)

Consider the following relational schemas describing an atlas(地图集) :

continent (name, area)

country (name, continent, population)

city (name, country, province)

Write **SQL** statements in to perform the following instructions.

(1) List the name of the countries of the continent whose name begins these letters:'as' in alphabetical order.

```
select name
  from country
  where continent like 'as%'
  order by name;
```

(2) Give the number of cities for each country in the continent whose name is 'asia' in ascending order.

```
select count(*)
  from country c1, city c2
  where c1.name = c2.country and continent = 'asia'
  group by c2.country
  order by count(*);
```

(3) List the name of all countries with more than ten cities.

```
select country
  from city
  group by country
  having count(*) > 10;
```

(4) Give the name of the country that has the most cities.

```
select country
  from city
  group by country
  having count(*) >= all
  ( select count(*)
    from city
    group by country);
```

(5) Give the name of the largest population continent.

```
select continent
  from country
  group by continent
  having sum(population) >= all
  (select continent
    from country
    group by continent);
```

(6) List the countries name in the continent ‘asia’ that have a larger population than any of the countries of ‘europe’.

```
select name
  from country
  where continent = ‘asia’ and population > any
  ( select population
      from country
      where continent = ‘europe’);
```

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## 4. Normalization. (Total marks: 20)

1. The following table stores information about students and projects they participate in a university.

student_project

| s_id | name | proj_id | proj_name | proj_budget |
|---|---|---|---|---|
| 98988 | Tanaka | 4 | SCC | 8,000 |
| 98988 | Tanaka | 5 | YK | 5,000 |
| 76653 | Aoi | 5 | YK | 5,000 |

**1)** Identify **functional dependencies** of the table **EMP_DEPT** according to your reasonable assumptions. **(Marks: 6)**

s_id ->name, proj_id ->proj_name, proj_budget

**2)** Identify the **candidate key(s)** of the table **EMP_DEPT**. **(Marks: 6)**

(s_id, proj_id)

**3)** IS the relation schema **student_project** in **BCNF**? Why? Is it in **3NF**? Why? If it is not in 3NF, bring it to a set of relations at least in 3NF; specify primary keys and referential integrity constraints for each relation. **(Marks:8)**

Not BCNF. For s_id->name, it is not trivial, and s_id is not a superkey.

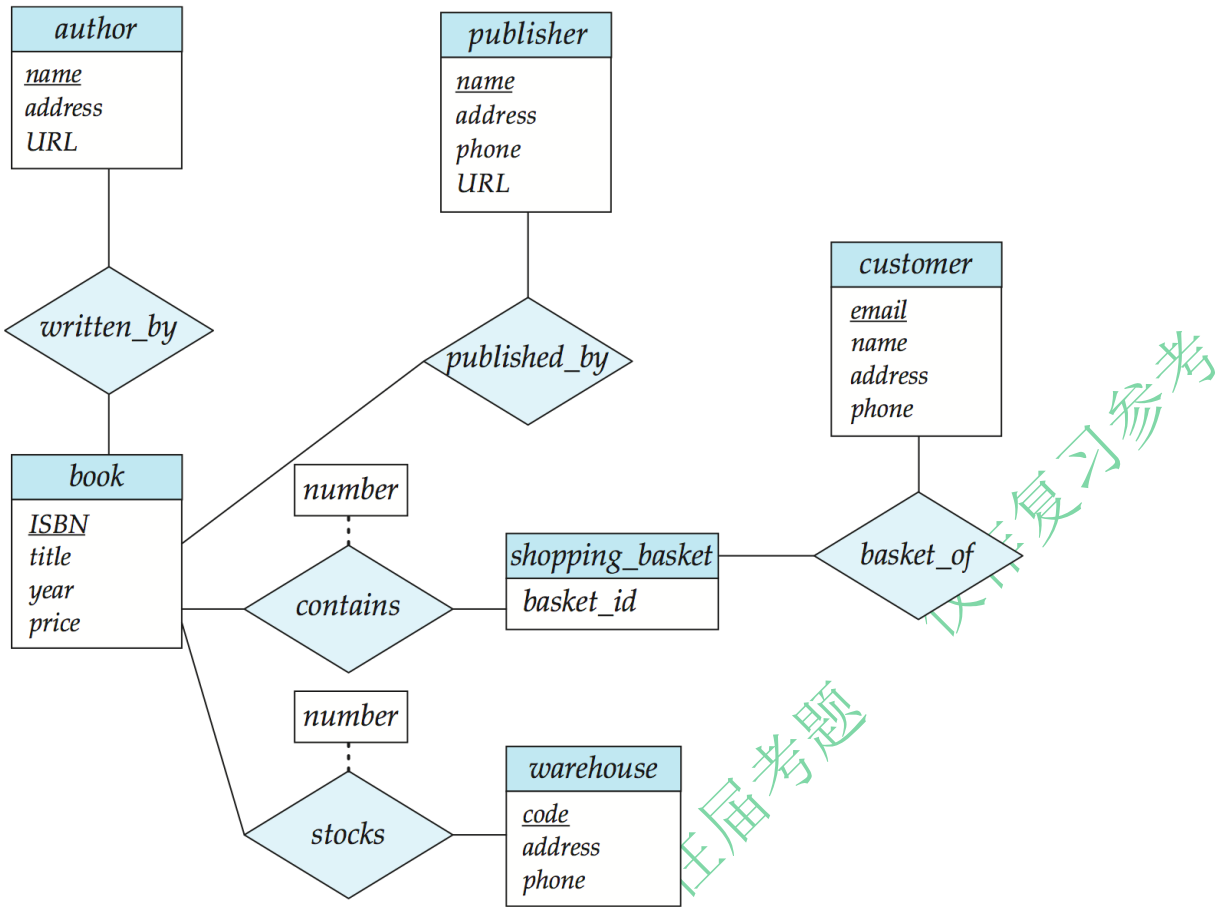
Not 3NF. For s_id->name, it is not trivial, s_id is not a superkey, and name is not in any candidate key.

i, student (s_id, name), PK: s_id

ii. project (proj_id, proj_name, budget), PK: proj_id

iii. student_project (s_id, proj_id) PK: (s_id, proj_id), FK1:s_id -> student, FK2: proj_id -> project

## 5. Database Design (Total marks: 30)




1. Consider above figure, which models an online bookstore. Convert the E-R diagram to 3NF relations. Specify keys and referential integrity constraints. (Marks:15)

   Shopping_basket 应该是一个弱实体，它必须依赖强实体 customer 的存在才会存在。因此，在对 ER 图的弱实体转化成关系模式的时候，需要加上外键，构成新的主键。在第六版书上（P159）有大学 ER 图转化为关系模式的实例，可以参考。

   Author(aname, address, URL)
   Book(ISBN, title, year, price)
   Publisher(pname, address, phone, URL)
   Shopping_basket(basket_id, email)
   Warehouse(code, address, phone)
   Customer(email, name, address, phone)
   Written_by(aname, ISBN)
   Published_by(pname, ISBN)
   Contains(ISBN, email,basket_id, number)
   Stocks(ISBN, code, number)
   Basket_of(email, basket_id)

2. Consider the following information about a university database:

   - Professors have an id, a name, a date of birth, a rank, and a research specialty.
   - Projects have a project number, a sponsor name (e.g. NSF), a starting date, an ending date, and a budget.
   - Graduate students have an id, a name, a date of birth, and a degree program (e.g. M.S or Ph.D).
   - Each project is managed by one professor (known as the project's principal investigator).
   - Each project is worked on by one or more professors (known as the project's co-investigators).

- Professors can manage and/or work on multiple projects.
- Each project is worked on by one or more graduate students (known as the project's research assistant).
- When graduate students works on a project, a professor must supervise their work on the project. Graduate students can work on multiple projects, in which case they will have a (potentially different) supervisor for each one.

Design an E-R diagram that captures the information above. (Mark: 15)

- Professors have an id, a name, a date of birth, a rank, and a research specialty.

  实体:professor 属性：id, name, birth_date, rank, specialty
- Projects have a project number, a sponsor name (e.g. NSF), a starting date, an ending date, and a budget.

  实体:project 属性：pro_no, sponsor, start_date, end_date, budget
- Graduate students have an id, a name, a date of birth, and a degree program (e.g. M.S or Ph.D).

  实体:graduate 属性：id, name, birth_date, deg_pro
- Each project is managed by one professor (known as the project's principal investigator).

  二元联系：manages
- Each project is worked on by one or more professors (known as the project's co-investigators).

  二元联系：works_on1
- Professors can manage and/or work on multiple projects.

  结合上两个条件，知道：

  联系 manages 在 professor 和 project 间是一对多

  联系 works_on1 在 professor 和 project 间是多对多
- Each project is worked on by one or more graduate students (known as the project's research assistant).

  二元联系:works_on2
- When graduate students works on a project, a professor must supervise their work on the project. Graduate students can work on multiple projects, in which case they will have a (potentially different) supervisor for each one.

  结合上一个条件，知道联系 works_on2 在 project 和 student 间是多对多

  三元联系：supervises

  一个教授可以监管多个学生，多个项目

Design an E-R diagram that captures the information above. (Mark: 15)