四川大学期末考试试题（闭卷）

（2014~2015 学年第 1 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 2012 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. **请将答案全部填写在本试题纸上；**

3. 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

Ⅰ	Ⅱ	Ⅲ	Ⅳ.	Ⅴ.

1. Multiple Choices. (Total marks: 10)

(1) （ ABD ）**An ER diagram** include_____. **(Marks: 2)**

A. entity　　B. attribute　　C. table　　D. relationship

(2) （ AB ）The modes in which a data item may be **locked** include_____. **(Marks: 2)**

A. shared lock　　B. exclusive lock　　C. dead lock　　D. unlock

(3) （ ABCD ）If $A \rightarrow B$, $B \rightarrow C$ and $C \rightarrow D$ are hold, which of the following **functional dependencies** are **true?** **(Marks: 2)**

A. AB → A

B. A → C

C. A,C → B,C

D. A,C → B,D

(4) Consider the following table.

Table ***Warehouse***:

WarehouseId	WarehouseName	WarehouseAddress	PhoneNo
W021	Warehouse X	London, YK55	3234568
W056	Warehouse Y	Glasgow, XZ16	4745679
W033	Warehouse Z	Glasgow, YD18	4655789
W022	Warehouse W	London, SE24	3234554
W011	Warehouse M	London, SW32	3244532

I. （ B ）The **degree** of the table is _____. **(Marks: 2)**

A. 3　　B. 4　　C. 5　　D. 6

II. （ C ）The **Cardinality** of the table is (　　). **(Marks: 2)**

A. 3　　B. 4　　C. 5　　D. 6

评阅教师	本题得分

2. Relational Algebra. (Total marks: 10)

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

Relation ***r***:

ID	Name	Age	City
S1	Smith	20	London
S4	Clark	20	London

Relation ***s***:

ID	Name	Age	City
S1	Smith	20	London
S2	Jones	19	Paris

1) $\Pi_{ID, City}(\sigma_{City='London'}(s))$

Answer:

ID	City
S1	London

2） r∪s

Answer:

ID	Name	Age	City
S1	Smith	20	London
S4	Clark	20	London
S2	Jones	19	Paris

3） r∩s

Answer:

ID	Name	Age	City
S1	Smith	20	London

4） r—s

Answer:

ID	Name	Age	City
S4	Clark	20	London

评阅教师	本题得分

3. SQL statements and Relational Algebra.　(Total marks: 38)

Table ***Book***:

BId	BookName	Author	Price
B1	DataBase Systems Concepts and Application, Fifth Edition	Smith	80
B2	The C Programming Language. 2nd ed	Clark	88
B3	C++ Language Tutorial	Joe	78
B4	Introduction to Programming Using Java, Fifth Edition	Carol	86
B5	Artificial intelligence: a modern approach. 2nd edition	Tina	68
B6	Cryptography Theory and Practice	Tony	70

Table ***Course***:

CId	CourseName	Teacher	Credit	BId
C1	DataBase Systems	Jackson	3	B1
C2	C	Philip	4	B2
C3	C++	John	4	B3
C4	Java	Philip	4	B4

C5	Artificial Intelligence	Mike	2	B5
C6	Network and Computer Security	Mary	2	B6

Write SQL statements, SQL query results and relational algebra expressions:

(1) List all courses with **a credit below 4**.

SQL Statement: **(Marks: 4)**

答案一：

```
SELECT *
FROM Course
WHERE Credit<4
```

答案二：

```
SELECT CId,CourseName
FROM Course
WHERE Credit<4
```

SQL Query Result: **(Marks: 2)**

答案一：

CId	CourseName	Teacher	Credit	BId
C1	DataBase Systems	Jackson	3	B1
C5	Artificial Intelligence	Mike	2	B5
C6	Network and Computer Security	Mary	2	B6

答案二：

CId	CourseName
C1	DataBase Systems
C5	Artificial Intelligence
C6	Network and Computer Security

Relational Algebra Expression: **(Marks: 3)**

答案一：

$\sigma_{Credit<4}$ (Course)

答案二：

$\Pi_{CId,CourseName}$ ($\sigma_{Credit<4}$ (Course))

(2) List the **title** and the **average price** of all books.

SQL Statement: **(Marks: 4)**

答案一：

```
SELECT AVG(Price) AS MyAvg
FROM Book
```

答案二：

```
SELECT AVG(Price)
FROM Book
```

SQL Query Result: **(Marks:2)**

答案一：

MyAvg

78.33

答案二：

（无列名）
78.33

Relational Algebra Expression:　　(Marks: 3)

答案一：

$\rho_{R(MyAvg)}(\Im_{AVG\ Price}(Book))$

答案二：

$\Im_{AVG\ Price}(Book)$

(3) List the **courses** taught by the teacher named "Philip", and the **books** used in the courses.

SQL Statement:　　(Marks: 4)

答案一：

```
SELECT c.*, b.*
FROM Book b, Course c
WHERE c.Teacher='Philip' AND c.BId= b.BId
```

答案二：

```
SELECT c.CId, c.CourseName, b.BId, b. BookName
FROM Book b, Course c
WHERE c.Teacher='Philip' AND c.BId= b.BId
```

SQL Query Result:　　(Marks:2)

答案一：

CId	CourseName	Teacher	Credit	BId	BId	BookName	Author	Price
C2	C	Philip	4	B2	B2	The C Programming Language. 2nd ed	Clark	88
C4	Java	Philip	4	B4	B4	Introduction to Programming Using Java, Fifth Edition	Carol	86

答案二：

CId	CourseName	BId	BookName
C2	C	B2	The C Programming Language. 2nd ed
C4	Java	B4	Introduction to Programming Using Java, Fifth Edition

Relational Algebra Expression:　　(Marks: 4)

答案一：

$Course \bowtie_{Course.BId=Book.BId} Book$

或

$Course \bowtie Book$

答案二：

$\Pi_{Course.CId,\ Course.CourseName}(Course) \bowtie_{Course.BId=Book.BId} \Pi_{Book.BId,\ Book.BookName}(Book)$

或

$\Pi_{Course.CId,\ Course.CourseName}(Course) \bowtie \Pi_{Book.BId,\ Book.BookName}(Book)$

(4) List the courses whose credits are the same as the courses, in which the books are used, whose names include

"Artificial intelligence".

SQL Statement: **(Marks: 4)**

答案:

```
SELECT *
FROM Course
WHERE Credit IN
    (SELECT Credit
    FROM Course
    WHERE BId IN
        (SELECT BId
        FROM Book
        WHERE BookName LIKE '%Artificial intelligence%'
        )
    )
```

SQL Query Result: **(Marks: 2)**

CId	CourseName	Teacher	Credit	BId
C5	Artificial Intelligence	Mike	2	B5
C6	Network and Computer Security	Mary	2	B6

Relational Algebra Expression: **(Marks: 4)**

$$Course \bowtie (\Pi_{Credit}(Course \bowtie (\Pi_{BId}(\sigma_{BookName='\%Artificial\ intelligence\%'}(Book)))))$$

评阅教师	本题得分

4. Normalization and ER diagram. (Total marks: 20)

Consider the relation **EMP_DEPT** presented below.

- "EmployeeNo", "EmployeeName", "BornDate" and "EmployeeAddress" represent the ID number, name, date of birth, and address of an employee.
- "DepartmentNo", "DepartmentName", and "DepartmentAddress" represent the ID number, name, and address of a department.
- "ProjectNo" and "ProjectName" represent the ID number and name of a project.
- "WorkHours" represents the working hours of an employee in a project.

Consider the following assumptions:

- A department has more than one employee;
- Two employees maybe have the same name;
- An employee works in a unique department;
- An employee can take part in several projects;
- Two or more employees from different departments can take part in a same project;
- An employee can take part in more than one project;
- The working hours of an employee in different project may be different.

EMP_DEPT

EmployeeNo	EmployeeName	BornDate	EmployeeAddress	DepartmentNo	DepartmentName	DepartmentAddress	ProjectNo	WorkHours	ProjectName
E001	Clark	1968-7-9	Glasgow, XZ15	D001	Administration	Glasgow, WZ188			
E002	Jones	1973-2-6	Glasgow, YD13	D001	Administration	Glasgow, WZ188			
E003	Stevens	1980-7-7	London, SE14	D002	Research001	London, SE20	P001	25	Project X
E004	Wolf	1981-3-2	London, SW12	D002	Research001	London, SE20	P001	30	Project X
E005	Brick	1977-5-6	London NE21	D002	Research001	London, SE20	P002	40	Project Y
E006	Jackson	1971-11-20	London, XR68	D003	Research002	London, WE21	P003	20	Project Z
E007	Peters	1983-8-16	London, YK33	D004	Research003	London, ZD45	P003	30	Project Z
E007	Peters	1983-8-16	London, YK33	D004	Research003	London, ZD45	P004	10	Project M
E008	Smith	1985-10-22	London, GH11	D004	Research003	London, ZD45	P004	42	Project M

1) Identify **the functional dependencies** and **candidate key(s)** of the table **EMP_DEPT**, based on the assumptions presented above. **(Marks: 8)**

答案：

外部关键字

EmployeeNo→EmployeeName，BornDate，EmployeeAddress，DepartmentNo，DepartmentName，DepartmentAddress　　部分函数依赖

DepartmentNo→DepartmentName，DepartmentAddress　　传递函数依赖

ProjectNo→ProjectName　　部分函数依赖

外部关键字

EmployeeNo，ProjectNo→WorkHours，EmployeeName，BornDate，EmployeeAddress，DepartmentNo，ProjectName，DepartmentName，DepartmentAddress　　主关键字

2) IS the relation EMP_DEPT in **BCNF**? Why? If not, bring it to BCNF relations; specify primary keys and referential integrity constraints, using directed arcs, for each relation. **(Marks: 12)**

答案：

部分函数依赖

EmployeeNo	EmployeeName	BornDate	EmployeeAddress	DepartmentNo

部分函数依赖

ProjectNo	ProjectName

传递函数依赖

DepartmentNo	DepartmentName	DepartmentAddress

EmployeeNo	ProjectNo	WorkHours

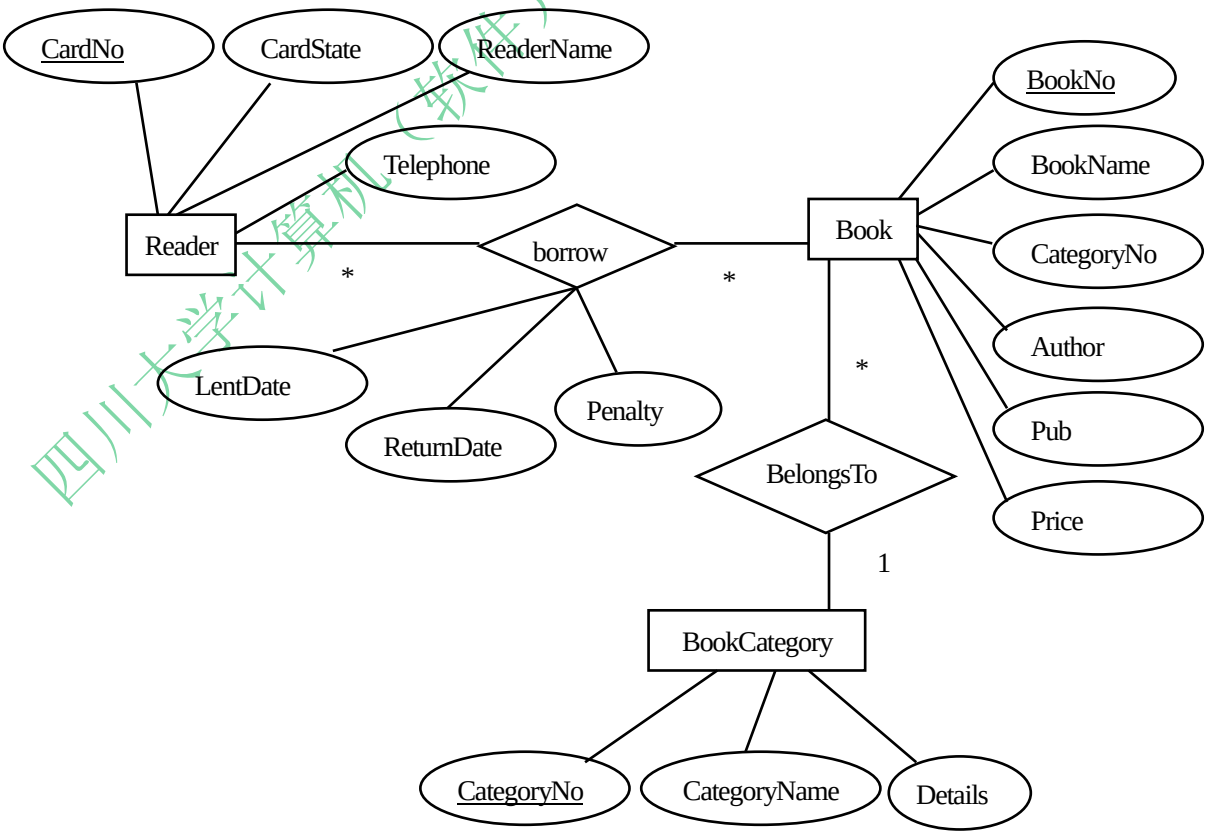
5. Database Design　　(Total marks: 22)

Consider a library management system below.

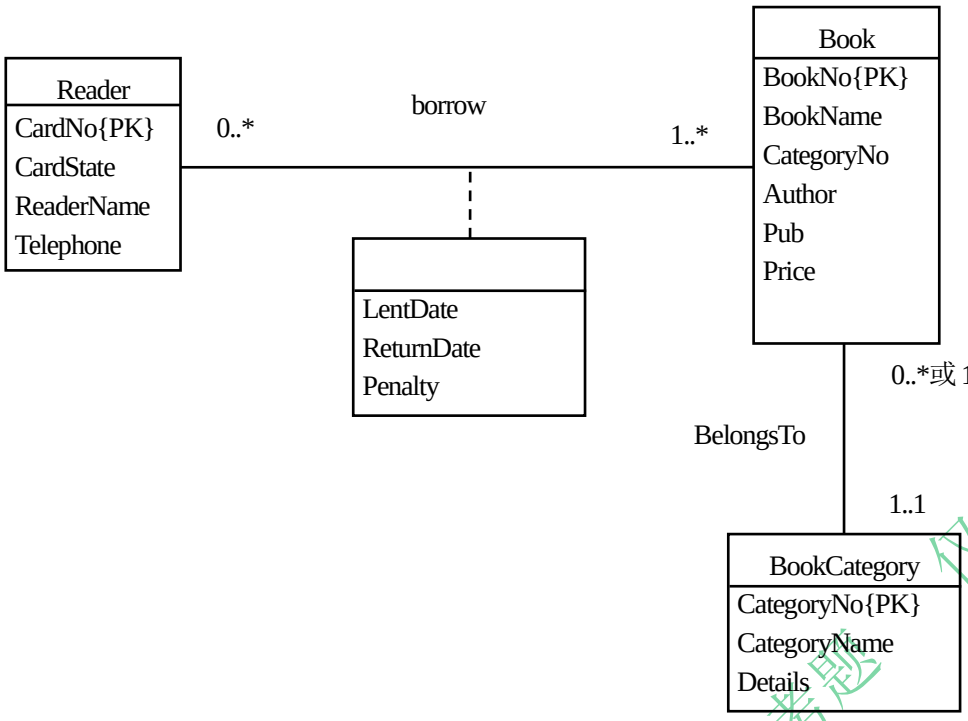
- Every book is given a unique book number.
- The category number uniquely identifies a type of books.
- Every book belongs to a unique category.
- The data held on a book is the book number, name, category number, author, publishing company, and price which are represented by "BookNo", "BookName", "CategoryNo", "Author", "Pub" and "Price".
- The data held on the category of books is the category number, name, details which are represented by "CategoryNo", "CategoryName" and "Details".
- Every reader has a library card with a unique number and his or her name.
- The data held on a reader is the library card number and state of his or her library card, name, telephone number which are represented by "CardNo", "CardState", "ReaderName" and "Telephone".
- Every reader can borrow many books.
- Every book can be lent to many readers in a different time.
- Before a book is lent, the book number and the dates the book is lent out must be inputted into system, which are represented by "BookNo", "LentDate".
- After a book is returned, the book number and the date the book is lent out are checked out, the date the book is returned is inputted into system, which are represented by "ReturnDate", and the penalty may be computed which is represented by "Penalty".

1. Based on the assumptions presented above, draw an **ER diagram** for it. (Marks:12)
2. Convert the E-R diagram to 3NF relations. Specify keys and referential integrity constraints, using directed arcs. (Marks:10)

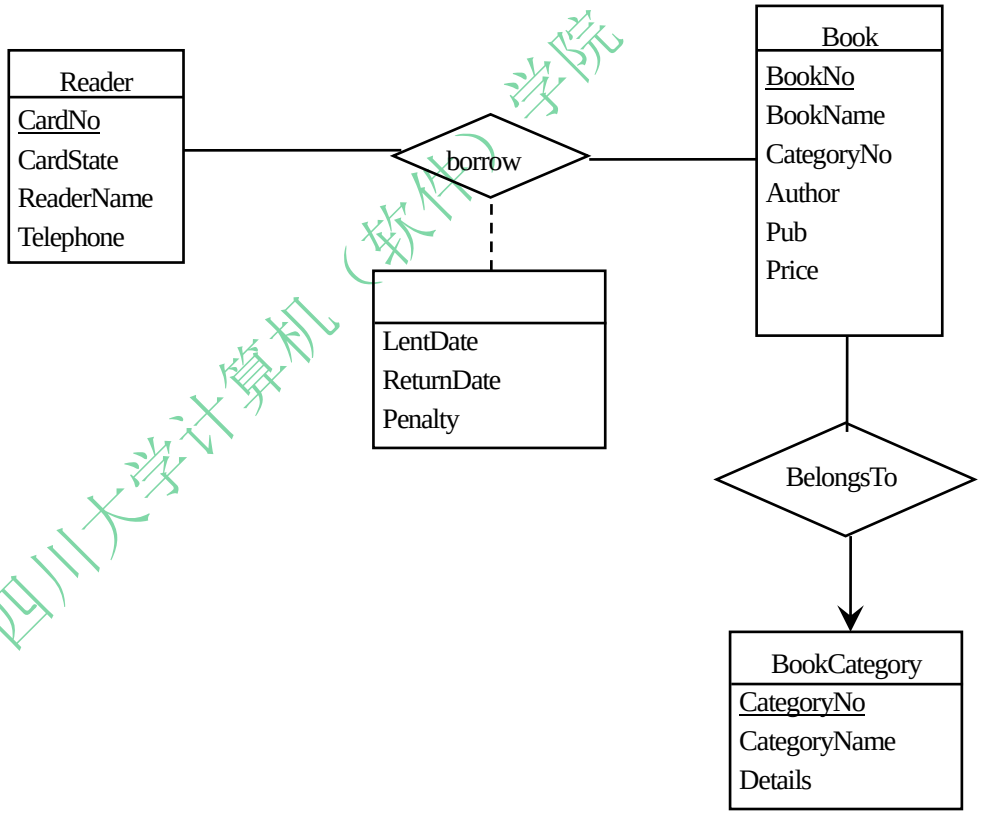
1、答案一：



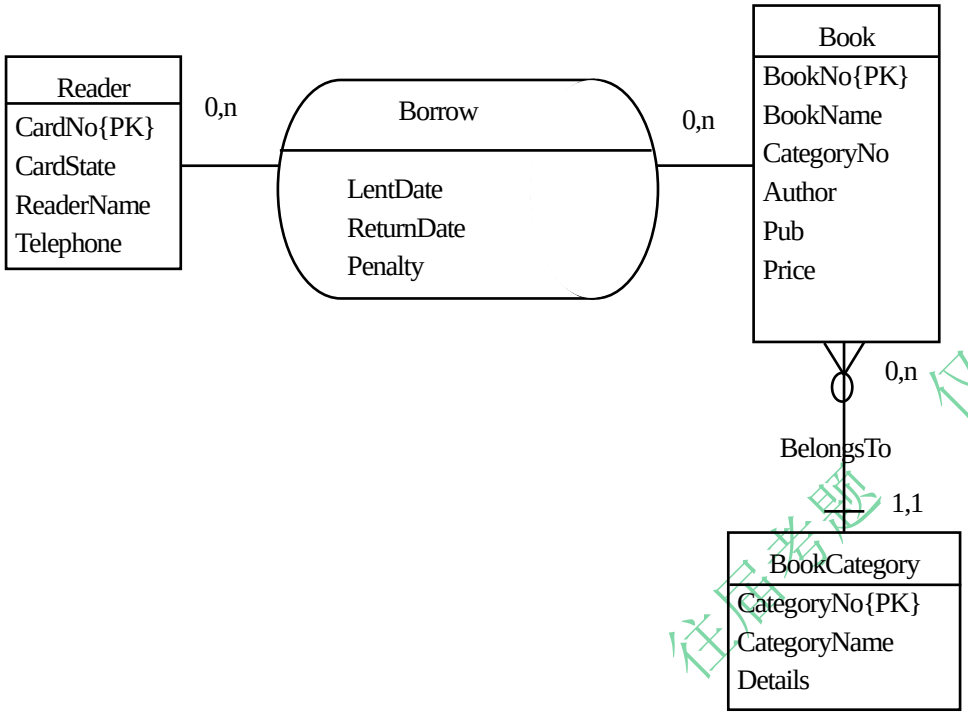
答案二：



答案三：



答案四：



2、答案：

Reader(CardNo, CardState, ReaderName, Telephone)

外部关键字　外部关键字

Borrow(CardNo, BookNo, LentDate, ReturnDate, Penalty)

外部关键字

Book(BookNo, BookName, CategoryNo, Author, Pub, Price)

BookCategory(CategoryNo, CategoryName, Details)