四川大学期末考试试题（闭卷）

（2017~2018 学年第 2 学期）　　B 卷

课程号：311038040 课程名称：数据库系统 任课教师：_____

适用专业年级：软件工程 2016 级 学号：_____ 姓名：_____

考生承诺

我已认真阅读并知晓《四川大学考场规则》和《四川大学本科学生考试违纪作弊处分规定（修订）》，郑重承诺：

1、已按要求将考试禁止携带的文具用品或与考试有关的物品放置在指定地点；

2、不带手机进入考场；

3、考试期间遵守以上两项规定，若有违规行为，同意按照有关条款接受处理。

考生签名：

题　号	一(10%)	二(40%)	三(20%)	四(10%)	五(20%)
得　分					
卷面总分			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	得分

I. Simple choice. (2 points each; 10 total)

1	2	3	4	5

1. Which built-in SQL function computes the number of rows in a table?
(a) AVG
(b) MAX
(c) COUNT
(d) SUM

2. Which one of the following is **not** true?
(a) Every relation schema that's in BCNF is also in 3NF.
(b) Every relation schema that's in 3NF is also in 1NF.
(c) A relation schema R is in 1NF if the domains of all attributes of R are atomic.
(d) Decomposition of a 3NF relation into BCNF always preserves functional dependencies.

3. F={A→B, B→C}, which functional dependencies **cannot** be implied?
(a) A→C
(b) A→BC
(c) B→BC
(d) C→B

4. Which of the following is not a property of transaction?
(a) Atomicity
(b) Serializability
(c) Durability
(d) Isolation

5. The relation r1(R) has 10 tuples, and r2(R) has 8 tuples, the number of tuples of r1∪r2 can be:
(a) 2
(b) 8
(c) 15
(d) 80

评阅教师	得分

II. Queries. (5 points each; 40 total)

The following relational schemas store information about students and research projects that they have taken part in. (The primary keys are underlined):
student (ID, name, dept_name)
project(project_no, title)
s_p(student_id, project_no, grade)

1. Give a relational algebra expression for each of the following queries:

(1) List the IDs and names of all students who have taken part in the project titled "Wechat Programming".
(2) List the IDs and names of all students who have taken all projects that the student with ID "CS101" has taken part in.
(3) List the IDs of all students who have taken part in more than five projects.

2. **Write SQL statements to perform the following commands:**

(1) List the IDs and names of all students who have **NEVER** taken part in the project titled "Wechat Programming".
(2) List the project numbers and titles of all projects whose title begin with "Program".
(3) List the ID and name of the employee who have taken part in the project titled "Programming of Wechat" and get the highest grade.
(4) List the IDs and names of all students who have taken part in all projects that the student with ID "CS101" has taken part in.
(4) List the students' names and the average grades of projects they have taken part in.

评阅教师	得分

III. Normalization　(20 points total)

1. Consider the following relational schema:
student_dept=(ID, name, tot_credit, dept_name, building, budget)

It contains information about students and their departments in a university. A student studies in just one department, and a department has exactly a building and budget. The following is an instance of the schema:

ID	**name**	**tot_credit**	**dept_name**	**building**	**budget**
00128	Zhang	102	Comp. Sci.	Taylor	100000
12345	Shankar	32	Comp. Sci.	Taylor	100000
19991	Brandt	80	History	Painter	50000
23121	Chavez	110	Finance	Painter	120000
44553	Peltier	56	Physics	Watson	70000
45678	Levy	46	Physics	Watson	70000

(1) Identify **functional dependencies** of ***student_dept*** based on above. **(3 points)**

(2) Identify the **candidate key(s)** of ***student_dept***. **(3 points)**

(3) IS the relation schema ***student_dept*** in **BCNF**? Why? Is it in **3NF**? Why? If it is not in 3NF, bring it to a set of relation schemas at least in 3NF; specify primary keys and referential integrity constraints for each relation. (5 points)

2. Consider the relation schema R = (A, B, C, D, E) and the set of functional dependencies F= {A→B, C→D, AC→E}

(1) List the candidate key(s) for R. Write 'none' if you think there are no candidate keys. **(3 points)**

(2) List the FDs in F that violates BCNF. **(3 points)**

(3) Is R in 3NF? Why? **(3 points)**

评阅教师	得分

IV. Concurrent Control (10 points total)

Consider two concurrent schedules ***S1*** and ***S2*** of transactions T1 and T2.

T1	T2
read (A)	
write (A)	
	read (A)
	write (A)
read (B)	
write (B)	
	read (B)
	write (B)
commit	
	commit

S1

T1	T2
read (A)	
	read (A)
	write (A)
	read (B)
write (A)	
read (B)	
write (B)	
commit	
	write (B)
	commit

S2

1. Is the schedule ***S1*** conflict serializable? If so, give an equivalent serial schedule. If not, give an explain briefly. **(5 points)**
2. Is the schedule ***S2*** conflict serializable? If so, give an equivalent serial schedule. If not, give an explain briefly. **(5 points)**

评阅教师	得分

V. Database Design (20 points total)

To develop an employee training database system (员工培训数据库系统) for a company. It involves the following situations about employees, instructors, training projects, and training materials.

Every employee has a unique ID, a name, and his/her date of birth (DOB). An instructor has a unique ID, a name and an address. Each training project has a different training number, content, a start date and an end date. A material has a title and description. An employee can take part in several training projects. Each training project has several instructors and some kinds of materials. A material is written by only one instructor and can be used in different projects.

1. Construct an E-R diagram that captures the information above. **(10 points)**
2. Convert the E-R diagram to 3NF relations. Specify keys and referential integrity constraints. **(10 points)**