

四川大学期末考试试题（闭卷）

（2017~2018 学年第 2 学期）

A 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. What does ACID stand for in the context of DBMS transactions?

- (a) Atomicity, Consistency, Isolation, and Durability
- (b) Analysis Console for Intrusion Databases
- (c) Atomicity, Consistency, Isolation, and Data
- (d) Automatic Classification and Interpretation of Data

2. A candidate key is:

- (a) a set of one or more attributes that allow us to identify uniquely a tuple in the relation
- (b) functionally dependent on non-key attributes
- (c) the minimal super key (no proper subset of the super key is a super key)
- (d) the primary key of a relation

3. Which pair of SQL keywords is used to create and delete a table?

- (a) CREATE, DROP
- (b) CREATE, DELETE
- (c) CREATE, ALTER
- (d) INSERT, DROP

4. Which pair of SQL keywords is used to create and delete records in a table?
- (a) CREATE, DROP
(b) CREATE, DELETE
(c) CREATE, ALTER
(d) INSERT, DELETE
5. A lossless join decomposition of a relation means:
- (a) none of the attributes are lost
(b) no functional dependencies are lost
(c) the natural join of the relations in the decomposition produces the original relation
(d) no information of any kind is lost

评阅教师	得分

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

An employee training database contains following relational schemas (primary keys are underlined):

employee (ID, name, address, salary)

course(course_id, title, hours)

section(course_id, sec_id, start_date, finish_date)

takes(employee_id, course_id, sec_id, grade)

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

- List the IDs and names of all employees who have taken a course titled "Company Culture".
- List the IDs and names of all employees who have taken all courses that the employee with ID "dev101" has taken.
- List the IDs of all employees who have taken more than five courses.

2. Write SQL statements to perform the following commands:

- List the IDs and names of all employees who have NEVER taken the course titled "Business Decision".
- List the IDs and titles of all courses whose title begin with "Business".
- List the ID and name of the employee who have taken the course titled "Business Decision" and get the highest grade.
- List the IDs and names of all employees who have taken all courses that the employee with id "dev101" has taken.
- List the employee names and the average grades of courses they have taken.

评阅教师	得分

III. Normalization (20 points total)

1. Consider the following relational schema:

Articles=(ID, title, journal, issue, year, start_page, end_page, TR_ID)

It contains information on articles published in scientific journals. Each article has a unique ID, a title, and information on where to find it (name of journal, what issue, and on which page). Also, if results of an article previously appeared in a "technical report" (TR), the ID of the technical report can be specified. We have the following information on the attributes:

- For each journal, an issue with a given number is published in a single year.
- The end page of an article is determined by the start page.
- There is never more than one article on a single page.

The following is an instance of the schema:

ID	title	journal	issue	year	start_page	end_page	TR_ID
2	Cuckoo Hashing	JAlg	51	2015	68	80	87
17	Time Serial DM	JAlg	48	2014	69	85	62
17	Time Serial DM	JAlg	48	2014	69	85	78
23	P vs. NP resolved	SICOMP	23	2016	3	7	98
25	P vs. NP resolved	JACM	46	2016	1	5	98

- Based on above, indicate for each of the following potential functional dependencies, whether it is indeed an FD or not. (3 points)
 - ID → title
 - start_page → end_page
 - (journal, issue) → year
 - title → ID
 - ID → (start_page, end_page, journal, issue)
 - TR_ID → ID
 - Based on above, indicate for each of following sets of attributes whether it is a candidate key for **Articles** or not. (3 points)
 - {ID}
 - {ID, TR_ID}
 - {ID, title, TR_ID}
 - {title}
 - {title, year}
 - {start_page, journal, issue}
 - Is the relation schema **Article** 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. (5 points)
2. Consider the relation schema $R = (A, B, C, D, E, F)$ and the set of functional dependencies $F = \{A \rightarrow B, A \rightarrow C, BC \rightarrow E, BC \rightarrow D, E \rightarrow F, BC \rightarrow F\}$
- List the candidate key(s) for R. Write 'none' if you think there are no candidate keys. (3 points)
 - List the FDs in F that violates BCNF. (3 points)
 - Is R in 3NF? Why? (3 points)

评阅教师	得分

IV. Concurrent Control (10 points total)

Consider the concurrent schedule of transactions T1 and T2.

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

- Is the schedule conflict serializable? If so, give an equivalent serial schedule. If not, give an explain briefly. (5 points)
- Add lock and unlock instructions to Transactions T1 and T2, so that they observe the two-phase-locking protocol. Can it results in a deadlock? (5 points)

评阅教师	得分

V. Database Design (20 points total)

To build a database to handle information about law firms(律师事务所). Each law firm is identified by a name that is unique within a city. A lawyer is identified by an ID, and have a name, address, and salary. A lawyer may be employed by at most one firm. A customer is also identified by an ID, and have a name, address and phone number. A firm can serve a number of customers, and a customer can have a number of law firm serves. Each lawyer handles a load of cases, which involves different customers, identified by a case number. Cases may be handled by more than one lawyer, even if the lawyers work for different firms.

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)**