

四川大学期末考试试题（闭卷）

(2020~2021 学年第 2 学期)

## B 卷

课程号: 311235040      课程名称: 数据库系统和信息管理      任课教师:

适用专业年级: 软件工程 2019 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《四川大学本科学子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 (21%)	四 (9%)	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、答卷纸和草稿纸一并交给监考老师。

评阅教师	得分

**I. Simple choice. (1 point each, 10 total)**

- The most widely used data model in the database domain is ( ).  
A. hierarchical model                      B. network model  
C. relational model                          D. Object-oriented model
- The foreign key is defined mainly to guarantee the ( ) of data  
A. Entity Integrity                          B. Reference Integrity  
C. Custom Integrity                          D. Semantic Integrity
- The ( ) requirement of transaction is: either all operations of the transaction are properly reflected in the database or none are.  
A. Atomicity                      B. Consistency                      C. Isolation                      D. Durability
- Which order of SQL clauses **EXECUTES** is correct? ( )  
A. SELECT-FROM-GROUP-WHERE-ORDER  
B. FROM-SELECT-WHERE-GROUP-ORDER  
C. FROM-WHERE-GROUP-SELECT-ORDER  
D. SELECT-FROM-WHERE-GROUP-ORDER

5. Natural-Join operation in relational algebra can be combined by ( ) operations.
  - A. Select and Project
  - B. Select and Cartesian-Product
  - C. Project and Cartesian-Product
  - D. Select, Project and Cartesian-Product
6. Creation of an ER diagram is a result in the ( ) phase of database design.
  - A. characterize the data needs
  - B. conceptual-design
  - C. logical-design
  - D. physical-design
7. If all candidate keys for a relation schema consist of only one attribute, the schema is satisfied at least ( )
  - A. 2NF
  - B. 3NF
  - C. BCNF
  - D. 4NF
8. 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
9. Which of the following commands can be used to remove access privileges associated with a table? ( )
  - A. DELETE
  - B. REMOVE
  - C. REVOKE
  - D. DROP
10. Which pair of locks is compatible: ( )
  - A. S, X
  - B. X, X
  - C. S, IX
  - D. IX, IX

评阅教师	得分

## II. Queries. (4 points each; 40 total)

Consider the relational database of a library with the following relation schemas, where the primary keys are underlined.

reader ( ID, name, community, phone)

book ( ISBN, title, author) ISBN: International Standard Book Number

staff ( NO, name, salary, department)

borrow ( ID, ISBN, date, NO)

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

- (1) List the IDs and names of all readers whose community is 'Jiang An'
- (2) List the ISBNs and titles of books that have been borrowed by reader with name 'Li Si'
- (3) List the ISBNs of books that have been borrowed by reader with ID '888' and handled by staff with NO '#666'.
- (4) List the IDs and names of readers who borrowed all books that have been borrowed by reader with ID '888'.

## 2、Write SQL statements to perform the following commands:

- (1) List the names of all staffs whose salary is more than 5000.
- (2) List the departments with average salary more than 5000.
- (3) List the names of all staffs with maximum salary in his/her department.
- (4) List the ISBNs and titles of books that have been borrowed by reader with ID '888' between '2021-6-1' and '2021-6-30'.
- (5) List the names of readers who have never been handled by staff with NO '#666' for borrowing a book.
- (6) List the IDs and names of readers who borrowed all books that have been handled by staff with NO '#666'.

评阅教师	得分

## III. Normalization (21 points total)

For each following relational schemas:

- a. Give all candidate keys for each.
- b. Give the normal form level of it (until BCNF) and explain why.
- c. If the schema not meets 3NF, lossless Ly decompose it into a set of relational schemas that satisfied 3NF and preserved dependency.

### 1. Worker (ID, name, birthday, team, leader)

A worker can only join one team; A team has only one leader, but the same person can lead multiple teams.

### 2. Shop (NO, name, place, owner, item)

A shop has only one owner, one place, and multiple items.

### 3. R(U, F), U={A, B, C, D}, F={BC, (A,B)D, CB}

评阅教师	得分

## IV. Concurrent Control & Recovery (9 points total)

Consider the concurrent schedule of transactions T1 and T2 with immediate-modification scheme.

step	T1	T2
1		Read(C)
2		C = C - 5
3	Read(B)	
4	B = B - 10	

step	T1	T2
5		Write(C)
6	Write(B)	
7	Read(A)	
8	$A = A - 2$	
9	Write(A)	
10		Read(A)
11	Commit	
12		$A = A / 2$
13		Write(A)
14		Commit

1. Is the schedule conflict serializable? If so, in the equivalent serial schedule which transaction will be executed at first? If not, give an explain briefly. (5 points)
2. At step 1, if the value of (A, B, C) is (100, 100, 100), give the log for the schedule, include  $\langle T_i\text{-Start} \rangle, \langle T_i, X \ V1, V2 \rangle, \langle T_i\text{-Commit} \rangle$  (2 points)
3. If a system crash occurs in Step 13, give the value of (A, B, C) after system recovery. (2 points)

评阅教师	得分

## V. Database Design (20 points total)

A hospital inpatient department wants to establish a database management system, used to manage the following information:

- (1) Patient: Includes ID, name, age, gender
- (2) Nurse: Includes nurse\_no, name
- (3) Doctor: Includes doctor\_no, name
- (4) Ward: Includes ward\_no, capacity

Each ward can have a number of patients according to its capacity. Each ward is managed by several nurses, and one nurse can manage multiple wards. A doctor can act as a supervisor doctor for multiple patients, and a patient has only one supervisor doctor.

1. Please give the corresponding ER diagram. (8 points)
2. Create the corresponding relational schemas satisfied 3NF, and mark the primary keys by underline. (8 points)
3. Use SQL statements to list names and ages of all patients who managed by nurse named 'Rose' (4 points)