四川大学期末考试试题（闭卷）

（2020~2021 学年第 2 学期）　　A 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。

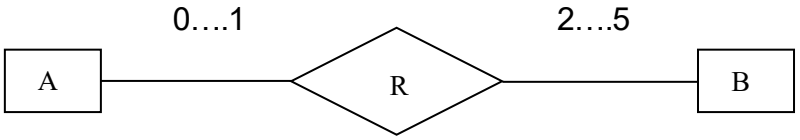
评阅教师	得分

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

1. The degree of a table is the number of (　　) in the table.
   (A) foreign keys　(B) columns　(C) rows　(D) keys
2. The following are functions of a DBMS except (　　)
   (A) creating and processing forms　(B) creating databases
   (C) processing data　(D) administrating databases
3. In a Select statement, (　　) can be used to take out repetition tuples.
   (A) unique　(B) count　(C) distinct　(D) union
4. To authorize query privilege of table s to database user Wang, and permit Wang to authorize the privilege to others, The SQL sentence is (　　).
   (A) GRANT SELECT TO S ON Wang WITH PUBLIC OPTION
   (B) GRANT SELECT ON S TO Wang WIT H PUBLIC OPTION
   (C) GRANT SELECT ON Wang TO S WITH GRANT OPTION
   (D) GRANT SELECT ON S TO Wang WITH GRANT OPTION

5. SQL views can be used to hide: (　　)
   (A) columns and rows only.
   (B) complicated SQL syntax only.
   (C) both of the above can be hidden by an SQL view.
   (D) None of the above is correct.

6. For the E-R diagram given below, the mapping cardinality from **A** to **B** is (　　).



   (A) one-to-many　(B) one-to-one　(C) many-to-one　(D) many-to-many

7. As for the following equivalence rules for transformation of relational expressions, which one is NOT right? (　　)
   (A) $\sigma_{\theta_1 \wedge \theta_2}(E) = \sigma_{\theta_1}(\sigma_{\theta_2}(E))$　(B) $\sigma_\theta(E_1 \times E_2) = E_1 \div E_2$
   (C) $E_1 \cup E_2 = E_2 \cup E_1$　(D) $\prod_L(E_1 \cup E_2) = (\prod_L(E_1)) \cup (\prod_L(E_2))$

8. From the functional dependency set F= {A→B, BC→D, C→E}, we can infer that (　　).
   (A) AC→ABCDE　(B) BC→ABCDE　(C) CD→ABCDE　(D) A→ABCDE

9. In a database system, which part is it to provide data consistency? (　　)
   (A) the DBA　(B) the user　(C) the DBMS　(D) the application program

10. In 2PL protocol, at (　　) stage, A transaction may obtain locks, but cannot release locks.
    (A) Growing phase　(B) Shrinking phase　(C) Committed　(D)Aborted

评阅教师	得分

II. Queries. (4 points each, 40 total)

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

teacher (ID, name, dept_name)

project (ID, name, teacher_ID, budget)

student (ID, name, age, dept_name)

participate (student_ID, project_ID, salary)

Note: Each project has a teacher as a leader, represented by attribute teacher_ID.

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

(1) List the Ids and names of all projects whose leader is the teacher of the “Software” department.

(2) List the Ids and names of all members who have participated in the project named “AI”.

(3) List the IDs of all students who have taken more than five projects.

(4) List the IDs and names of all students who have participated all projects that the student with ID “12345” has participated.

2、Write SQL statements to perform the following commands:

(1) List Ids and names of all projects with a budget greater than 10,000 and with a name include “Software”.

(2) List Ids and names of all student of “Software” department who have NOT participated in any project.

(3) List Ids and names of all projects and the number of students who have participated in it. Sort the results in descending order based on the number of students.

(4) List Ids of projects whose students earn a higher salary on average than the average salary at project with id '001'.

(5) List the names, sum salary of all students who have the most (highest) sum salary.

(6) List the names of all students who have participated in all projects led by the teacher whose name is ‘Enstein’.

评阅教师	得分

III. Normalization (20 points total)

1. Consider the following relational schema:

project_material = (prjno, prjname, prjbudget, begin date, end date, material No, material Name, material quantity)

It contains information about the material usage of projects. The Attribute prjno is the No. of **project**, The Attribute prjname is **the** name of project, The Attribute prjbudget is the budget of project. The Attribute material quantity is quantities of materials used in a projerct.

- Each project has unique project No.
- Different projects may have same project name, project budget, project begin date and project end date.
- Each project use various materials.

The following is an instance of the schema:

prjNo	prjName	prjBudget	Begin date	End date	Material No	Material Name	Material quantity
101	1# project	10000	2020/01/01	2021/01/01	10001	cement	100
101	1# project	10000	2020/01/01	2021/01/01	10002	steel	120
101	1# project	10000	2020/01/01	2021/01/01	10003	sand	120
102	2# project	20000	2020/09/01	2021/07/01	10001	cement	100
102	2# project	20000	2020/09/01	2021/07/01	10003	sand	110
103	1# project	10000	2020/01/01	2021/01/01	10001	cement	100

(1) Based on above, Identify functional dependencies of project_material. (3 points)

(2) Based on above, Identify the candidate key(s) of project_material. (3 points)

(3) Is the relation schema **project_material** 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. (4 points)

2. Consider a relation R(A,B,C,D,E,G) with the set of Functional Dependencies.

$F=\{BE\rightarrow G, BD\rightarrow G, CD\rightarrow A, CE\rightarrow G, CDE\rightarrow AB, BC\rightarrow A, B\rightarrow D\}$

(1) Give all candidate keys of R. (3 points)

(2) Give a canonical cover of F. (3 points)

(3) Is R in 3NF? explain why if it is or decompose it into 3NF if not. (4 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)	
A=A+1	
	read (B)
write(A)	
	B=B-1
read(B)	
	write(B)
B=B+1	
	read(C)
write(B)	
	C=C+2
	write(C)
	Commit
Commit	

1. Is the schedule conflict serializable? If so, give an equivalent serial schedule. If not, give an explain briefly. (5 points)
2. Add lock and unlock instructions to Transactions T1 and T2，only consider the 2PL concurrent schedule of transactions T1 and T2, 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)

For a simplified application on Supermarket Management, there are three entity sets: Supermarket, Product, and Warehouse. The attributes of Supermarket includes: SupermarketNo, SMName, SMAddress, Telephone, Manager; and the attributes of Product contains: Product No, PName, Price, Producer, Produce Date; and the attributes of Warehouse contains: Warehouse No, Warehouse Name, WAddress, Adminstrator. And two relationship sets: Supermarket and Product related through a binary relationship set Sale, Supermarket sales products, record the product's sale quantities every day; and Product and Warehouse related through a binary relationship set Stock. The warehouse only input (store)

each product once a day.

The two relationship sets have the following attributes respectively: Sale has attributes: Sale Date and Sale Quantity; Stock has attributes: In Date, In Price, and Stock Quantity.

1. Please give the corresponding ER diagram. (8 points)
2. Create the corresponding relational schemas, and point out the primary keys and the foreign keys. (8 points)
3. Use SQL statements to define Product table, and give proper integrity constraints. (4 points)