

**北京交通大学 软件学院 2009 级**

**《Database System》期末考试试卷(A) (2011-06-20)**

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题号	一	二	三	四	五	六	总分
得分							

**I. Single choice (10 points)**

1. Relational Model, Network Model and Hierarchical Model belong to ( 1 )  
(a) conceptual model      (b) logical model  
(c) physical model      (d) E/R model
2. Which symbol is used in standard SQL as a wildcard to represent a series of zero or more unspecified characters? ( 2 )  
(a)? (question mark)      (b)! (exclamation mark)      (c)% (percent sign)  
(d)\_ (underscore)      (e); (semi-colon)
3. When a transaction functions in such a way that either all of the transaction actions are completed or none of them will be, the transaction is said to be: ( 3 )  
(a)atomic.      (b)logical.      (c)isolated.      (d)consistent.      (e)locked.
4. The component of a database that describe structure of database is the: ( 4 )  
(a)related tables.      (b)metadata.      (c)related tuples.      (d)data set.      (e)library.
5. Which of the following is not true about primary keys? ( 5 )  
(a) Primary keys must be unique.  
(b) Primary keys can be defined using a SQL CONSTRAINT phrase.  
(c) Primary keys must be a single attribute.  
(d) Primary keys are used to represent relationships.  
(e) Primary keys cannot be null.
6. If all concurrent transactions follow 2PL protocol , they must be serializable.  
Is it true? ( 6 )  
(a) Maybe      (b) No      (c) not sure      (d) Yes
7. A point of synchronization between the database and the transaction log is called a(n) ( 7 )  
(a) after-image.      (b) recovery.      (c) checkpoint.      (d) before-image.
8. During the normalization process, the remedy for a relation that is not well formed

is to ( 8 )

- (a) decompose it into two or more relations that are well formed.
- (b) combine it with another relation that is well formed.
- (c) convert it into a list.
- (d) create a functional dependency.
- (e) create a surrogate key.

9. Which type of join, although not included in standard SQL, was created to allow unmatched rows to appear in the result of a join operation? ( 9 )

- (a) OPEN JOIN (b) INNER JOIN (c) OUTER JOIN (d) COMBINE JOIN

10. Which of the following is true when representing a 1:1 binary relationship using the relational model? ( 10 )

- (a) The key of the entity with the most attributes must be placed in the other entity as a foreign key.
- (b) The key of the entity with the highest minimum cardinality must be placed in the other entity as a foreign key.
- (c) The key of each entity must be placed in the other as a foreign key
- (d) The key of the entity being searched less frequently is placed in the other as a foreign key.
- (e) Both entities must have the same primary key.

No	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Answer	b	c	a	b	c	d	c	a	c	d

## II. Fill in the blanks (10 points)

1. Database integrity refers to the \_\_\_\_ (1) \_\_\_\_ and \_\_\_\_ (2) \_\_\_\_ of stored data.
2. Among the three levels of schemas, \_\_\_\_ (3) \_\_\_\_ level is the “heart” of the database.
3. The physical data model is used to describe data at the \_\_\_\_ (4) \_\_\_\_ level.
4. Among the four levels of Transaction isolation defined in SQL-92, only the \_\_\_\_ (5) \_\_\_\_ isolation level is safe, that is, not generating \_\_\_\_ (6) \_\_\_\_ or \_\_\_\_ (7) \_\_\_\_ phenomena which maybe appear in other three levels.
5. Please give the names of three popular commercial DBMS dialects, i.e. \_\_\_\_ (8) \_\_\_\_ produced by Oracle company, \_\_\_\_ (9) \_\_\_\_ by Microsoft company and \_\_\_\_ (10) \_\_\_\_ by IBM company.

No.	(1)	(2)	(3)	(4)	(5)
answer	validity	consistency	conceptual	internal	serializable
No.	(6)	(7)	(8)	(9)	(10)
answer	Dirty read / <b>Uncommitted dependency problem</b>	Nonrepeatable read / <b>Inconsistent analysis problem</b>	Oracle	SQL Server	DB2

**III. (30 points)** There are three relation schemas in Database STUDENT, which are as follows.

S (sno, sname, age, sex, Total\_credits ) <PK>=sno,

where Total\_credits is the sum of the credits of all courses which the student has chosen.

C (cno, cname, credit, teacherNo) <PK>=cno

SC (sno,cno,grade) <PK>=(sno, cno) , <FK>=sno, <FK>=cno

- (3 points)** Delete the attribute named teacherNo from Table C.  
Alter table C drop teacherNo
- (7 points)** Write a stored procedure that shows all students having chosen all courses that a certain student given by his/her student number (@given\_sno) chooses, list such students' name, the number of all courses which he or she chooses, and the average grade and the total credits. (Maybe two or more students have the same name. if so, list them respectively)

CREATE PROCEDURE list @given\_sno varchar (20)

AS select S.sno, sname, count(cno), average(grade), sum(credit) ----- (2 points)

from S , SC, C

where S.sno=SC.sno and SC.cno=C.cno and S.sno in ----- (2 points)

( select sno from sc

where cno in (select cno from sc where sno=@ given\_sno)

group by sno

having count(cno)=

(select count(cno) from sc where sno=@ given\_sno)

) ----- (3 points)

exec list 'S1'

or (Oracle)

create or replace procedure aaa

(p\_sno in s.sno%type)

Is

```

Cursor c1 is select s.sno a1,sname,count(cno) a2,avg(grade) a3 ,sum(credit) a4
From s,sc,c
Where s.sno=sc.sno and sc.cno=c.cno and s.sno in
  (Select sno from sc x
   Where not exists
     (select * from sc y
      Where y.sno=p_sno and not exists
        (select * from sc z
         Where z.sno=x.sno and z.cno=y.cno)
    )
  )
Group by s.sno, sname;
V1 c1%rowtype;
Begin
  Open c1;
  Fetch c1 into v1;
  While c1%found Loop
    Dbms_output.put_line(v1.a1||v1.sname||v1.a2||v1.a3||a1.a4);
    Fetch c1 into v1;
  End loop;
  Close c1;
End;

```

3. (5 points) For all female students, create a view that list her student number, name, the number of all courses which she chooses and the average grade that is more than 85. In addition, **it prohibits a row migrating out of the view.**

```

CREATE VIEW VIEW_85
AS SELECT S.sno, sname, count(cno), avg(grade) as agv_grade
FROM S, SC
WHERE S.sno=SC.sno and sex='f'
Group by S.sno, sname
Having avg (grade) > 85
WITH CHECK OPTION----- (1 points)

```

4. (5 points) In Table SC, list all female students' tuples in which the grades are greater than all grades that student 's1' (it is the value of sno) earned.

```

select * from sc
where grade>
  all ( select grade from sc y where sno='s1') ----- (3 points)
and sno in (select sno from S where sex='f'); ----- (2 points)

```

5. (5 points) List the student numbers of all the students who do not choose 'c2' and 'c4' (it is the value of cno) simultaneously. (Write relational algebra expression)

$$\pi_1(S) - \pi_1(\delta_{1=4 \wedge 2='C2' \wedge 5='C4'}(SC \times SC))$$

6. (5 points) Design one trigger that can prevent a student from choosing more than three courses when a inserting or updating the information in Table SC.

(oracle)

```
create or replace trigger aa
after insert or update on sc
for each row
begin
    if 3<(select count(cno) from sc where sno=:new.sno) then
        raise_application_error(-20012,'too many selection course');
    end if;
end;
```

Or (sqlserver)

```
create trigger tri_nottoomuch on sc
for insert,update
as begin
    if 3<(select count(*) from sc
        where sno=(select sno from inserted))
    begin
        ROLLBACK TRANSACTION
        print 'insert or update rollback transaction'
    end
end
```

- IV. (10 points) Specify all candidate keys of each relation and the highest normal formal to which the following relation belongs. Please write your reasons, and decompose it to BCNF if it is not in BCNF.

1. Table1 (A, B, C) and its set of functional dependencies is as follows.

$F=\{(A,C)\rightarrow B, B\rightarrow C\}$

**Solution:**

Two candidate keys: (A,C) and (A,B)----- (1 point)

It is in 3NF because there is no non-primary attributes

and the determinant of  $B\rightarrow C$  is not CK ----- (2 points)

It is decomposed to (A, B) and (B, C), which are all in BCNF----- (2 points)

2.  $R(A,B,C,D)$ 、 $F=\{D\rightarrow A, D\rightarrow B\}$

**Solution:**

Only one candidate key (C,D) ----- (1 points)

Because non primary-key attribute A, B are partially functionally dependent on candidate key (C,D), R is in 1NF ----- (2 points)

It can be decomposed as follows.

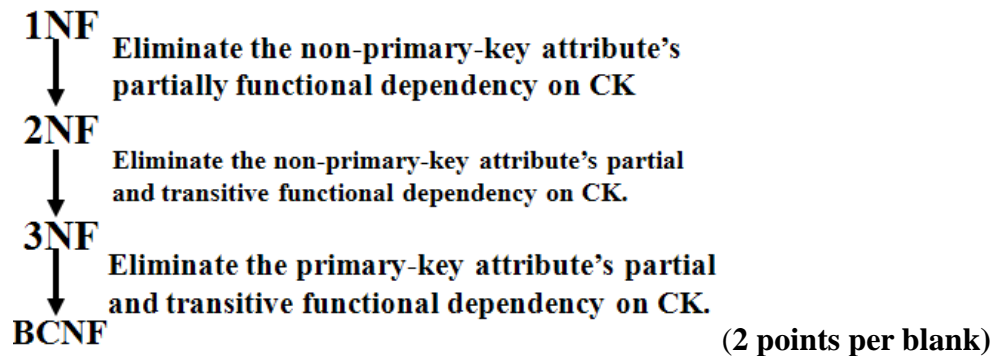
( C,D ) and ( D, A, B ) Both are in BCNF ----- (2 points)

**V. (20 points) Please answer the following questions briefly.**

1. (4 points) Please write the four levels of Transaction isolation defined in SQL-92 or defined by a certain commercial DBMS after giving the name of the DBMS.

READ UNCOMMITTED ,      READ COMMITTED ,  
REPEATABLE READ ,      SERIALIZABLE

2. (6 points) Please fill in the following blanks.



3. (5 points) What are the functions of locks? What the different function between S lock and X lock? If the two kinds of lock have alias, please write all of them.

One transaction uses locks to deny access to other transactions and so prevent incorrect updates. -----(1 point)

If a transaction has S lock on a data item, it can read but not update the item. -----(1 point)

If a transaction has X lock on a data item, it can both read and update the item. -----(1 point)

S lock is also called shared lock or read lock, and X lock is also called exclusive lock or write lock -----(2 points)

4. (5 points) Distinguish between the HAVING clause and the WHERE clause. When both the WHERE clause and the HAVING clause appear in the same SELECT statement, which clause is generally executed first?

Answer:

The HAVING clause and the WHERE clause differ in that the WHERE clause is used to identify rows that satisfy a stated condition. The HAVING clause is used to identify groups, (2points)

The HAVING clause have been created by the GROUP BY clause, that satisfy a stated condition. (2points)

In cases when the WHERE clause and the HAVING clause are both allowed to appear in the same SELECT statement, the WHERE clause is generally implemented to execute before the HAVING clause. (1points)

**VI. (20 points)** Suppose that you are asked to design a database for a specific bank which has many branches.

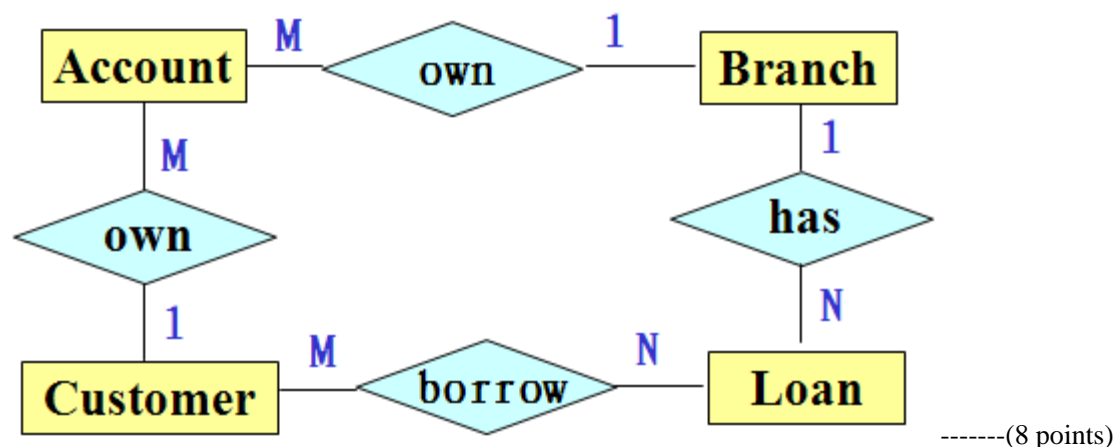
- (1) One branch owns many accounts and one account can only belong to one branch.
- (2) One customer can own many accounts, but one account can only belong to one customer.
- (3) A branch can loan money to customers. One customer can borrow several loans from the bank and one loan can have several debtors, i.e. customers.

**In addition**, the database should also include the following information.

- (1) The individual information of every customer, such as customer name, address and phone-number.
- (2) The detail information of each branch, such as the branch number, address and assets.
- (3) The information of a loan, such as loan-number, branch-number and amount.
- (4) The information of an account, such as account-number, branch-number and balance.

Please draw the ER-diagram for the application, **leaving the attributes out of the diagram**, and write the set of relation schemas. Then point out the primary key of each relation schema and foreign keys if it has.

SOLUTION:



Branch (branch-number, address, assets) ----- (2 points)

Customer (customer-name, address, phone-number) ----- (2 points)

Account (account-number, branch-number, customer-name, balance) ----- (2 points)  
FK: branch-number

Loan (loan-number, branch-number, amount) ----- (3 points)  
FK: branch-number

Borrow (customer-name, loan-number) ----- (3 points)  
FK: loan-number