北京交通大学　软件学院 2008 级

《Database System》Final Exam(A)　(2010-06-16)

姓名_____学号_____班级_____

题号	一	二	三	四	五	六	总分
得分							

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

1. There are two transactions scheduled as shown in Fig.1. What kind of schedule is it?
   (A) Unserializable concurrent schedule　(B) Serial Schedules
   (C) serializable concurrent schedule　(D) None is correct

T_1	T_2
read(A)	
$A := A - 50$	
write(A)	
	read(A)
	$temp := A * 0.1$
	$A := A - temp$
	write(A)
read(B)	
$B := B + 50$	
write(B)	
	read(B)
	$B := B + temp$
	write(B)

Fig. 1

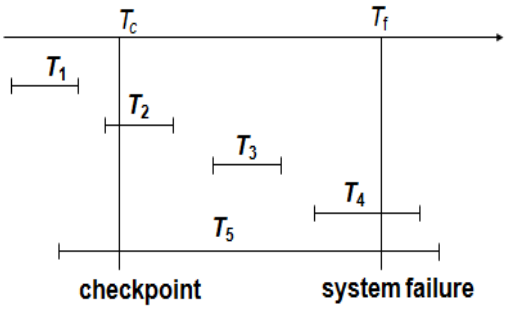


Fig.2

2. In Fig.2，which transactions should be put into redo-list and which into undo-list?
   (A) redo list: T1,T2　undo list: T3,T4,T5
   (B) redo list: T1,T2, T3　undo list:T4,T5
   (C) redo list: T1　undo list: T2, T3,T4,T5
   (D) redo list: T2,T3　undo list:　T4,T5

3. The purpose of schema normalization is to
   (A)　Reduce the number of anomalies that can occur during inserts, deletes, and updates.
   (B)　Eliminate functional dependency among data stored in the database.
   (C)　Reduce the number of joins required to satisfy a query.
   (D)　Convert the data to a canonical form to promote schema integration.

4. Let A, B, and C be subsets of the attributes of relation R. which one is Reflexivity rule of Armstrong's axioms?
   (A)　If A → B and A → C, then A → B,C

(B) If B is a subset of A, then A → B
(C) If A → B and B → C, then A → C
(D) If A → B, then A,C → B,C

5. The physical storage structure will be _____ to the application programmer in a database approach, and will be _____ to the application programmer in a file system approach.
(A) hidden, visible (B) visible, hidden
(C) visible, visible (D) hidden, hidden

6.What information is necessary when specifying the structure of a table?
(A) the name of the table, the names of the table's attributes, the data types of the table's attributes, the formats of the table's attributes, and the maximum number of rows that the table can have.
(B) the name of the table and the amount of storage space to be allocated to the table.
(C) the name of the table, the names of the table's attributes, the data types of attributes, and the formats of attributes.
(D) the name of the table and the names of the table's attributes.

7. Which of the following is true about views being up to date?
(A) Views are up to date only after the synchronization operation by the user.
(B) Views are never up to date; there is always a lag time.
(C) Views can be automatically made up to date periodically by the system.
(D) Views are always up to date.

8. If database has been damaged, users need to restore the last_____copy of database and reapply updates of committed transactions using____ .
(A) backup, bg file (B) log file , backup
(C) data, checkpoint record (D) backup, checkpoint record

9. Consider the functional dependency: {A, B} -> {C} Regarding this dependency, which of the following statements is (are) true?
I .The values of C are uniquely determined by the values of A.
II The values of A are uniquely determined by the values of C.
(A) I and II (B) I only (C) II only (D) None

10. An exclusive lock on a data item represents permission to perform which of the operations, read and write, on the data item?
(A) Both read and write (B) Write only
(C) Neither read nor write (D) Read only

Please write your answer in this table, otherwise invalid.

No	(1)	(2)	(3	(4	(5)	(6)	(7)	(8)	(9)	(10)
Answer	C	D	A	B	A	C	D	A	D	A

II. Fill in blanks **(10 points)**

1. The log records are written before writing data to database, this rule is called (1) .
2. (2) model is a data model built in the information world and can represent the logical (or community) view that is DBMS-independent.
3. The ANSI-SPARC three-level architecture of DBS includes three-level schemas and two-level mapping, please give their names: (3) schema , (4) schema, (5) schema and (6) mapping , (7) mapping.
4. (8) schedule is such kind of schedule where operations of each transaction are executed consecutively without any interleaved operations from other transactions.
5. Armstrong's Axioms consist of three rules, i.e. Reflexivity, (9) and (10).

Please write your answer in this table, otherwise invalid.

No.	(1)	(2)	(3)	(4)	(5)
answer	Write-ahead log protocol	Conceptual	Internal schema	Conceptual schema	External schema
No.	(6)	(7)	(8)	(9)	(10)
answer	External/ conceptual	Conceptual/ internal	Serial	Augmentation	Transitivity

III. **(10 points)** Given a relational schema, write its functional dependency set, all candidate keys of each relation schema and the highest normal form which it belong to. Then decompose it to BCNF if it is not in BCNF.

1. warehouse (wno, addr, goodsNo, qty) where wno is the warehouse number, addr is the address of a warehouse, goodsNo is the goods number, one kind of goods can be stored in many warehouse and one warehouse can hold many kinds of goods, qty is the quantity of one kind of goods being stored in one warehouse.

FD={ wno ---> addr, (wno,goodsNo) ---> qty } ----------**(1 point)**

<PK>=(wno,goodsNo) warehouse $\in$ 1NF ---------- **(2 points)**

It can be decomposed as follows.

W1 (wno, addr) , W2 (wno, goodsNo, qty). Both are in BCNF.----------**(2 points)**

Or

FD={ wno ---> addr, addr ---> wno, (wno,goodsNo) ---> qty } ----------**(1 point)**

<PK>=(wno,goodsNo) <AK>=(addr,goodsNo) warehouse ∈ 3NF ---------- **(2 points)**

It can be decomposed as follows.

W1 (wno, addr) , W2 (wno, goodsNo, qty). Both are in BCNF.----------**(2 points)**

2. Table1 (City, Street, Zip) where Zip is the Zip code of a street in a certain city. You can get the other semantic meaning according to our national situation.

FD={ Zip ---> City, (City , Street) ---> Zip } ----------**(1 point)**

<PK>=(Zip , Street) <AK>=(City , Street) ---------- **(1 point)**

Table1 ∈ 3NF ---------- **(1 points)**

It can be decomposed as follows.

T1 (Zip , City) , T2 (Zip , Street). Both are in BCNF.----------**(2 points)**

IV. **(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 taken.

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

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

1. **(3 points)** Add a new attribute named Addr (varchar(20)) into Table S.

```
Alter table S add Addr varchar(20)
```

2. **(7 points)** Write a trigger that can modify the corresponding value of Total_credits when a student changes one course to another course in Table SC.

```
CREATE TRIGGER update_sc ON sc
  FOR UPDATE                                    ---------- (1 point)
  AS if update(cno)
  begin
    update s
    set Total_ credits= Total_credits-
        (select credit
         from deleted d,c
         where d.cno=c.cno )
    where s.sno=( select sno from deleted)      ---------- (3 points)

    update s
    set Total_credits= Total_credits+
        (select credit
         from inserted i,c
         where i.cno=c.cno )
```

where s.sno=(select sno from inserted) ---------- **(3 points)**

end

3. **(5 points)** Write a stored procedure that shows a student's name, the names of all courses which he or she takes, the grades and the credits when the student's name is given.

```
CREATE PROCEDURE Grade_list @given_name varchar(20)
 AS select sname, cname, grade, credit
    from S , SC, C
    where S.sno=SC.sno and SC.cno=C.cno
      and sname=@ given_name

exec Grade_list 'Zhang Shan'
```

4. **(5 points)** Create a view that lists the student number, name and average grade of all the students whose average grades are more than 80. In addition, **it prohibits a row migrating out of the view.**

```
CREATE VIEW VIEW_80
AS SELECT S.sno, sname, avg(grade) as agv_grade ---------- (1 point)
   FROM S, SC
   WHERE S.sno=SC.sno ---------- (1 point)
   Group by S.sno, sname ---------- (1 point)
   Having avg (grade) > 80 ---------- (1 point)
   WITH CHECK OPTION ---------- (1 point)
```

5. **(5 points)** In Table SC, list the tuples in which the grades are less than the average grade of the same course.

```
select * from sc x ---------- (1 point)
 where grade < ---------- (1 point)
      ( select avg(grade) from sc y where x.cno=y.cno); -------- (3 points)
```

6. **(5 points)** List the student numbers of all the students who take at least two different courses. (Write relational algebra expression)

$$\pi_{1}(\delta_{1=4 \wedge 2 \neq 5}(SC \times SC))$$

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

1. Explain the following terminologies.

(1) Data Independence ,PDI , LDI (5 points)

Data Independence means that upper level of database schemas are unaffected by changes to lower levels, and it is the independence between data and program. ---------- **(1 point)**

Logical Data Independence ---------- **(2 points)**

It refers to immunity of external schemas to changes in conceptual schema.

Physical Data Independence ---------- **(2 points)**

It refers to immunity of conceptual schema to changes in the internal schema.

(2) Two-Phase Locking Protocol (5 points)

Transaction follows 2PL protocol if all locking operations precede first unlock operation in the transaction. ---------- **(1 point)**

The first phases for transaction is Growing phase in which a transaction acquires all locks but cannot release any locks. ---------- **(2 points)**

The second phase is Shrinking phase in which a transaction releases locks but cannot acquire any new locks. ---------- **(2 points)**

2. (5 points) What items are contained in transaction records in Log file? Write at least five items of them.
   a) Transaction identifier.
   b) Type of log record, (transaction start, insert, update, delete, abort, commit).
   c) Identifier of data item affected by database action (insert, delete, and update operations).
   d) Before-image of data item.
   e) After-image of data item.
   f) Time of Transaction operation.

3. **(5 points)** Please write the difference between serial schedule and serializable schedule.

Serial schedule is such kind of schedule where operations of each transaction are executed consecutively without any interleaved operations from other transactions. ---------- **(2 points)**

Serializable schedule is a nonserial schedule where operations from set of concurrent transactions are interleaved, ---------- **(1 points)**

and it is equivalent to *some* serial schedule. ---------- **(2 points)**

VI. **(20 points)** Database Design

Suppose that you are asked to design a database about book publishing and selling. There are many publishers and many kinds of books. One book only can be published by one publisher and may be written by several authors. All the authors of one book share the copyright in different proportion, and each author has his or her rank among all the authors of this book. Each book has a fixed price. One book can be sold by many book stores and one store can sell many books. Each transaction of book store's book-selling has an order which includes order number, order date, store number, book number and the quantity of each book. **In addition**, the database should also include the following information.

(1) The individual information of every author, such as name, phone number, address, state and city where he lives.

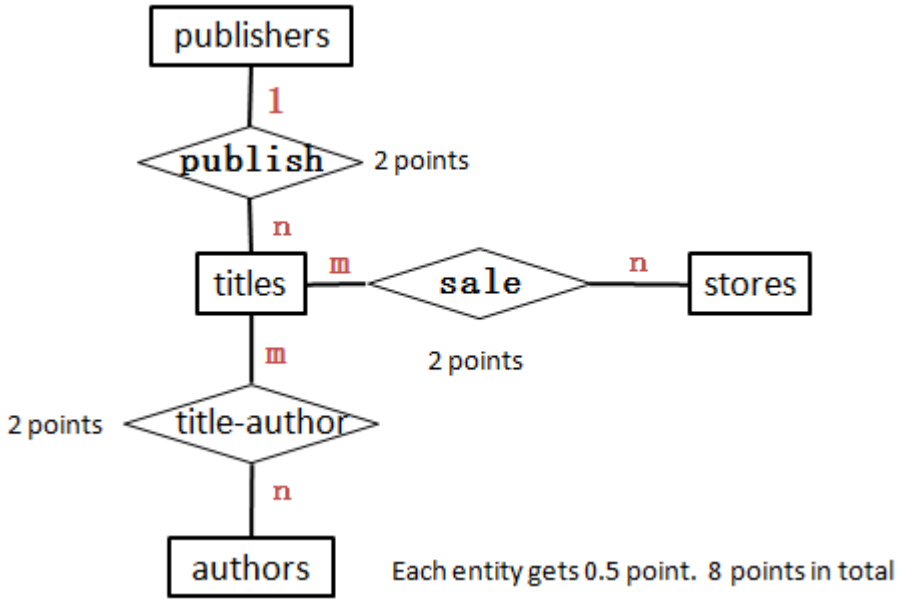
(2) The detail information of every publisher, such as its number, name, state and

city where it locates.

(3) The information of a book, such as its title, type, publisher, price, author(s).

(4) The information of a book store, such as its name, address, state and city where it locates.

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.



authors(au-id,au-lname,au-fname, phone,address,state,city) (2 points)

titles (title-id,title, type, pub-id,price) (2 points)

title-author (au-id, title-id, au-ord, opyright) (2 points)

publishers (pub-id,pub-name,city,state) (2 points)

stores (store-id,store-name, store-address,city,state) (2 points)

sales (ord-num,title-id,store-id,ord-date,qty) (2 points)