四川大学期末考试试题（闭卷 - A）

（2012-2013 学年第 1 学期）

课程号：311038040 课序号：0 - 4 课程名称：数据库系统 任课教师：阮树骅、张天庆、龚勋、李川

适用专业年级：软件工程 2010 级 学生人数：316 印题份数：330 学号：_____ 姓名：_____

考试须知

四川大学学生参加由学校组织或由学校承办的各级各类考试，必须严格执行《四川大学考试工作管理办法》和《四川大学考场规则》。有考试违纪作弊行为的，一律按照《四川大学学生考试违纪作弊处罚条例》进行处理。

四川大学各级各类考试的监考人员，必须严格执行《四川大学考试工作管理办法》、《四川大学考场规则》和《四川大学监考人员职责》。有违反学校有关规定的，严格按照《四川大学教学事故认定及处理办法》进行处理。

题　号	一	二	三	四	五	六	七	八	九	十
得　分										
阅卷教师										
阅卷时间										

总成绩		期末卷面 50%		单元测验 2 次 10%		练习/项目 30%		考勤成绩 10%	

1. Multiple Choices (20 marks, 2 marks for each)

1)	2)	3)	4)	5)	6)	7)	8)	9)	10)

1) In a database system, whose responsibility is it to provide **data consistency**? B

A. the database administrator's　　B. the DBMS's

C. the user's　　D. the application programmer's

2) The term **logical data independence** refers to the ability to change A

A. the conceptual schema without changing the external schemas, or the application programs

B. the physical schema of the data without changing the external schemas, the conceptual schemas, or the application programs

C. the application programs without changing the conceptual schema

D. the data without physically relocating the tables

3) A database is needed for which of the following **application scenarios**? A

I. A video store that needs to keep track of data about members, about videos carried by the store, about videos rented by members, as well as data concerning borrow-date, return-date, and payment information.

II. In the human resources department of a company, information about employees, their titles, their salaries and sick days, and about vacation days taken by each employee.

III. A computer-simulated video game which needs to calculate and display, the physical (x, y) location of each actor in the game, the speed with which they are moving at the current instant, the direction in which they are moving, the action they are performing, the angle at which the game-player is viewing the scene.

A. I and II only　　B. I only　　C. I and III only　　D. I, II, and III

4) Which of the following are usually used to represents **ENTITY TYPE** in ER modeling. B

A. verb　　B. noun　　C. proposition.　　D. adjective

5) What information is necessary when specifying the structure of a table in a relational schema? A

A. the name of the table, the names of the table's attributes, the data types of attributes, and the formats of attributes
B. the name of the table and the names of the table's attributes
C. 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
D. the name of the table and the amount of storage space to be allocated to the table

6) Which of the following problems can be caused by data redundancy in a relational schema? A
I. Inefficient use of space
II. Update anomalies and possible loss of data
III. Inefficient use of processing time
A. I and II only B. II only C. I and III only D. I, II, and III

7) Which of the following are properties of transactions in database systems? A
I. Atomicity and Durability
II. Consistency and Isolation
III. Unique and Independent
A. I and II only B. I and III only C. II and III only D. I, II, and III

8) Which of the following is true about transactions affecting the consistency of a database? A
A. A transaction always leaves the database in a consistent state.
B. A transaction leaves the database in a consistent state if there is no system crash during the execution of the transaction.
C. A transaction leaves the database in a consistent state if the user has not violated any integrity constraints.
D. There are no guarantees that transactions will leave the database in a consistent state.

9) In a two-phase locking protocol, what happens when a transaction requests a conflicting lock? D
A. The transaction is aborted immediately.
B. The transaction immediately acquires the lock from the current lock-holder.
C. The transaction proceeds without acquiring the lock.
D. The transaction is blocked to acquire the lock.

10) During recovery, which of the following **transaction operations** has both the before and after images? D
A. Commit B. Insert C. Delete D. Update

2. Write SQL statements (30 marks, 5 marks for each)

Consider a database schema with the following relations:
Student (SSN, name);
Course (ID, instructorName, title, credits, classroom);
Enroll (studentSSN, courseID, score);
Write SQL statements in SQL2 to perform the following commands.

1) Find SSNs and names of all students who are enrolled in a class taught by 'Smith';

```
Select Distinct SSN, name
From Student, Course, Enroll
Where SSN = studentSSN and ID = courseID and instructorName = 'Smith';
```

2) Find SSNs and names of all students who are NOT enrolled in a class taught by 'Smith';

```
Select SSN, name
From Student
Where not exists
( Select * From Course, Enroll
```

```
Where SSN= studentSSN and ID = courseID and instructorName = 'Smith');
```

3) List alphabetically titles of all courses either are taught by teachers whose names begin with "Li" OR are taught in room number 4-456. Do NOT list duplicate titles;

```
Select Distinct title
From Course
Where instructorName like 'Li%' or classroom = '4-456'
Order by title;
```

4) Find the name of the student who enrolled in the course titled "Database" and get the highest score;

```
Select name
From Student
Where SSN in
(Select studentSSN From Enroll, Course Where ID = courseID and title = 'Database' and score =
  (Select max (score) From Enroll, Course Where ID = courseID and title='Database'));
```

5) List all students' name and their average score;

```
Select name, avg(score)
From Student, Enroll
Where SSN = studentSSN
Group by SSN, name;
```

6) Find SSNs and names of all students who are enrolled in at least all classes that the student 'John' enrolled.

```
Select SSN, name
From Student
Where not exists
((Select courseID From Student, Enroll Where SSN = studentSSN and name = 'John')
  Except
(Select courseID From Enroll Where SSN = studentSSN));
```

3. Database Design (30 marks)

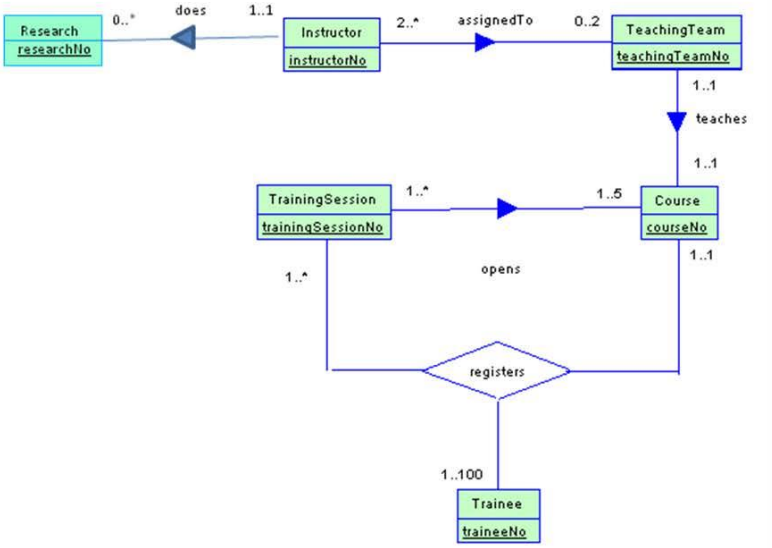
You are first required to create a conceptual data model of the data requirements for a company that specializes in IT training and then map the conceptual data model into a relational schema. The Company has 30 instructors and can handle up to 100 trainees per training session. The Company offers five advanced technology courses, each of which is taught by a teaching team of two or more instructors. Each instructor is assigned to a maximum of two teaching teams or may be assigned to do research. Each trainee undertakes one advanced technology course per training session.

1) Identify the main entity types for the company.

2) Identify the main relationship types and specify the multiplicity for each relationship. State any assumptions you make about the data.

3) Using your answers for the previous two to draw a single ER model to represent the data requirements for the company.

4) Convert the E-R model into a relational schema using the mapping algorithm specified in this course. Specify key and referential integrity constraints, using directed arcs. Make sure you also identify alternate keys. Label each step of the mapping algorithm.



4. Normalization (20 marks)

The following table lists dentist/patient appointment information. A patient is given an appointment at a specific date and time with a dentist located at a particular surgery. On each day of patient appointments, a dentist is allocated to a specific surgery for that day.

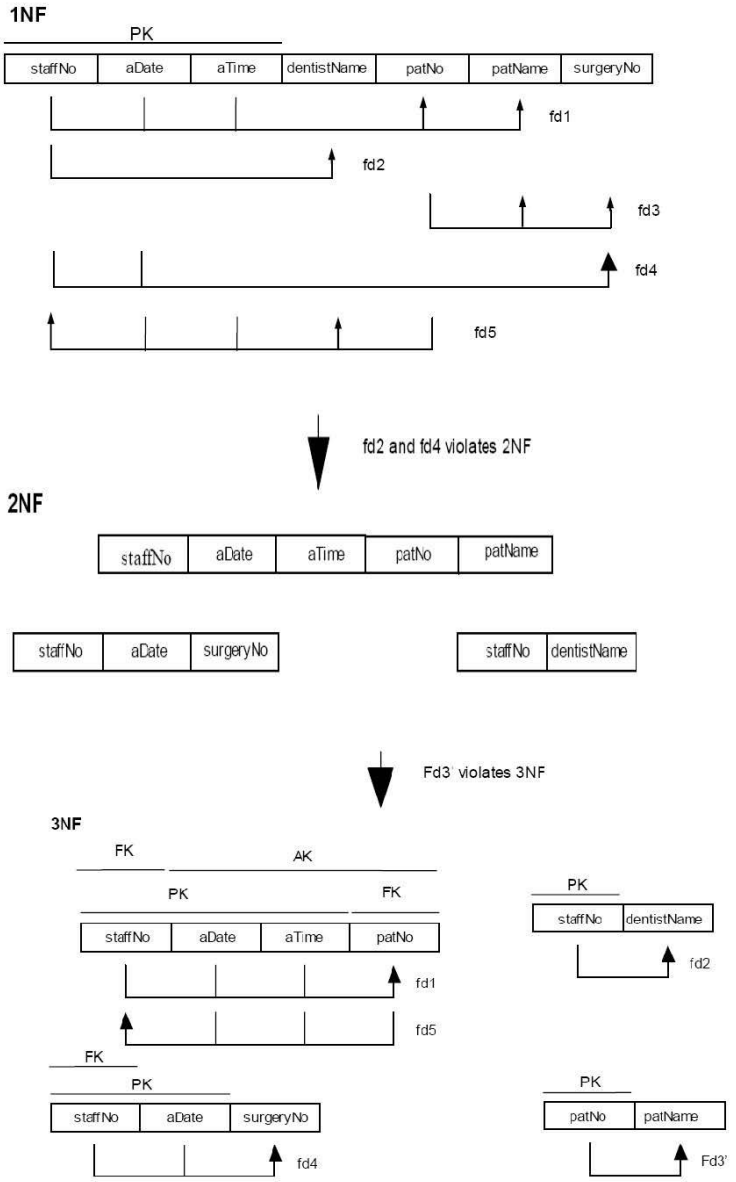
staffNo	dentistName	patNo	patName	appointment		surgeryNo
				date	time	
S1011	Tom Smith	P100	Mary White	20-Dec-12	10:00	S15
S1011	Tom Smith	P105	Jill Bell	20-Dec-12	12:00	S15
S1024	Helen Pearson	P108	Rose Plevin	20-Dec-12	10:00	S10
S1024	Helen Pearson	P108	Rose Plevin	21-Dec-12	14:00	S10
S1032	Robin Williams	P105	Jill Bell	21-Dec-12	16:00	S15
S1032	Robin Williams	P110	John Walker	22-Dec-12	16:00	S13

Perform the following tasks:

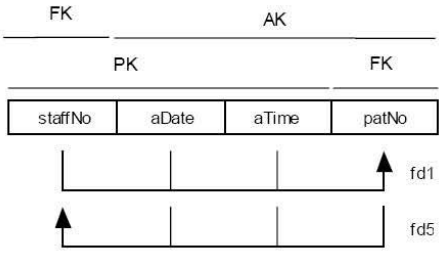
1) The table is susceptible to update anomalies. Provide examples of insertion, deletion, and update anomalies.

   An example of a deletion anomaly is if we delete the details of the dentist called 'Helen Pearson', we also loose the appointment details of the patient called 'Ian MacKay'.

2) Describe and illustrate the process of normalizing the table to BCNF. State any assumptions you make about the data shown in the table.



The only relations that may violate BCNF are those that have more than one candidate key. Therefore we need only re-examine the Appointment relation, which has (staffNo, aDate, aTime) as a PK and (patNo, aDate, aTime) as an alternate key. This relation contains the following functional dependencies:



The presence of fd5 does not break BCNF because (patNo, aDate, aTime) is a candidate key for this relation. Hence the Appointment relation is in BCNF.

As the other relations shown in the answer have only one candidate key, they must also be in BCNF.