

1. (10 points) Explain why the following table is not in 3NF, and rewrite the table definition (introducing new tables as necessary) to be in 3NF.

```
CREATE TABLE Book (  
    ISBN VARCHAR(255) PRIMARY KEY,  
    Title VARCHAR(255),  
    AuthorId INT,  
    AuthorName VARCHAR(255),  
    AuthorBirthDay DATE  
);
```

2. (10 points) Which of the statements can be executed given the following table and data? *If a statement cannot be executed, you must explain why.*

```
CREATE TABLE Foo (  
  A INT PRIMARY KEY,  
  B INT NOT NULL,  
  C INT CHECK (C >= A + B),  
  D REFERENCES Foo.A  
);
```

A	B	C	D
1	2	3	1
2	3	5	1
3	3	7	2

(a) `INSERT INTO Foo (100, 200, 300, 1);`

(b) `INSERT INTO Foo (1, 2, 3, 1);`

(c) `INSERT INTO Foo (200, NULL, 300, 1);`

(d) `INSERT INTO Foo (200, 200, 300, 1);`

(e) `INSERT INTO Foo (600, 200, 800, NULL);`

(f) `INSERT INTO Foo (2, 2, 300, 200);`

3. Use the following tables and example data in the questions below.

```
CREATE TABLE Person (  
    Id INT PRIMARY KEY,  
    Name VARCHAR(255) NOT NULL,  
    BirthDate DATE,  
    Age INT  
);
```

Id	Name	BirthDate	Age
1	John Audubon	1785-04-26	65
42	Marie Winn	NULL	NULL
23	Hong-gu Won	1888-04-08	82

```
CREATE TABLE Account (  
    Id INT PRIMARY KEY,  
    Type INT NOT NULL,  
    Owner INT  
        REFERENCES Person.Id ,  
    Opened DATE NOT NULL,  
    Balance INT NOT NULL  
);
```

Id	Type	Owner	Opened	Balance
5	0	1	1908-01-26	100
6	1	1	1999-07-03	100
7	2	1	2004-04-08	100
8	2	23	2004-04-08	100
9	0	42	2018-05-08	100

(a) (3 points) Write a query which computes the sum of all of the account balances for each account type.

(b) (3 points) Write a query which will compute, for each person, the sum of their account balances.

(c) (4 points) Write the results of above queries when run on the example data.

(d) (10 points) Write a trigger that will allow the following view to be inserted into.

```
CREATE VIEW AccountDemo AS  
SELECT Person.Id ,  
        Person.FirstName ,  
        Person.LastName ,  
        Person.BirthDate ,  
        Account.Id ,  
        Account.Opened ,  
        Account.Balace  
FROM Person  
JOIN Account  
    ON Person.Id = Account.Id ;  
);
```

4. Use the following tables and example data in the questions below.

```
CREATE TABLE Employee (
    EmplId INT PRIMARY KEY,
    Name INT NOT NULL
);
```

EmplId	Name
1000	Akira Kawaguchi
1001	John Connor
1002	Peter Barnett

```
CREATE TABLE Class (
    Id
    CHAR(11) PRIMARY KEY,
    Section INT NOT NULL,
    Lecturer INT
    REFERENCES Employee.Id,
    Room INT
    REFERENCES Location.Id,
    StartsAt TIME NOT NULL,
    Days CHAR(3)
);
```

Id	Section	Lecturer	Room	StartsAt	Days
'CSC336'	1	1001	4121	17:00	'MW'
'CSC336'	2	1002	4121	17:00	'TR'
'CSC336'	3	NULL	7101	10:00	'MW'
'CSC337'	1	NULL	7101	10:00	'TR'
'CSC338'	1	NULL	4121	17:00	'F'

- (a) (5 points) Write a query which will give each class name and section along with its associated lecturer's EmplId and name. Include classes without lecturers as well as those lecturers who are not assigned to any classes.
- (b) (5 points) Write a query which will give each class name and section along with its associated lecturer's EmplId and name. Include classes without lecturers but *not* lecturer who are not assigned to any classes.
- (c) (5 points) Write a query which will give each class name and section along with its associated lecturer's EmplId and name. Include lecturers who are not assigned to any classes but *not* classes without lecturers.

5. Use the tables and example data in the questions below. (Next to each statement is a number indicating the “step” at which the instruction is executed. If two statements have the same step number, then they are executed simultaneously.)

	A	B	C
S =	1	2	3
	2	3	4
	3	4	5

- (a) (5 points) What does the left transaction output at time 7?

1 SET ISOLATION LEVEL READ UNCOMMITTED;	1 SET ISOLATION LEVEL READ UNCOMMITTED;
2 BEGIN TRANSACTION;	2 BEGIN TRANSACTION;
5 INSERT INTO S VALUES (SELECT MAX(A), MAX(B), MAX(C) FROM S);	3 UPDATE S SET A = 100 WHERE A = 1;
7 SELECT * FROM S;	4 INSERT INTO S VALUES (2, 200, 300);
	6 ROLLBACK;

- (b) (5 points) What does the left transaction output at time 7

1 SET ISOLATION LEVEL READ COMMITTED;	1 SET ISOLATION LEVEL READ UNCOMMITTED;
2 BEGIN TRANSACTION;	2 BEGIN TRANSACTION;
5 INSERT INTO S VALUES (SELECT MAX(A), MAX(B), MAX(C) FROM S);	3 UPDATE S SET A = 100 WHERE A = 1;
7 SELECT * FROM S;	4 INSERT INTO S VALUES (2, 200, 300);
	6 ROLLBACK;

- (c) (5 points) What does the left transaction output at time 7

1 SET ISOLATION LEVEL REPEATABLE READ;	1 SET ISOLATION LEVEL READ UNCOMMITTED;
2 BEGIN TRANSACTION;	2 BEGIN TRANSACTION;
3 SELECT * FROM S;	4 UPDATE S SET A = 100 WHERE A = 1;
6 SELECT * FROM S;	5 COMMIT;
10 SELECT * FROM S;	7 UPDATE S SET A = 200 WHERE A = 100;
	9 COMMIT;

6. (10 points) This question is about how to design databases. Give an ER diagram for a Library's database.

7. (10 points) Convert the ER-diagram to relational database schemas. (Interpret the empty triangles as an 'is-a' relationship.)

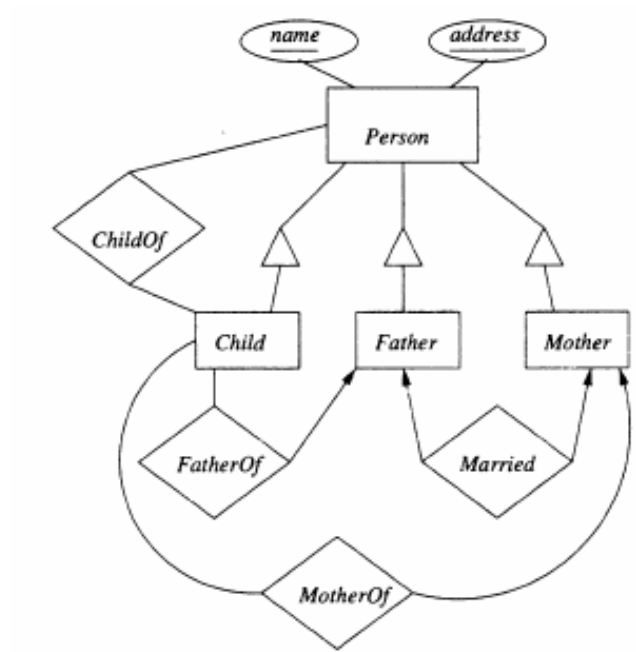


Figure 1: This is Part of Exercise 4.6.2 in the textbook.

8. (10 points) Convert the ER-diagram to relational database schemas.

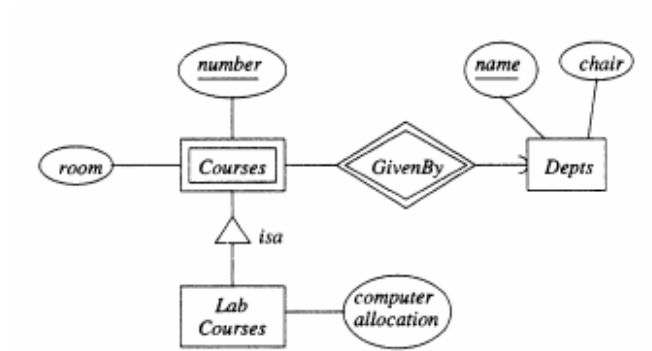


Figure 2: This is Part of Exercise 4.6.1 in the textbook.