First set of Mandatory Exercises in INF3100 Spring 2008

All students are to submit an individual assignment. If two students still want to submit a joint solution, they have to apply *in advance* to the group teacher. Write full name and user name on the assignment.

Preparation and submission of the assignment must be done in accordance with the directions in force at the Department of Informatics, see
http://www.ifi.uio.no/studinf/skjemaer/erklaring.pdf (Norwegian)
http://www.ifi.uio.no/studinf/skjemaer/declaration.pdf (English)
Submitting an assignment serves as an acknowledgment on the directions having been read and understood.

Deadline: Friday 14. March, 12:00 o'clock.

The assignment is to be sent as email to the group teacher. A detailed description of what to submit is described in Section «Deliverables».
The deadline is final; no delays will be granted. All exercises must be answered in order to get the assignment approved.

Students that have an approved mandatory exercise and still want to withdraw from the exam, should provide the group teacher with a paper copy and obtain an endorsement. This applies only to students that withdraw from the exam before the 14-day withdrawal limit.

Exercise 1

Below is a conceptual schema for a small relational database used for registering loans from the library in a company to the employees:

```
DEPARTMENT(DeptCode, DeptName, Address)
BORROWER(BorrowNo, Name, DeptCode, Telephone)
BOOK(ISBN, CopyId, Author, Title, PubYear, PurchYear)
LOAN(ISBN, CopyId, TakeOutDate, BorrowNo, ReturnDate)
```

DeptCode is primary key in DEPARTMENT
BorrowNo is primary key in BORROWER
Telephone is key (candidate key) in BORROWER
(ISBN, CopyId) is primary key in BOOK
(ISBN, CopyId, TakeOutDate) is primary key in LOAN
Nilvalues are allowed in ReturnDate in LOAN
DeptCode in BORROWER is foreign key to DEPARTMENT
(ISBN, CopyId) in LOAN is foreign key to BOOK
BorrowNo in LOAN is foreign key to BORROWER

In addition we have two FDs (functional dependencies):
ISBN → (Author, Title, PubYear) in BOOK
(ISBN, BorrowNo, TakeOutDate) → CopyId in LOAN

The database system returns the difference between two dates as the number of days between the dates.

Examples: 18.6.2007 - 8.6.2007 = 10 and 1.1.2008 - 31.12.2007 = 1

The system function `CURRENT_DATE` returns today's date.

1. Which normal form has each of the tables in the schema? State the reason for your answer and describe changes needed in order to make the schema 4NF.

In the rest of this exercise you shall use the original data structure and ignore possible changes made in point 1.

2. Write a relation algebra expression and a SELECT statement that return a list of all loans older than four weeks where the book has not been returned. The list shall contain name and address of the borrowers and author and title of the books. Sort the list according to department address, and for each department, the borrower's name.
3. Write a relation algebra expression and a SELECT statement that find the number of books per author that has been borrowed by (the employees in) each department. Sort the result according to author and department.

Exercise 2

Prove the transitive rule for multivalued dependencies (MVDs):

If $X \twoheadrightarrow Y$ and $Y \twoheadrightarrow Z$, then $X \twoheadrightarrow (Z \setminus Y)$

Hint: Draw a Venn diagram before you start working on this exercise.

Exercise 3

In this exercise, you are to use the 2007 film database described in Filmdatabasen-ORM-UML.pdf[1]. An English summary can be found in Filmdatabase-ORM-UML_eng.pdf[2].

Use SQL towards the film database to answer the following questions:

1. How many cinema films are registered in the database?
2. There are different kinds of film participation. How many persons are there in each participation type?
3. The films are divided into genres. Make a list over all the genres and the percentage of the films in each genre. The list should be sorted descending by percentage. Use two decimals in the percentages.
4. How many distinct directors are there in the database? What percentage of these is female, and male?

[1] http://www.uio.no/studier/emner/matnat/ifi/INF3100/v08/undervisningsmateriale/Filmdatabasen-ORM-UML.pdf

[2] http://www.uio.no/studier/emner/matnat/ifi/INF3100/v08/undervisningsmateriale/Filmdatabase-ORM-UML_eng.pdf

5. List series title, first production year and number of episodes for all TV series that commenced in the first year that the database has registered TV series from (i.e. the very oldest TV series).
6. Find first and last names of all actors and actresses (‘cast’) that have participated in more than 50 films, and whose family name for each of their films was the very first in the alphabet among all actors and actresses in the film.

Deliverables

Email with the solution is to have the following in the subject field:
Subject: Oblig 1 inf3100 (<username student >)

For Exercise 1 and 2 the following is to be delivered:

A document containing the solution. Include a Venn diagram for exercise 2. Format: PDF.

For Exercise 3 the following is to be delivered:

An SQL-file and a result file. The SQL-file should be a text file with the name

```
<username student>_oblig1-3.sql
```

It should be possible to run the file using the `\i` command in psql. The first line in the file should be the same as in the subject field of the email, but in the form of an SQL comment:

```
-- <username student>_oblig1-3.sql
```

All comments in the file should start with a double minus. Alternatively you may use C-style comments:

```
/* multiline comment
 * with nesting: /* nested block comment */
 */
```

Comments regarding the solution in general should be put first in the file (after the first line).

The results from a run of this SQL file is also to be delivered. The result file should be a text file named

```
<username student>_oblig1-3.res
```

The first line in this file is to be identical to the first line in the SQL file.

End of mandatory exercise set 1