

**University of Helsinki, Department of Computer Science
Introduction to Databases, 12.12.2007, H. Laine**

A brief SQL-syntax diagram should be included

You should submit TWO answer papers, one for tasks 1 and 2 and the other for tasks 3 and 4. Please, write the name of the course, your name clearly, your date of birth or your student number, and your signature on both answer papers.

1. (ANSWER PAPER 1)

In the following schemas $X \rightarrow Y$ indicates that attribute X is a foreign key that refers to relation Y. $(X,Z) \rightarrow Y$ indicates that both X and Z constitute the foreign key.

- Explain briefly (one statement) the concept *domain* in the relational model.
- Consider the relations $H(\underline{K}, \underline{E}, N, T)$ and $V(\underline{N}, O, P)$. Foreign keys are not shown. Is it possible that attribute P is a foreign key that refers to relation H? Justify your answer briefly.
- Consider the relations $R(\underline{K}, A, B, C)$ and $S(\underline{K} \rightarrow R, \underline{E}, N, T)$. Relation R has 100 tuples and relation S has 2000 tuples. The relations are joined on condition $R.K=S.K$. How many tuples there are in the result?
- On what conditions is the union of R and S (of case c) possible?
- Consider the relation S of case c. Which has more rows $\pi_K(S)$ or $\pi_{K,E}(S)$? Justify your answer briefly.
- Tuples with K value 205 are deleted from relation S (of case c). What should be done to relation R?

(12p)

2. (ANSWER PAPER 1)

Consider the following pawn shop database:

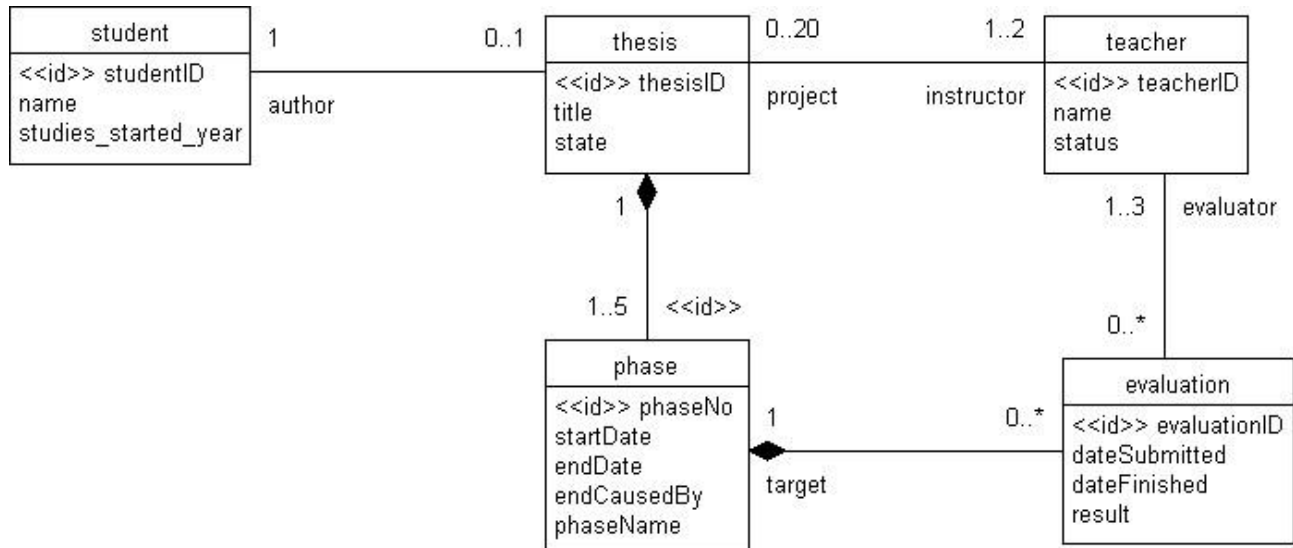
```
customer(personalID, name, address, city, phone)
officer(officerID, name, jobtitle, phone, email)
loan(loanNo, amount, customer->customer, dateAdmitted, whoAdmitted->officer)
pawn(receiptNo, type, description, age, value, loanNo->loan,
    evaluator->officer)
instalment(loanNo->loan, instalmentNo, dueDate, amount)
```

- List in alphabetic order by name the names and addresses of customers that live in Espoo.
- Find out the number and total amount of loans admitted in November 2007.
- Remove from the database data about customers that have no loans..
- Find out the number of the loan, name of the customer, money amount loaned, the number of instalments, the total money amount of instalments, and the due date of the last instalment for the loans that have been admitted in November 2007 and have more than 3 instalments.

(12p).

Turn the paper for tasks 3 and 4 and give their answer on a separate paper.

3. (ANSWER PAPER 2) The following conceptual schema describes the information in the management of master's theses.



Which of the following claims do not conflict with the schema above?

- a) every phase of a thesis is evaluated
- b) a teacher can instruct at most 2 theses
- c) every thesis must have an instructor
- d) the instructor of a thesis must also act as its evaluator
- e) a thesis may not have more than 15 evaluators within its life cycle
- e) a phase number is enough to identify a phase

f) Construct a relational database schema based on the above diagram. Use the notation of task 2 to represent the schema. (6+6p)

4. (ANSWER PAPER 2) A fishing club arranges about 10 fishing contests in a year. They have designed the following database table to register contest results:

```

catch (contest_ID, contest_location, contest_date, fisherman_ID,
       fisherman_name, fish_species, fisherman_yearofbirth,
       catch_weight, number_of_fishes_in_catch,
       ranking_in_contest)
  
```

- a) What would the functional dependency $contest_ID \twoheadrightarrow fisherman_ID$ mean in practice?
- b) Which columns of this table depend functionally on the column $fisherman_ID$?
- c) How is the rule 'a fisherman may attend only one contest on the same day' expressed as a functional dependency? (9p)

Turn for tasks 1 and 2 and give their answer on a separate paper.