Data Modeling and Normalization
Exercise taken from TOD122 exam spring 2010

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HVL

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The data

- Åse Åsen (Student ID: XY97235), female, born in 1990, Norwegian, National ID (Fødselsnummer): 230790 35432, Room: E815, Room phone: 35 98 23 75

- Ola Lien (Student ID: XZ45535), male, born in 1987, Finnish, National ID: 150287 03225, Room: A153, Room phone: 35 98 12 35

- Jacob R. Smith (Student ID: TT98762), male, born in 1992, National ID: 211292 02212, Room: A122, Room phone: 35 98 12 29

- Patterson, Jane K (Student ID: XQ82319), female, born in 1979, National ID: 191179 01231, Room: C632, Room phone: 35 98 21 11

- Brown, Richard E (Student ID: TZ18201), male, born in 1987, British, National ID: 300787 18979, Room: B332, Room phone: 35 98 19 19

The queries

The following queries will be carried out on the data:

1. Find out the average ages of all female tenants from the same country. Namely, find out the average ages of female tenants grouped by nationalities.

2. Search for the full names and room phone numbers of all tenants whose surnames are "Lien", ordered by first names lexicographically.

Data sample

Åse Åsen (Student ID: XY97235), female, born in 1990, Norwegian, National ID (Fødselsnummer): 230790 35432, Room: E815, Room phone: 35 98 23 75

▶ See the exam for the complete exercise.

▶ We will here only focus on the design of the database.

▶ Will make a 3NF logical database model suited for the given queries.

First attempt (solution of most candidates)

national_id	first_name	last_name	gender	nationality

Table: Entity **Person**

student_id	national_id (FK)	room_number (FK)

Table: Entity **Student**

room_number	phone_number

Table: Entity **Room**

► The queries:
  1. Required attributes: *national_id*, *nationality* and *gender*.
  2. Required attributes: *first_name*, *last_name* and *phone_number*.

▶ The attributes of entity **Student** could have been put into **Person**.

▶ Is the model good?

▶ It is 3NF, but:
  - It is not good for the queries!

▶ The problem:
  - The model give unneccesary joins (more on this later).
  - Query 2 requires a join between all the entities.
  - Performance may suffer!

A solution?

Question

Can we make a 3NF model where all attributes required by any of the queries belong to one entity?

national_id	student_id (CK)	first_name	last_name	gender	nationality	phone_number (FK)

Table: Entity **Student**

phone_number	room_number

Table: Entity **Room**

The queries:

1. Required attributes: *national_id*, *nationality* and *gender*.
2. Required attributes: *first_name*, *last_name* and *phone_number*.