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Datenbanksysteme · Prof. Dr. Grust

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Datenbanksysteme I

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Assignment #12

Submission Deadline: January 28, 2020 - 10:00

Exercise 1: ER → SQL (10 Points)

Recall the hospital ER in assignment #10. We provided you with a possible ER diagram in Figure 1 created from the information given. Translate the ER diagram in Figure 1 into a SQL database schema. Make use of the translation rules presented in the lectures.

Note: Translate relationship cardinalities as faithfully as relational constraints permit. In this exercise disregard EER inheritance.

Exercise 2: SQL → ER (10 Points)

The SQL DDL commands listed in Figure 2 were generated from an EER diagram by applying the mapping steps discussed in the lectures (slides 20 - 32, slide set 11 "The Entity-Relationship Model").

Please restore the EER diagram the mapping steps were applied on. Make sure to model **all** entity types, relationship types, attributes and do not forget to underline key attributes.

Exercise 3: Relational Algebra (10 Points)

Consider the following relations containing airline flight information:

Aircraft(*aid*, *name*, *manufacturer*, *cruisingrange*)
Pilots(*pid*, *name*, *salary*)
Certified(*pid*, *aid*)
Flights(*flno*, *from*, *to*, *distance*, *departs*, *arrives*)

The *cruiserange* describes the maximum distance an aircraft is able to travel airborne before having to land. The *distance* is the total distance required to complete a flight from source to destination. Formulate the following queries in relational algebra:

1. Find the *flno* and the origin of all flights *to* 'Berlin'.

   `result(flno, origin)`

2. Find the *aid* of all aircraft which can be used on non-stop flights *from* 'Bonn' *to* 'Madras'.

   `result(aid)`

3. Find the *pid* and *name* of all pilots certified for some 'Boeing' aircraft.

   `result(pid, name)`

4. Find the name of all cities that lie on a round trip flight route with exactly three flights.
   Note: Departure and arrival times do *not* have to be considered here.

   `result(from)`

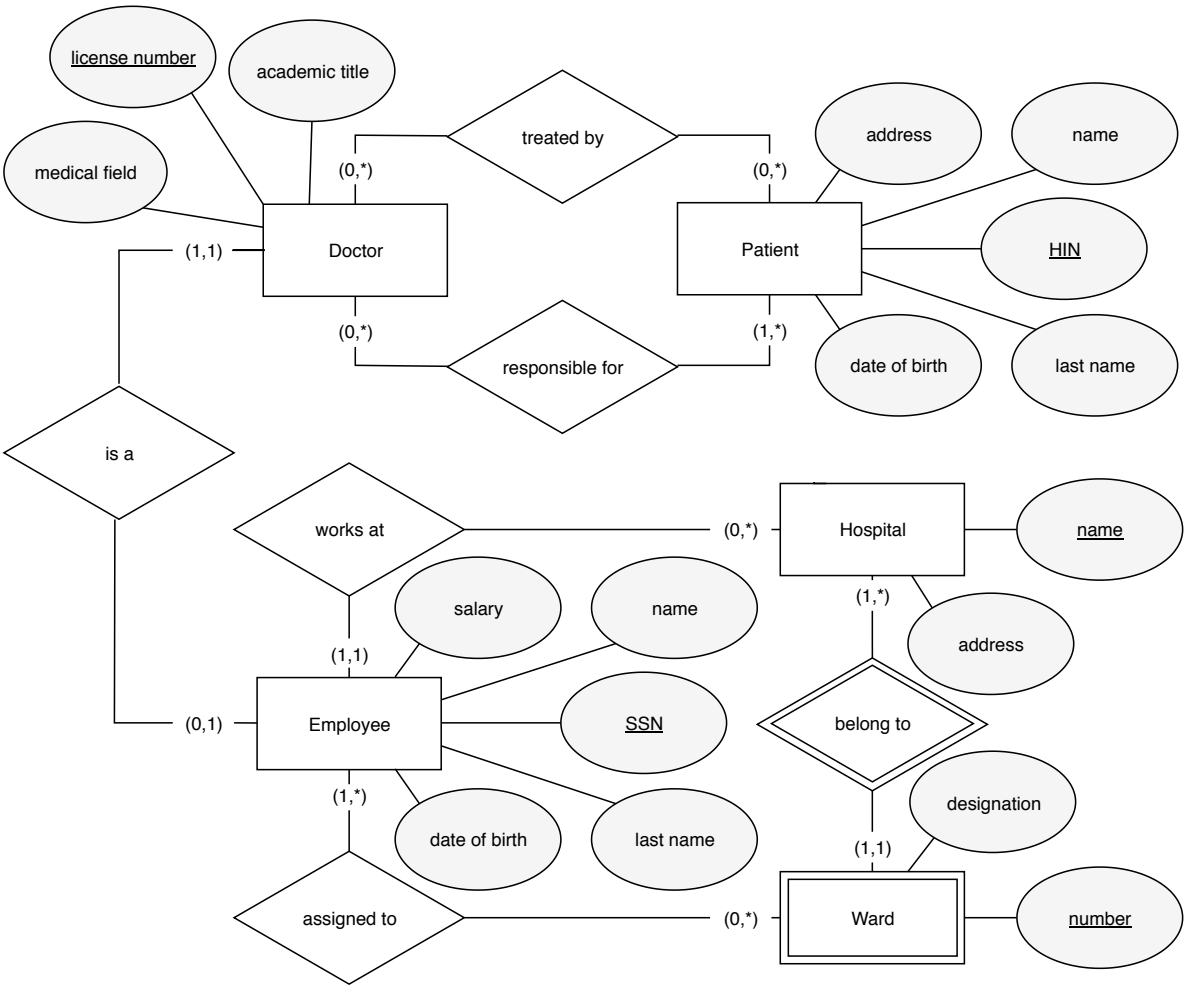

Figure 1: ER of the hospital description of assignment #10

```
CREATE TABLE countries (
    code        VARCHAR(2),
    name        VARCHAR(50),
    population  int
);
ALTER TABLE countries ADD PRIMARY KEY (code);

CREATE TABLE cities (
    name VARCHAR(50),
    lat   float,
    lon   float
);
ALTER TABLE cities ADD COLUMN code VARCHAR(2);
ALTER TABLE cities ADD COLUMN __id__ integer GENERATED ALWAYS AS IDENTITY;
ALTER TABLE cities ADD PRIMARY KEY (code, __id__);
ALTER TABLE cities ADD FOREIGN KEY (code)
    REFERENCES countries(code) ON DELETE CASCADE;

ALTER TABLE countries ADD COLUMN __id__ int;
ALTER TABLE countries ADD FOREIGN KEY (code, __id__)
    REFERENCES cities(code, __id__);

CREATE TABLE languages (
    language VARCHAR(50)
);
ALTER TABLE languages ADD PRIMARY KEY (language);

CREATE TABLE speaks (
    code        VARCHAR(2),
    language    VARCHAR(50),
    percent     DECIMAL(5, 2)
);
ALTER TABLE speaks ADD PRIMARY KEY (code, language);
ALTER TABLE speaks ADD FOREIGN KEY (code)
    REFERENCES countries(code) ON DELETE CASCADE;
ALTER TABLE speaks ADD FOREIGN KEY (language)
    REFERENCES languages(language) ON DELETE CASCADE;
```

Figure 2: Schema translated from an ER diagram