# Exercise Sheet 7: Relational Calculus

(until Thursday 06.12.2012)

Please note that you need **50%** of all exercise points to receive the "Studienleistung". Exercises have to be turned in until **Thursday** of each respective week and must be completed in teams of two students each. You may hand in your solutions either on paper **before the lecture** or into the mailbox at the IFIS floor (Informatikzentrum 2nd floor). Please do not forget to write your "Matrikelnummer" and your tutorial group number on your solutions. Your solutions may be in German or English. Please note: To pass the "RDB 1 Modul" you need both the exercise points and the exam!

Exercise 7.1 (12 points)

Following conceptual schema describes a simple movie database.
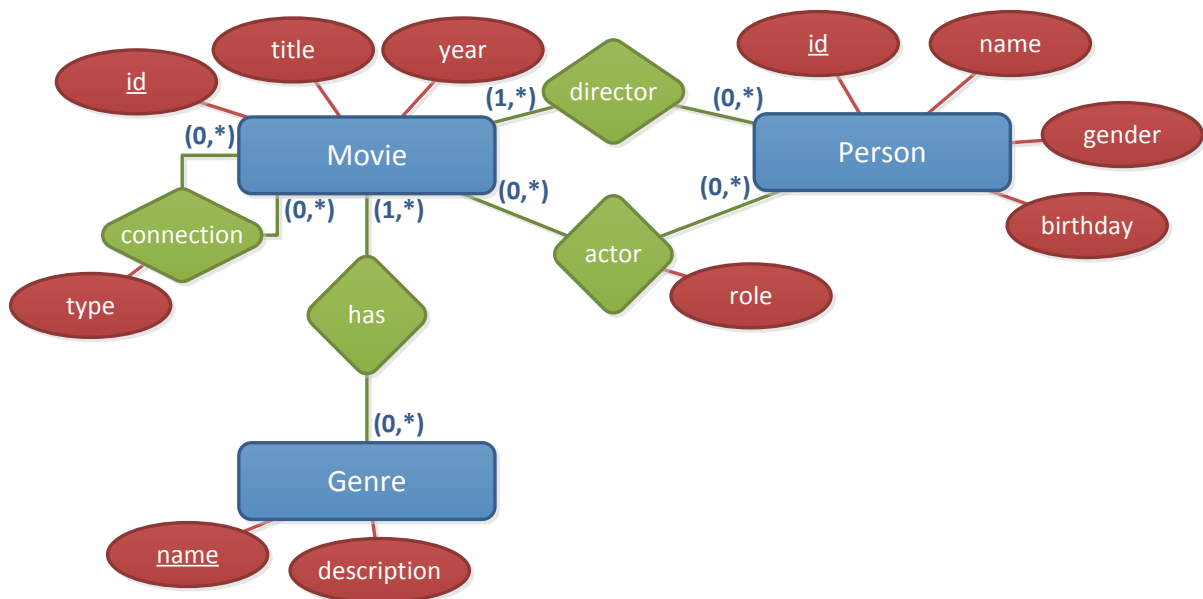
The schema describes movie data, including the movie's title and the production year. Also actors and directors are described, by introducing the relationship types "actor" and "director", which connects persons with movies. The actor relationship type also includes the role played by the person in the respective movie. As neither persons nor movies can be uniquely identified by a set of their "natural" attributes, an id was introduced. Persons are further described by their name, gender and birthday. Movies can also be connected to each other. For example one movie can be a "parody" or "sequel" to another movie. In that case the attribute "type" of the relationship type "connection" would yield the value "sequel" or "parody". A movie can also have several genres, which are further described by a description attribute.

With respect to the given conceptual schema the following relation schema was derived:

    Movie(id, title, year)
    Person(id, name, gender, birthday)
    Genre(name, description)
    actor(person → Person, movie → Movie, role)
    director(person → Person, movie → Movie)
    hasGenre(movie → Movie, genre → Genre)
    connection(from → Movie, to → Movie, type)

Based on this relation schema, please provide statements returning following results in relational algebra, tuple relational calculus and domain relational calculus:

a. The title of all movies that have been created before 1970. (3 points)
b. The name of all persons who participated in an "action" movie. (3 points)
c. The name of all persons who only played in the movie "The mighty Oracle" but apart from that in no other movie. (6 points)

Exercise 7.2 (7 points)

Express following statements in **natural** language:

a. { per | ∃mov, year ((3 points)
        Movie(mov, "The Power of Projection", year) ∧
        actor(per, mov, "forest ranger")
)} \ { per | ∃mov, r(actor(per, mov, r) ∧ hasGenre(mov, "comedy"))}

b. {p.name | Person(p) ∧ ∀a((4 points)
        (actor(a) ∧ a.person=p.id) → (
                ∃hg(hasGenre(hg) ∧ a.movie=hg.movie ∧ hg.genre="drama")
)
)}

    Hint: "→" stands for "implies": a → b = ¬a ∨ b

Exercise 7.3 (4 points)

Briefly explain in your own words:

a. What are unsafe queries and how can you avoid them? (2 points)
b. What is relational completeness? (1 point)
c. What is the difference between a formula and an atom? (1 point)