

# Assignment 1

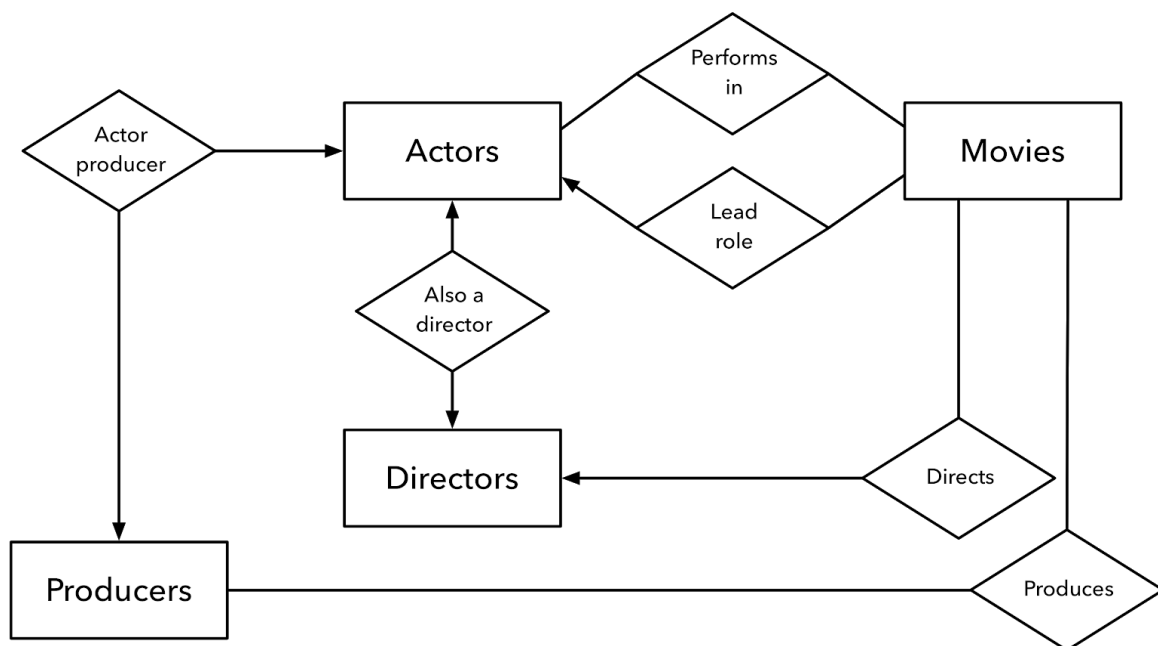
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You are free to make additional assumptions, if you feel that some information is missing. Make sure to document all assumptions that you make. **Please justify each answer!**

All answers should be your own. You are allowed to work in groups of two. Make sure you include your names in the report when you submit.

## Tasks

### 1. MoviesDB



Assume that *MoviesDB* is a populated database. Given the constraints shown in the E/R diagram, respond to the following statements with True, False, or Maybe. Assign a response of Maybe to statements that, although not explicitly shown to be True, cannot be proven False based on the schema as shown.

1. There are no actors in this database that have been in no movies.
2. There are some actors who have acted in more than ten movies.
3. Some actors have done a lead role in multiple movies.
4. A movie can have only a maximum of two lead actors.

5. Every director has been an actor in some movie.
6. No producer has ever been an actor.
7. A producer cannot be an actor in some other movie.
8. There are movies with more than a dozen actors.
9. Some producers have been a director as well.
10. Most movies have one director and one producer.
11. Some movies have one director but several producers.
12. There are some actors who have done a lead role, directed a movie, and produced a movie.
13. No movie has a director who also acted in that movie.

## 2. Births

Consider a model where an entity set *Births* is related to *Babies*, *Mothers*, *Doctors*, and *Nurses* by four binary relationships. How can you use multiplicity to represent the following conditions?

1. Every baby is the result of a unique birth, and every birth is of a unique baby.
2. In addition to (1), every baby has a unique mother.
3. In addition to (1) and (2), for every birth there is a unique doctor.

In each case, what design flaws do you see?

Suppose we change our viewpoint to allow a birth to involve more than one baby born to one mother. How would you represent the fact that every baby still has a unique mother?

## 3. The registrar's office

A university registrar's office maintains data about the following entities: (a) courses, include number, title, credits, syllabus, and prerequisites; (b) course offerings, include course number, year, semester, section number, instructor(s), timings, and classroom; (c) students, including student-id, name, and program; and (d) instructors, including identification number, name, department, and title. Further, the enrollment of students in courses and grades awarded to students in each course they are enrolled for must be appropriately modeled.

Construct an E/R diagram for the registrar's office.

#### 4. Classroom scheduling

Consider a university database for the scheduling of classrooms for the final exams. This database could be modeled as a single entity set *exam* with attributes *course\_name*, *section\_number*, *room\_number*, and *time*. Alternatively, one or more additional entity sets could be defined, along with relationship sets to replace some of the attributes of the *exam* entity set, as:

- *course* with attributes *name*, *department*, and *c\_number*
- *section* with attributes *s\_number* and *enrollment*, and dependent as a weak entity set on *course*.
- *room* with attributes *r\_number*, *capacity*, and *building*

Show an E/R diagram illustrating the use of all three additional entity sets listed.

Explain what application characteristics would influence a decision to include or not include each of the additional entity sets.

*Note:* A section is a part of course. How sections are used varies from university to university, but they could for example be used to separate multiple versions of the course (imaging that a course has so many students that there has to be parallel lectures) or if a course is given multiple times per year.

#### 5. Relational algebra

Write the following queries in the relational algebra using relational schema:

student(id, name)

enrolledIn(id, code)

subject(code, lecturer)

1. What are the names of students enrolled in 2dv513?
2. What are the names of students in both 1dv513 and 2dv513?
3. Who teaches 2dv610?
4. Who teaches 1dv513 and 2dv513?
5. What are the names of students who are taking a subject not taught by Ilir?

## 6. FDs and Normalization

Several managers perform interviews with job applicants (one applicant is interviewed by one manager). The manager makes appointments for interviews with the applicants. Each applicant may be interviewed at several occasions, possibly by different managers, but in that case the interviews take place during different days. Each manager uses the same room for all interviews during a day. A room may, however, be used by different managers during a day, as long as the interviews are not at the same time. The system use a single relation for all data, with the following schema:

Interviews(manager, applicant, day, time, room).

1. Find functional dependencies.
2. Find the keys of the relation.
3. Show that the relation is in 3NF but not in BCNF.
4. Decompose the relation in relations that are in BCNF.
5. Draw an E/R diagram that describes the system. Try to incorporate all dependencies.

## Submission and deadlines

Your submission should include solutions to all assignments above.

Submit a report in PDF format on Moodle. You can draw the E/R diagrams by hand and submit scanned versions or photos (as long as they are readable).

**Deadline:** End of day 2021-02-10.

**IMPORTANT:** In case you have a question, try to find the answer in the assignment forum. If the answer/question is not there, ask your question in the forum first instead of writing a direct email to the contact person. This will be the fastest way to get a reply.