Exercise 3.1.

Study the database schema containing the relations:

FILMS (FilmNumber,Title, Director, Year, ProductionCost)
ARTISTS (ActorNumber, Surname, FirstName, Sex, BirthDate, Nationality)
ROLES (FilmNumber, ActorNumber, Character)

1. Produce a database on this schema for which the joins between the various relation are all complete
2. Assuming two referential constraints between the relation ROLES and the other two, discuss possible cases of incomplete join.
3. Show a cartesian product that involves relations in this database.
4. Show a database for which one (or more) of the joins is (are) empty

Exercise 3.2.

With reference to the schema in Exercise 3.1, express the following queries in relational algebra, in domain calculus, in tuple calculus and in Datalog:

1. The titles of the films starring Henry Fonda;
2. The titles of the films in which the director is also an actor;
3. The actors who have played two characters in the same film; show the title of the films, first name and surname of the actor and the two characters;
4. The titles of the films in which the actors are all of the same sex;.

Exercise 3.3.

Consider the database containing the following relation:

REPRESENTATIVE(Number, Surname, FirstName,Committee,County,Constituency)
CONSTITUENCIES(County,Number, Name)
COUNTIES(Code,Name,Region)
COMMITTEES(Number,Name, President)

Formulate the following queries in relational algebra, in domain calculus and in tuple calculus:

1. find the name and surname of the presidents of the committees in which there is at least one representative from the county of Borsetshire;
2. find the name and surname of the members of the finance committee;
3. find the name, surname and constituency of the members of the finance committee;
4. find the name, surname, county and region of election of the delegates of the finance committee;
5. find the regions in which representatives having the same surname have been elected.

Exercise 3.4.

Show how the formulation of the queries in Exercise 3.3could be facilitated by the definitions of views.

Exercise 3.5

Consider the database schema on the relations:

COURSES(Number, Faculty, CourseTitle,Tutor)
STUDENTS (Number, Surname, FirstName, Faculty)
TUTORS (Number, Surname, FirstName)
EXAMS(Student, Course, Grade, Date)
STUDYPLAN (Student, Course, Year)

Formulate in relational algebra, in domain calculus, in tuple calculus and in Datalog, the queries that
produce:

1. The students who have gained 'A' in at least one exam, showing, for each of them, the first name, surname and the date of the first of such occasions;
2. For every course in the engineering faculty, the students who passed the exam during the last session;
3. The students who passed all the exams required by their respective study plan;
4. For every course in the literature faculty, the student (or students) who passed the exam with the highest grade;
5. The students whose study plan require them to attend lectures only in their own faculty;
6. First name and surname of the students who haven taken an exam with a tutor having the same surname as the students.

Exercise 3.6

With reference to the following database schema:

CITIES(Name, Region, Population)
CROSSING (City, River)
RIVERS (River, Length)

Formulate the following queries in relational algebra, domain calculus, tuple calculus and Datalog:

1. Find the names, regions and population for the cities that (i) have more than 50 thousand in habitants and (ii) are crossed by the Thames or the Mersey
2. Find the cities that are crossed by (at least) two rivers, giving the name of the city and that of the longest of the rivers.