Exercise 1

We want to build a relational database about the domain of universities. In particular, we want to store information about students, professors, courses, exams in four distinct relations. In particular, the relations students and professors store personal data about students and professors (last name, first name, birthdate, city, ID), the relation courses stores information about courses (the course code, the course name, the year in the master program, and the professor) and the relation exams stores information about exams, storing the exam date, the course, the student, and the grade.

1. Write SQL statements that define the schema of the above described database;
2. Write SQL statements that insert at least two tuples in each of the tables defined at the previous point;
3. Write SQL statements that express the following queries:
   (a) return the last name and first name of the professors who teach at least one course;
   (b) return the last name and first name of the students who passed at least one exam;
   (c) return the last name and first name of the students who passed at least three exams;
   (d) return the last name and first name of the students who passed at least two exams with the same professor;
   (e) return the last name and first name of the students who passed at least one exam with a professor from the same city as the student;
   (f) return the last name and first name of the students who passed the Data Management for Data Science exam;
   (g) return the ID of the students who have passed no exam in the last year;
   (h) return the last name and first name of the professors who do not teach any course;
   (i) for every year, return the year and the number of students who were born in that year and live in Rome;
   (j) for every year, return the year and the number of students who were born in that year and passed the maximum number of exams, but only if this number is greater than 2;
   (k) for every student, return the student ID and the number of exams that such a student passed with grade greater than 28.

Exercise 2

1. Define a file organization for the relations of the schema of Exercise 1 such that the execution of the SQL query relative to point (a) of Exercise 1 is optimized;
2. define a file organization for the relations of the schema of Exercise 1 such that the execution of the SQL query relative to point (b) of Exercise 1 is optimized.

Exercise 3

(a) Write an RDF model representing the following statements about URIs Person, Director, Actor, Country, Movie, Comedy, Drama, Horror, Male, Female, filmedIn, isDirectorOf, playsIn, bornIn, Ingrid, Cary, Alfred, Notorious, USA, Brazil, UK.

1. Alfred is the director of Notorious;
2. Ingrid and Cary play in Notorious;
3. Notorious was filmed in the U.S.A. and in Brazil;
4. Alfred was born in the U.K.;
5. Ingrid is female;
6. Cary is male.

(b) Write SPARQL queries corresponding to the following requests: (a) return all the countries where at least one comedy or one horror movie were filmed; (b) return the directors who directed at least one movie that was filmed in U.S.A. or in the UK; (c) return every movie filmed in the U.S.A. and, optionally, the director of the movie and the country where it was filmed.

Exercise 4

Consider the information requested in point 2 of Exercise 1. Express such an information using a graph database (e.g., Neo4J).

Exercise 5

Consider the information requested in point 2 of Exercise 1.

1. Express such an information using the MongoDB data model (JSON);
2. express the queries (a), (b), (c), (d) and (e) at point 3 in Exercise 1 as queries in the MongoDB system.