

Database and Security

Date: 12/02/2020

Test duration: 2 hours

Exercise 1

Provide, by means of an E-R diagram, the conceptual design of the domain described by the following specification. We want to design an application to manage the university courses organized by a university department. For each course, we want to know the name (for instance "Computer Science", "Chemistry", etc.), the number of credits (an integer), the academic year (an integer) in which it is held, and the Professors (at least one) who teach in the course. Note that the number of credits for a course may change depending on the academic year in which the course is held. For each Professor, we want to know the tax code (identifier - a string), the name (a string), the surname (a string), the date of birth (a date), and its role within the Department (e.g., "Researcher", "Associate Professor", "Full Professor", etc.). For each student, we want to know the tax code, the name, the surname, the date of birth, the address (a string) and her/his registration number (identifier - a string). The system also keeps records of the university staff (Ph.D. students, research fellows, etc.) who could, in the future, become a professor. Of these persons, we want to know the tax code (identifier), name, surname, and date of birth. For each course, a certain number of exams (at least one) are organized every academic year. An exam has a date and is identified by its course and its date. Each student can take each exam at most once, and we want to know the mark obtained (from 0 to 30 with honors).

Exercise 2

Provide the logical design of the E-R diagram provided in **Exercise 1** by using solutions that minimize NULL values. Motivate, if needed, the choices you made.

Exercise 3

Consider the following relational schema:

STUDENT(SSN, Name, Surname, Age)

COURSE(CODE, CName, Credits)

ENROLLMENT(Student, Course, Year)

foreign key: ENROLLMENT(Student) \subseteq STUDENT(SSN)

foreign key: ENROLLMENT(Course) \subseteq COURSE(CODE)

- 1) Write a **relational algebra query** that returns the Name and Surname of the students who are enrolled in a course for the *first time* in 2019.
- 2) Write an **SQL query** that returns for each course and year the average age of the enrolled students.

Exercise 4

List and describe four (of the seven) key principles of the GDPR.