Database and Security

Date: 15/01/2020 **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 a smartphone sales management application for a distribution company. A smartphone is characterized by an IMEI (International Mobile station Equipment Identity) code that identifies it, a color (a string), and a model. Each model is characterized by a name (a string) that is unique within the company that produces it, by the size of the screen (an integer) and by the amount of RAM (an integer). Each company is characterized by a name (a string) that identifies it and a year of foundation (an integer). Some smartphones are offered for sale in a store at a certain price (a number). Each store is characterized by a name (a string) and an address (a string). Some stores are Department stores and of these, we additionally want to know the name of the manager (a string), other stores are Supermarkets, of these we want to know the name of the city in which they are located in (a string). Of course, a Supermarket is not a Department store and vice versa.

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:

EMPLOYEE(SSN, Name, Surname, City)
DEPARTMENT(ID, DName, Director, Address)
foreign key: DEPARTMENT(Director) ⊆ EMPLOYEE(SSN)
AFFILIATION(Employee, Department, Year)
foreign key: AFFILIATION(Employee) ⊆ EMPLOYEE(SSN)
foreign key: AFFILIATION(Department) ⊆ DEPARTMENT(ID)

1) Write a **relational algebra query** that returns the Name and Surname of the employees who are directors of at least one department but who are not affiliated with any department.
2) Write an **SQL query** that returns the number of cities where at least one department director lives.

Exercise 4

Describe the JOIN relational operator and its variants.