SD202 Exam

06 November 2020

Grades : **I** (10 points), **II** (10 points)
Recommandation : prefer simple solutions and brief answers.
You can answer in *English* or *French*.
Course materials (on papers **ONLY**) are authorized.

Part I : Functional Dependencies and Normalization

Exercise I.1 :

R1

A	B	C
1	4	10
1	5	20
2	6	10
3	6	10
2	4	10

1. Given the instance from the relation of three attributes **R1(A,B,C)** above. Which of the following functional dependencies (FDs) hold on this instance:
   a) $A \rightarrow B$
   b) $C \rightarrow A$
   c) $B \rightarrow C$
   d) $AB \rightarrow C$
   e) $BC \rightarrow A$

2. Consider a relation **R2(A,B,C,D)** with the following FDs:
   $AB \rightarrow C$; $AB \rightarrow D$; $C \rightarrow A$; $D \rightarrow B$
   a) List all the candidate keys for **R2**.
   b) Is **R2** in 3NF? Justify
   c) Is **R2** in BCNF? Justify

Exercise I.2 :

Consider a relation **R3** with schema **R3(A, B, C, D, E)** and FDs:

$A \rightarrow B$; $B \rightarrow DE$; $C \rightarrow E$

1. Decompose the relation **R3** using the BCNF decomposition algorithm. Give a short justification for each new relation.

Part II : SQL
Exercise II.1 :

Suppose that we have a booking agency, to make hotel reservations for clients, that uses a database whose schema is as follows (the primary keys of the relations are underlined):

Hotel *(hotelNo, name, city)*
Guest *(guestNo, name, address)*
Room *(roomNo, hotelNo, type, price)*
Booking *(hotelNo, guestNo, dateFrom, dateTo, roomNo)*

Notes:

- In the **Room** table, *hotelNo* is a foreign key which refers to the primary key of the Hotel table. *Type* of room is a one-character that refers to single (S), double (D), or family (F). *Price* (in €) refers to the price of the room per night.
- In the **Booking** table, *dateFrom* and *dateTo* denote the arriving and leaving dates, respectively.
- The dates are in the form *MM-DD-YYYY*.

You are asked to provide the following information. Write the corresponding queries in SQL:

1. What is the average price of a room?
2. List all double ('D') or family rooms ('F') with a price below 80€ per night, in ascending order of price.
3. List the number of rooms in each hotel in Paris and Bordeaux.
4. How many different guests have made bookings for August 2020. *Hint: use dateFrom and dateTo.*
5. List the number of hotels with more than 100 rooms and located in Paris.
6. List the hotel names and room numbers of any hotel rooms that have not been booked.
7. List the hotel name and city of the hotel with the highest priced room.
8. List hotel names, room numbers, city, and prices for hotels that have rooms with prices lower than the lowest priced room in the 'Paris hotel'.