

Concordia University  
Dept. of Computer Science & Software Engineering  
**Comp 353- Databases**  
**Winter 2023**

## **Main Project**

**Title: A Simple database Application System for the health facilities**

**Reports Due: Tuesday April 11<sup>th</sup>, 2023 before 12:00 noon.**

**Demos: on April 12<sup>th</sup>, and 13<sup>th</sup>.**

**Maximum Mark: 12%**

### **Project Description**

This system builds on and extends the application developed in the warm-up project. It adds some new functionalities and requires a Graphical User Interface to facilitate user interaction with the system.

In the main project, you develop a database system, called Health Facility Employee Status Tracking System (HFESTS). The HFESTS system help health care facilities to keep track of their employees' health status during the COVID-19 pandemic. The system should maintain all the information about the employees of the facilities that are related to the pandemic. Information includes infection(s) of every employee, date of infection and nature of infection. Also, information about the vaccination of every employee including for every vaccination, the vaccination date, the type of vaccination, and the dose number of the vaccination. Also, the schedule of work of every employee is maintained by the system. The information maintained by the system is used to help the facilities to keep track of their employees' health status to reduce the risk of contamination between the employees of the facilities.

A facility could be a hospital, a CLSC, a clinic, a pharmacy, or a special installment. Each facility could include name, address, city, province, postal-code, phone number, web address, type (Hospital, CLSC, clinic, pharmacy, or special installment), capacity (Maximum number of employees that the facility needs to operate. At any moment in time, a facility cannot have employees working at the facility that exceeds the capacity. A new employee cannot be assigned to a facility if the current total number of employees currently working for the facility is equal to the capacity of the facility). A facility have one general manager.

The application must maintain information about every employee working in each facility. The information includes first-name, last-name, date of birth, Medicare card number, telephone-number, address, city, province, postal-code, citizenship, and email address.

Every employee must be registered with the public health care system which means that the Medicare card number cannot have null value. No two employees can have the same

Medicare card number. The role of every employee must be maintained by the system. The role could be either a nurse, a doctor, a cashier, a pharmacist, a receptionist, an administrative personnel, a security personnel, or a regular employee (include all other tasks). A general manager is considered to be an administrative personnel.

An employee can work at many facilities at the same time. For every employee, the start date and end date working at each facility must be maintained. If the end date is null, it indicates that the employee is still working at the facility. An employee can work at the same facility at different interval of times. For example, Roger Smith who is a doctor could have worked at Hospital Maisonneuve Rosemont from Jan 15<sup>th</sup>, 2022, to June 30<sup>th</sup> 2022, then worked at Hospital Maisonneuve Rosemont from Jan 7<sup>th</sup> 2023 to now.

The application must maintain information on whether the employee has been vaccinated or not. For each vaccination the employee had, the system must maintain information about the type of Vaccination is given and the dose number as well with the date and the facility location of each dose given. The type of vaccinations could be Pfizer, Moderna, AstraZeneca, Johnson & Johnson, etc. Also, the dose number could be 1, 2, or more. For example: Alfred McDonald could have taken the first vaccination dose Pfizer on the 20<sup>th</sup> of January 2021 at CLSC Montréal South, and the second vaccination dose Moderna on the 25<sup>th</sup> of April 2022 at Olympic Stadium Montréal.

Also, the application must maintain information on whether the employee has been infected or not, and if yes, what was the infection name and type, and on which date(s). The infection type could be COVID-19, SARS-Cov-2 Variant, or could be other types.

The schedule of every employee at each facility is maintained by the system. For every facility, and for every employee working in the facility, the schedule includes the date, the start time, and the end. Start time cannot be greater than the end time. An employee cannot be scheduled at two different conflicting times neither at the same facility nor at different facilities. If an employee is scheduled for two different periods on the same day either at the same facility or at different facilities, then at least on hour should be the duration between the first schedule and the second one. The history of the schedules is maintained by the system. A schedule of four weeks ahead of time is supported by the system. If a nurse or a doctor is infected by COVID-19, then he/she cannot be scheduled to work for at least two weeks from the date of infection. An employee cannot be scheduled if she/he is not vaccinated, at least one vaccine for COVID-19 in the past six months prior to the date of the new schedule.

If a doctor or a nurse gets infected by COVID-19, then the system should automatically cancel all the assignments for the infected employee for two weeks from the date of infection. Also, the system should send an email to inform/track all the doctors and nurses who have been in contact by having the same schedule as the infected employee. Each email should have as a subject "Warning" and as a body "One of your colleagues that you have worked with in the past two weeks have been infected with COVID-19".

On Sunday of every week, for every employee working in every facility, the system should automatically send an email to every employee indicating the schedule of the employee in the facility for the coming week. The subject of the email should include the facility name, and the dates covered by the schedule. A subject example: “CLSC Outremont Schedule for Monday 20-Feb-2023 to Sunday 26-Feb-2023”. The email body should include the facility name, the address of the facility, the employee’s first-name, last-name, email address, and details of the schedule for the coming week. Details include day of the week, start time and end time. The body of the message should also include an entry for every day of the week followed by the starting hour and end hour for that day. A message “No Assignment” is displayed if the employee is not scheduled for that specific entry.

A log table is stored in the database that contains information of every email generated by the system. The log includes date of the email, the sender of the email (name of the facility), the receiver of the email, the subject of the email, and the first 80 characters of the body of the email.

### **What you should do:**

In the above, we provided the minimum requirements for this application. You could add more details if you find suitable and useful. Considering the information so far, do the following steps in your database design process:

1. Develop an E/R diagram to represent the conceptual database design for the above application.
2. In the diagram, mark or express various constraints (keys, functional dependencies, cardinalities of the relationships, etc.) Identify any constraints that are not captured by the E/R diagram.
3. Convert your E/R diagram into a relational database schema. Make refinements to the DB schema if necessary. Identify various integrity constraints such as primary keys, foreign keys, functional dependencies, and referential constraints. Make sure that your database schema is at least in 3NF.
4. Is all your relations in the database in BCNF? (Explain which ones and why not)
5. For any relation in your database, if it is not in BCNF, then show that it is in 3NF.
6. Create at least one trigger to execute some of the requirements specified in the description above.

Formulate and evaluate the following SQL DDL and DML commands against your database in which every relation is populated with 'sufficient' representative tuples.

1. Create/Delete/Edit/Display a Facility.
2. Create/Delete/Edit/Display a Employee.
3. Create/Delete/Edit/Display a Vaccination.
4. Create/Delete/Edit/Display an Infection.
5. Assign/Delete/Edit schedule for an Employee. (Attempt to schedule a conflicting assignment for an employee)
6. Get details of all the facilities in the system. Details include facility's name, address, city, province, postal-code, phone number, web address, type, capacity, general manager's name and number of employees currently working for the facility. Results should be displayed sorted in ascending order by province, then by city, then by type, then by number of employees currently working for the facility.
7. Get details of all the employees currently working in a specific facility. Details include employee's first-name, last-name, start date of work, date of birth, Medicare card number, telephone-number, address, city, province, postal-code, citizenship, and email address. Results should be displayed sorted in ascending order by role, then by first name, then by last name.
8. For a given employee, get the details of all the schedules she/he has been scheduled during a specific period of time. Details include facility name, day of the year, start time and end time. Results should be displayed sorted in ascending order by facility name, then by day of the year, then by start time.
9. Get details of all the doctors who have been infected by COVID-19 in the past two weeks. Details include doctor's first-name, last-name, date of infection, and the name of the facility that the doctor is currently working for. Results should be displayed sorted in ascending order by the facility name, then by the first-name of the doctor.
10. List the emails generated by a given facility. The results should be displayed in ascending order by the date of the emails.
11. For a given facility, generate a list of all the doctors and nurses who have been on schedule to work in the last two weeks. The list should include first-name, last-name, and role. Results should be displayed in ascending order by role, then by first name.
12. For a given facility, give the total hours scheduled for every role during a specific period. Results should be displayed in ascending order by role.
13. For every facility, provide the province where the facility is located, the facility name, the capacity of the facility, and the total number of employees in the facility who have been infected by COVID-19 in the past two weeks. The results should be displayed in ascending order by province, then by the total number of employees infected.

14. For every doctor who is currently working in the province of “Québec”, provide the doctor’s first-name, last-name, the city of residence of the doctor, and the total number of facilities the doctor is currently working for. Results should be displayed in ascending order by city, then in descending order by total number of facilities.
15. Get details of the nurse(s) who is/are currently working and has the highest number of hours scheduled in the system since they started working as a nurse. Details include first-name, last-name, first day of work as a nurse, date of birth, email address, and total number of hours scheduled.
16. Get details of the nurse(s) or the doctor(s) who are currently working and has been infected by COVID-19 at least three times. Details include first-name, last-name, first day of work as a nurse or as a doctor, role (nurse/doctor), date of birth, email address, and total number of hours scheduled. Results should be displayed sorted in ascending order by role, then by first name, then by last name.
17. Get details of the nurse(s) or doctor(s) who are currently working and has never been infected by COVID-19. Details include first-name, last-name, first day of work as a nurse or as a doctor, role (nurse/doctor), date of birth, email address, and total number of hours scheduled. Results should be displayed sorted in ascending order by role, then by first name, then by last name.
18. You should show the trigger(s) used by your system. Explain the trigger(s) used and their benefits.
19. You need to demonstrate the integrity of all the requirements provided in the description. Example, the system should not allow a user to schedule an employee on two different conflicting time.
20. You need to demonstrate the generation of emails and the logs of the emails produced by the system.

### **What you should submit:**

Your project report should include the E/R diagram, the DB-design, and its normalization (including the analysis of 3NF and BCNF), the SQL declarations of the relations, the implementation code, relation instances, and the SQL scripts for the queries and transactions, and 5 tuples of each query result. Build a useful web interface to facilitate interactions with the database application system. Also include in your report, a few snapshots of the user interface you developed. A schedule of time slots for the demos of your main project will be posted through the course Moodle in April which is assigned on a first come first served basis. All members of your team must be present during your project demo.