Concordia University
Dept. of Computer Science & Software Engineering

Comp 353- Databases
Main Project
Summer 2022

Title: A Simple database Application System for the COVID-19 Non-Profit Health Organization
Reports Due: Monday August 1st, 2022 before 12:00 noon.
Demos: on August 1st, and 2nd.
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 COVID-19 Pandemic Progress System (C19PPS). The C19PPS system help researchers, companies, and world population to keep track of the COVID-19 pandemic progress.

The system divides the world into six regions: Africa, Americas, Eastern Mediterranean, Europe, South-East Asia, and Western Pacific. Each region is composed of a set of countries.

Each country is composed of a set of either provinces, states, or territories. To simplify, we call it ProStaTer to represent any one of these cases, or even if the country has other naming, we still use ProStaTer.

For each ProStaTer, the system maintains information of the total number of populations of the ProStaTer, total number of people died from COVID-19 virus, total number of people who got vaccinated by each type of vaccination, total number of people who got infected by the COVID-19 virus and have never been vaccinated, for each type of vaccines the total number of people who got vaccinated by that type of vaccine and still got infected by COVID-19 virus, and for each type of vaccines the total number of people who got vaccinated by that type of vaccine and died because of the COVID-19 virus.

Type of vaccinations could be Pfizer, Moderna, AstraZeneca, Johnson & Johnson, etc.

People from all over the world can use the system to view information related to the progress of COVID-19 in the world. Users of the system could be either administrators, researchers, organization's delegate, or regular people. Users with administrators' privileges can add/delete/edit any user to the system. Users with researchers's privileges can add/delete/edit articles to the system that other users can see and profit from the

researcher's findings. Users with organization delegate privileges can add/delete/edit articles for their organization to the system. Administrator users have the privilege to remove any article from the system or suspend any account in the system.

Each article in the system is identified by its author, major topic, minor topic, summary, the article itself, and the date of publication of the article. The summary of each article should not exceed one hundred characters. The author could be either a researcher's first name and last name, or the organization's name. Only the author of the article can publish, edit, or remove an article. An organization could be either a company, a research center, or a government agency. Each country has one government agency that uses the system to provide their latest details about the progress of the COVID-19 in the country. Each government agency can add/delete/edit information related to the country alone and not records related to other countries. The historical records of the updates of the progress of COVID-19 are maintained by the system. Each time a new update is provided, the date of the update is recorded with the new record. Administrators, Researchers, and Organization delegates users are special users. All special users of C19PPS are identified by their first name, last name, citizenship, email address, phone number, username, and password. The citizenship value must be a value of a country that already exist in the system. Special users need to have a username and password authentication to access the system and be able to do the appropriate changes to the system based on their privileges. All other users who are nonspecial users can only view information but cannot do any modifications to the system, and these users do not need an account or a username to access the system.

Users can register their usernames with any author they are interested in her/his publications to receive a notification upon adding a new publication. This should be done through a trigger. Upon creation of a new publication, a trigger should be invoked to send an email to all the users that they registered their usernames with the author. The email should include in the subject the author's name and the major topic of the published article, and in the body of the email the summary of the published article. Email should be addressed to the email address stored for the registered username. A log of the emails sent to the users should be added to the system indicating the date and time of the email, the email address of the receiver of the email, the subject of the email, and 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 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 your database in BCNF? (Explain why/why not)

5. If your database is not in BCNF, then show that it is in 3NF.

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 an Administrator.
2. Create/Delete/Edit/Display a Researcher.
3. Create/Delete/Edit/Display an organization or government agency.
4. Create/Delete/Edit/Display an Employee for Organization.
5. Create/Delete/Edit/Display a Country or a Province/State/Territory.
6. Create/Delete/Edit/Display a report by a government agency.
7. Create/Delete/Edit/Display an article by an author.
8. Remove an article by an administrator.
9. Suspend/Activate a user account.
10. Get details of all the users in the system. Details include user role (administrator, researcher, organization's delegate, etc.), username, first name, last name, citizenship, email address, phone number. Results should be displayed sorted in ascending order by user's role, then by user's citizenship.
11. Get a briefing of all the articles in the system. Briefing includes article's author, major topic, minor topic, date of publication, and citizenship of the author. Results should be displayed sorted in ascending order of citizenship then by author then by date of publication. If the author is an organization, then the citizenship refers to the country that the organization belongs to. If the author is an organization, then the organization's name is used for author; otherwise, first name and last name are used for author.

12. Get a briefing of all the removed articles from the system. Briefing includes article's author, major topic, minor topic, date of publication, and citizenship of the author. Results should be displayed sorted in ascending order of citizenship then by date of removal of the article. If the author is an organization, then the citizenship refers to the country that the organization belongs to. If the author is an organization, then the organization's name is used for author; otherwise, first name and last name are used for author.
13. Get a list of all the suspended accounts in the system. List include the user 's role (researcher, organization's delegate, etc.), username, first name, last name, citizenship, email address, phone number, and date of suspension of the account. Results should be displayed sorted in ascending order of suspension date.
14. For a given author, get details of all the articles published by the author. Details include article's publication's date, major topic, minor topic, summary, and the article. Results should be displayed sorted in ascending order of publication date.
15. Get details of all the authors that have published articles in the system. Details include the author, citizenship, and the number of publications published by the author in the system. Results should be displayed sorted in decreasing order of the number of publications that the author published in the system. If the author is an organization, then the citizenship refers to the country that the organization belongs to. If the author is an organization, then the organization's name is used for author; otherwise, first name and last name are used for author.
16. Get details of the authors and publications in the system. Details include region name, country name, total number of authors in the system, total number of publications in the system. Results should be displayed sorted in ascending order by region, then in decreasing order of the total number of publications.
17. Get details of the progress of the COVID-19 for all the countries in the system. Details include region name, country name, number of populations in the country, number of people who got vaccinated for COVID-19, number of people who died due to COVID-19, number of people who got vaccinated at least one vaccine for COVID-19 and died due to COVID-19. Only the latest statistics provided for each country need to be displayed. Results should be displayed sorted in increasing order of the total number of people who died due to COVID-19.
18. List all the emails that have been sent by the system to the registered users to receive new publications during a specific period of time. List should include the date and time of the email, the email address of the receiver of the email, and the subject of the email. The results should be displayed sorted from the oldest date to the newest date of the generation of the email for the specified period.
19. Get the details of the historical progress of COVID-19 in Canada. Details include date of the report, number of populations in Canada, number of people who got vaccinated for COVID-19 for every vaccine type, number of people

who got infected by COVID-19, and for every vaccine type, the number of people who died due to COVID-19 and have already been vaccinated by the type of vaccine. Results should be displayed sorted in descending order by date of the report.

20. Get the details of the authors that have the highest number of registered users to receive notifications for their new publishing of articles by the author. Details include the author, citizenship, and the number of registered users to receive notifications. If the author is an organization, then the citizenship refers to the country that the organization belongs to. If the author is an organization, then the organization's name is used for author; otherwise, first name and last name are used for author.

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 late July which is assigned on a first come first served basis. All members of your team must be present during your project demo.