

Concordia University
Dept. of Computer Science & Software Engineering
Comp 353 – Databases
Summer 2025
Main Project

Title: A database application system for Montréal Volleyball Club (MVC)

Demos: on August 7 and 8.

Reports: Submission through Moodle is due by August 1, 2025

Maximum Mark: 12%

Project Description

This system builds on and extends the application developed in the warm-up project. It adds new functionalities and also requires development of a Graphical User Interface (GUI) to facilitate interactions of the end-users with the system.

Recalled from the description of the warm-up project that the system helps the Montréal Volleyball Club manage and organize their operations by keeping track of the club members. The MVC is an organization that develops, promotes and enhances volleyball in different areas. It provides services to its members long-term to become professional Volleyball players. The desired Volleyball program is offered by the club to the members of ages 11 and above. The club can have one main location as the Head location and several other locations or branches spread over different areas. The players are joined by either male teams or female teams. Every club member can be associated with only one location at any given time; however, a member can move to a different branch if/when desired.

A club member can either be major or minor. Major members are members who are at least 18 years of age. Minor members are members who are between 11 and 17 years of age. To become a minor member, at least a family member should be registered into the system. A registered family member can then help any number of his/her child(ren) register as a minor club member.

The system should record and maintain all the information related to the club, including the General head of the club, the club locations, the manager and other personnel working at each location, the members and other possible family members of each location, information about the teams at each location, and the formation of teams within each location.

The information maintained by the system is used to monitor and keep track of the members' progress made since they joined and the skills acquired. The system is called Volleyball Club System (VCS).

A location could be the head of the club or a branch of the club. The information for each location could include type (Head, Branch), name, address, city, province, postal code, phone number(s), web address, and the maximum capacity of active club members that the location can handle at any time. At any time, a location can have a manager and any number of other personnel working

at the location. The head location has the following personnel: the General manager, deputy manager, treasurer, secretary, and one or more administrators. The general manager of the head location is the president of the club.

The application must maintain information about every personnel operating in each location. The information includes first-name, last-name, date of birth, Social Security Number, Medicare card number, telephone number, address, city, province, postal-code, email address, role and mandate.

There are some constraints to be considered: No two personnel can have the same Medicare card number. Social Security Number cannot be null. Also, no two people can have the same Social Security Number. The role of every personnel must be recorded and maintained by the system. The role could be either an administrator, Captain, Coach, assistant Coach, or other (including all other tasks). A general manager is an administrative personnel member. The mandate could be either volunteer or salaried (paid). Personnel can have only one role at any given time.

A Personnel can operate at only one location at any time. Personnel can operate at different locations at different times. For every personnel, the start date and end date operating at each location must be maintained. If the end date is null, it indicates that the personnel are still active at the location. Personnel can operate at the same location at different time periods. For example, Roger Smith, who is a trainer, could have worked at location Montréal from Jan. 15th, 2022, to June 30th, 2022, then worked at location Laval from July 5th, 2022, to Dec. 15th, 2022, and then returned to location Montréal from Dec. 20th, 2022, till now.

The application must maintain information about every family member registering her/his child into the system. The information includes first-name, last-name, date of birth, Social Security Number, Medicare card number, telephone-number, address, city, province, postal code, email address, and the location. The family member can be associated with only one location at a given time and be associated with different locations at different times. A family member can have one or many children as members of the club. The relationship between the family member and each child must be maintained. The relationship could be one of the following: Father, Mother, Grandfather, Grandmother, Tutor, Partner, Friend, and Other.

A family member who is considered the primary family member can designate a secondary family member to be added to the system. The secondary family member is used as an alternative for emergency contact where the primary family member is not reachable. The information about the secondary family member includes first-name, last-name, telephone number and the relationship with each club member.

The application must maintain information about every club member including major and minor members. The application assigns a global unique auto increment club member number for every new club member. This number is unique at all locations and not just at a single location. That is, no two club members could have the same membership number in the whole system. A new club member must be at least 11 years old at the time of registration. Every minor club member must be associated with one family member and the relationship with the family member must be maintained. A minor club member can be associated with different family members at different times. A club member can have no hobby or can have many hobbies. The hobby must be from a

list of hobbies registered in the system. Hobby list could include volleyball, soccer, tennis, ping pong, swimming, hockey, golf, etc. The application must maintain information about every club member in the system. The information includes club membership number, first-name, last-name, date of birth, height, weight, Social Security Number, Medicare card number, telephone number, address, city, province, postal code, hobbies, and for minor members the family member with whom they are associated. A club member can join the club as a minor member and when he turns 18 years old, he becomes a major member.

The application must maintain information about every club member's financial status. The annual membership fee is 100\$ for each minor club member, and 200\$ for each major club member. A club member cannot participate in any game or activity if his/her membership is not yet renewed and the membership fees to date are not paid. Details of every payment by every club member must be maintained by the system. Payment details include club member number, payment date, amount of payment, method of payment (Cash, debit or credit card), date of the membership payment (for example, payment could be done by Dec. 31, 2024, for the membership in 2025. Payments can be made in a maximum of 4 installments. If total payments of a minor member within a year exceed 100\$, then the excess will be considered as donations to the club. If total payments of a major member within a year exceed 200\$, then the excess will be considered as donations to the club. A club member whose membership fees for the previous year were not fully paid is considered to be an inactive club member.

The application must maintain information about team formation for every game or training session. Every game or training session consists of two teams. Every team is associated with one location. The two teams can be either from the same location or from different locations. Every team includes the team's name, the head coach of the team, one or many setters, outside hitters, opposite hitters, middle blocker, defensive specialist, and libero. All players in the same team must be club members associated with the same location. The team formation must also include the date and time of the game or training session for the formation as well as the score for every team in the session. Also, the address of the training session or game must also be maintained by the system. All players in the same team formation must be either boys or girls and cannot be mixed. If a player is to be assigned to two team formations on the same day, then at least three hours of difference should be set between the start time of the two formations, otherwise the assignment should be rejected.

Every week on Sunday, for every training session or game that is scheduled in the coming week, the system should automatically send an email to every club member indicating the schedule of the session including date, time, address, name of the head coach and email of the head coach.

The subject of the email should include the team's name, the date and time of the session. A subject example: "Montreal Group 6 Monday 20-Feb-2025 6:00 PM training session". The email body should include the club member's first name, last name and role in the game (setter, libero, etc.), the first-name, last-name and email address of the head coach of the session, whether the session is a training session or a game session, and finally the address of the session.

A log table in the database contains information on every email generated by the system. The log includes the date of the email, the sender of the email (name of the location), the receiver of the email, the subject of the email, and the first 100 characters of the body of the email.

What you should do:

In the above, we provided the minimum/basic requirements for this application. You could add more details if you find it 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. Are 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.

Express and evaluate the following DDL and DML types of SQL commands against your database in which every relation is populated with 'sufficient' representative tuples:

1. Create/Delete/Edit/Display a Location.
2. Create/Delete/Edit/Display a Personnel.
3. Create/Delete/Edit/Display a FamilyMember (Primary/Secondary).
4. Create/Delete/Edit/Display a ClubMember (Major/Minor).
5. Create/Delete/Edit/Display a TeamFormation.
6. Assign/Delete/Edit a club member to a team formation. (Attempt to assign a conflicting assignment for a club member in two team formations on the same day).
7. Make payment for a club member.
8. Get complete details for every location in the system. Details include address, city, province, postal-code, phone number, web address, type (Head, Branch), capacity, general manager name, the number of minor club members associated with that location, the number of major club members associated with that location, and the

- number of teams associated with that location. The results should be displayed sorted in ascending order by Province, then by city.
9. For a given family member, get details of the secondary family member and all the club members associated with the primary family member. Information includes first name, last name and phone number of the secondary family member, and for every associated club member, the club membership number, first-name, last-name, date of birth, Social Security Number, Medicare card number, telephone number, address, city, province, postal-code, and relationship with the secondary family member.
 10. For a given location and for a given period of time, get details of all the team's formations recorded in the system. Details include, head coach first name and last name, start time of the training or game session, address of the session, nature of the session (training or game), the teams name, the score (if the session is in the future, then score will be null), and the first name, last name and role (setter, libero, etc.) of every player in the team. Results should be displayed sorted in ascending order by the start time of the session. For example, the period of time could be from Jan 1st, 2025, to May 31st, 2025.
 11. Get details of club members who are currently inactive and have been associated with at least two different locations and are members for at least two years. Details include Club membership number, first name and last name. Results should be displayed sorted in ascending order by club membership number.
 12. For a given period of time, give a report on the teams' formations for all the locations. For each location, the report should include the location name, the total number of training sessions, the total number of players in the training sessions, the total number of game sessions, the total number of players in the game sessions. Results should only include locations that have at least four game sessions. Results should be displayed sorted in descending order by the total number of game sessions. For example, the period of time could be from Jan 1st, 2025, to May 31st, 2025.
 13. Get a report on all active club members who have never been assigned to any formation team session. The list should include the club member's membership number, first name, last name, age, phone number, email and current location name. The results should be displayed sorted in ascending order by location name then by age.
 14. Get a report on all active major club members who have been members since they were minors. The list should include the club member's membership number, first name, last name, date of joining the club, age, phone number, email and current location name. The results should be displayed sorted in ascending order by location name then by age.
 15. Get a report on all active club members who have only been assigned as setters in all the team formation sessions they have been assigned to. They must be assigned to at least one formation session as a setter. They should have never been assigned to any

formation session with a role different than setter. The list should include the club member's membership number, first name, last name, age, phone number, email and current location name. The results should be displayed sorted in ascending order by location name then by club membership number.

16. Get a report on all active club members who have only been assigned at least once to every role throughout all the formation team game sessions. The club member must be assigned to at least one formation game session as a setter, one as a libero, one as an outside hitter, and one as an opposite hitter. The list should include the club member's membership number, first name, last name, age, phone number, email and current location name. The results should be displayed sorted in ascending order by location name then by club membership number.
17. For the given location, get the list of all family members who have currently active club members associated with them and are also head coaches for the same location. Information includes first name, last name, and phone number of the family member. A family member is considered to be a head coach if she/he is assigned as a head coach to at least one team formation session in the same location.
18. Get a report on all active club members who have never lost a game in which they played. A club member is considered to win a game if she/he has been assigned to a game session and is assigned to the team that has a score higher than the score of the other team. The club member must be assigned to at least one formation game session. The list should include the club member's membership number, first name, last name, age, phone number, email and current location name. The results should be displayed sorted in ascending order by location name then by club membership number.
19. Get a report on all volunteer personnels who are family members of at least one minor club member. Results should include the volunteer's first name, last name, number of associated minor members, telephone number, email address, current location name and current role. Results should be displayed sorted in ascending order by location name, then by role, then by first name then by last name.
20. You should show the trigger(s) used by your system. Explain the trigger(s) used and their benefits.
21. You need to demonstrate the integrity of all the requirements provided in the description. Example, the system should not allow a user to assign a player on two different formation sessions at the same time or on a conflicting time (less than three hours difference).
22. 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 at least 5 tuples of each query result. Build a useful web interface to facilitate interactions with the database application system. Also included 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 August which is assigned on a first come first served basis. All members of your team must be present during your project demo.