Database Programming Project Proposals

Zhizhang Shen *
Dept. of Computer Science and Technology
Plymouth State University

October 25, 2020

Abstract
This is Part III of the lab notes prepared for the students of CS3600 Introduction to the Database Systems for Fall 2020.
We present a few ideas, with consistent level of challenge, which you can use to develop your project proposal for this course.
This project worths fifteen points. We also give some specific criteria and guideline, in §4, as how the students will be graded for the outcome in completing this project.

Contents

1 The rule of the game 2

2 Project proposals 2
  2.1 Video Chain Database ................................................. 2
  2.2 Library Management System ......................................... 3
  2.3 A Music Store Database ........................................... 5
  2.4 University Student Database ......................................... 6
  2.5 Department Management Database .................................. 7
  2.6 Grade Book Database ............................................. 9
  2.7 Come up with your own project ..................................... 10

3 What to hand in... 11

4 Grading criteria 12

*Address correspondence to Dr. Zhizhang Shen, Dept. of Computer Science and Technology, Plymouth State University, Plymouth, NH 03264, USA. Email address: zshen@plymouth.edu.
1 The rule of the game

You will learn lots of database related concepts and skills throughout this course. But, *Application is the key.* To apply some of the stuff as we have been learning in this course, and to develop some habits of team work, the key ingredients of carrying out database projects, the class will be cut into a few project teams, with 3 to 4 students. Each team will elect a project leader, come up with a project proposal, a rough schedule, and complete the project by the end of this semester. The project group will then make a presentation to the whole class at the end of the semester.

In principle, all the members of the same team will be assigned the same grade. All the members of a team are expected to make a reasonable contribution, and the team leader will make a report about what each and every team member has done, which will be taken into consideration when a grade is assigned.

2 Project proposals

We list seven proposals in the following. Some of them are adapted based on some ideas as contained in [2].

2.1 Video Chain Database

This is essentially a management system for a chain of video stores. Thus, those stores might share the same inventory, but each store has its own rental records, and employee records. Thus, such a database should contain information about *Stores, Employees, Movies, Members, Rentals,* and *Vendors.*

The group should go through the following steps in completing this project:

1. Design the database, following an E/R approach; then go through the normalization process to come up with a collection of tables that are in Boyce-Codd normal forms. 
   *The team has to include the original design in terms of E/R diagrams and paper work to show the normalization process in the final documentation.*

2. Describe some realistic constraints such as primary keys, foreign keys, check constraints, and *not null* constraints, for the tables and attributes, etc..
   *The team has to include a requirement document in the form of the one as discussed in [1, 14.2], a preliminary analysis and a list of final constraints.*

3. Use *MariaDB* to create the normalized tables.
   *The team has to come up with a list of print-outs of the table structure and the content, similar to those as contained in the lab notes.*
4. Do a research on how the most recent version of MariaDB implements the concept of triggers and then create appropriate triggers for your database to maintain integrity of the database and to perform appropriate actions on database updates.

For example, one possible trigger could be placed and then acted upon after the last copy of a movie is being rented out.

The team has to come up with a list of issues, and a discussion as whether an issue can be resolved with a trigger, before, after or instead; and why it is not done.

5. Populate the database by using MariaDB statements, or with some GUI interface such as PhpMyAdmin.

6. Write an interface in HTML, with embedded PHP script(s). The main interface should contain a Main menu, including Member functions, Administrative functions, and Reporting functions.

   - Implement the password security mechanism as described in Section 5.1.1 in the PhP Notes.
   - The Member page should include such functions as Check out, New member sign-up, list of videos for a member that have yet to be returned, and Membership cancellation.
   - The administrative page should include such functions as add/delete employees, buy new tapes, as well as open new stores, etc.
   - The report page should include such features as print the whole catalog, print a due list of tapes, print the employee list, print rental summary (ordered by rental frequency, etc.
   - Describe some typical UX session of user’s experience, and discuss possible improvement, given more resource, including time.

The group should include in the final documentation a list of questions a user of this system might want to ask, together with a list of MariaDB queries that help to answer them.

7. Document the project, containing at least the pieces as pointed out in the above.

### 2.2 Library Management System

This is supposed to develop a database system for the local library. Your finished product should contain information about books, book authors, publishers, employees, ILLs, and borrowers.

The group should go through the following steps in completing this project:
1. Design the database, following an E/R approach; then go through the normalization process to come up with a collection of tables that are in Boyce-Codd normal forms. The team has to include the original design in terms of E/R diagrams and paper work to show the normalization process in the final documentation.

2. Describe some realistic constraints such as primary keys, foreign keys, check constraints, and not null constraints, for the tables and attributes, etc.. The team has to include a requirement document in the form of the one as discussed in [1, 14.2], a preliminary analysis and a list of final constraints.

3. Use MariaDB to create the normalized tables. The team has to come up with a list of print-outs of the table structure and the content, similar to those as contained in the lab notes.

4. Do a research on how the most recent version of MariaDB implements the concept of triggers and then create appropriate triggers for your database. to maintain integrity of the database and to perform appropriate actions on database updates. For example, One of such before triggers could be that someone wants to check out a book on how to build bombs The team has to come up with a list of issues, and a discussion as whether an issue can be resolved with a trigger, before, after or instead; and why it is not done.

5. Populate the database by using MariaDB statements, or with some GUI interface such as PhpMySQLAdmin.

6. Write an interface in HTML, with embedded PHP script(s).
   - The top page should direct the users to either Patron functions, Administrative functions, or Reporting functions.
   - Implement the password security mechanism as described in Section 5.1.1 in the PHP Notes.
   - The Patron page should include such functions as check out, sign-up, return, pay fine, and etc..
   - The administrative page should include such functions as buy a new book, sell a book, search for book (by title, subject, author), and patron cancellation.
   - The report page should include such features as print the patron list, print a due list, print the ILL list, print monthly Ten Hot Book list, etc.
   - Describe some typical UX session of user’s experience, and discuss possible improvement, given more resource, including time.
The group should include in the final documentation a list of questions a user of this system might want to ask, together with a list of MariaDB queries that help to answer them.

7. Document the project, containing at least the pieces as pointed out in the above.

2.3 A Music Store Database

This is to develop a database for a Music store. Your product should contain information about Employees, Inventory, Customers, Sales, and Returns.

The group should go through the following steps in completing this project:

1. Design the database, following an E/R approach; then go through the normalization process to come up with a collection of tables that are in Boyce-Codd normal forms.

   The team has to include the original design in terms of E/R diagrams and paper work to show the normalization process in the final documentation.

2. Describe some realistic constraints such as primary keys, foreign keys, check constraints, and not null constraints, for the tables and attributes, etc..

   The team has to include a requirement document in the form of the one as discussed in [1, 14.2], a preliminary analysis and a list of final constraints.

3. Use MariaDB to create the normalized tables.

   The team has to come up with a list of print-outs of the table structure and the content, similar to those as contained in the lab notes.

4. Do a research on how the most recent version of MariaDB implements the concept of triggers and then create appropriate triggers for your database to maintain integrity of the database and to perform appropriate actions on database updates.

   For example, one such before triggers could be that someone returns a piece s/he bought on the same day. As an action, you might want to ask him/her questions as why it is returned.

   The team has to come up with a list of issues, and a discussion as whether an issue can be resolved with a trigger, before, after or instead; and why it is not done.

5. Populate the database by using MariaDB statements, or with some GUI interface such as PhpMySQLAdmin.

6. Write an interface in HTML, with embedded PhP script(s).

   • Implement the password security mechanism as described in Section 5.1.1 in the PhP Notes.
• For the Sales/Return submenu, you should include such functions as Process a sale, process a return, view a sale, and view a return.
• For the administrative submenu, you should include such functions as add/delete employees, add/drop "stuff", add/drop customer, etc..
• For the report submenu, you should include such features as print the whole catalog, print a list of stuff (by format such as CD, tape, DVD, or by category), print the employee list, print monthly Top Ten lists, print out the Most Returned List, etc..
• Describe some typical UX session of user’s experience, and discuss possible improvement, given more resource, including time.

The group should include in the final documentation a list of questions a user of this system might want to ask, together with a list of MariaDB queries that help to answer them.

7. Document the project, containing at least the pieces as pointed out in the above.

2.4 University Student Database

This is supposed to develop a database for the College. Your finished product should contain information about courses and their sections, departments, instructors, students, as well as Enrollments.

The group should go through the following steps in completing this project:

1. Design the database, following an E/R approach; then go through the normalization process to come up with a collection of tables that are in Boyce-Codd normal forms.
   The team has to include the original design in terms of E/R diagrams and paper work to show the normalization process in the final documentation.

2. Describe some realistic constraints such as primary keys, foreign keys, check constraints, and not null constraints, for the tables and attributes, etc..
   The team has to include a requirement document in the form of the one as discussed in [1, 14.2], a preliminary analysis and a list of final constraints.

3. Use MariaDB to create the normalized tables.
   The team has to come up with a list of print-outs of the table structure and the content, similar to those as contained in the lab notes.

4. Do a research on how the most recent version of MariaDB implements the concept of triggers and then create appropriate triggers for your database. to maintain integrity of the database and to perform appropriate actions on database updates.
For example, one such *before* triggers could be that when a student fails to maintain full-time status after dropping another course. An action could be to remind him that his/her parents can no longer cover his/her medical insurance.

*The team has to come up with a list of issues,* and a discussion as whether an issue can be resolved with a trigger, *before, after* or *instead,* and why it is not done.

5. Populate the database by using *MariaDB* statements, or with some GUI interface such as *PhPMySQLAdmin*.

6. Write an interface in *HTML,* with embedded *PhP* script(s).
   
   - Implement the *password security* mechanism as described in Section 5.1.1 in the *PhP* Notes.
   - The *student* page should include such functions as *register for a course, add/drop a course, asks for a copy of transcript,* and *pay fees.*
   - The *administrative* page should include such functions as *create a new course and drop an existing one, add sections of an existing courses and drop one,* as well as *add/drop a student.*
   - The *report* page should include such features as *print the whole schedule, print an individual schedule, print the student list of a course,* or *a department,* etc.
   - Describe some typical UX session of user’s experience, and discuss possible improvement, given more resource, including time.

   The group should include in the final documentation a list of questions a user of this system might want to ask, together with a list of *MariaDB* queries that help to answer them.

7. Document the project, containing at least the pieces as pointed out in the above.

### 2.5 Department Management Database

This is supposed to develop a database for an academic department. You product should contain information about *administration, faculty, programs, assessments, committees* and various *documents.*

The group should go through the following steps in completing this project:

1. Design the database, following an E/R approach; then go through the normalization process to come up with a collection of tables that are in Boyce-Codd normal forms.

   *The team has to include the original design in terms of E/R diagrams and paper work to show the normalization process in the final documentation.*
2. Describe some realistic constraints such as primary keys, foreign keys, check constraints, and not null constraints, for the tables and attributes, etc..

   The team has to include a requirement document in the form of the one as discussed in [1, 14.2], a preliminary analysis and a list of final constraints.

3. Use MariaDB to create the normalized tables.

   The team has to come up with a list of print-outs of the table structure and the content, similar to those as contained in the lab notes.

4. Do a research on how the most recent version of MariaDB implements the concept of triggers and then create appropriate triggers for your database. to maintain integrity of the database and to perform appropriate actions on database updates.

   For example, one of such triggers could be to check when a certain date comes up, e.g., May 1, to see if a faculty has filed an annual report. If not, whenever that faculty member signs up, show a warning message.

   The team has to come up with a list of issues, and a discussion as whether an issue can be resolved with a trigger, before, after or instead; and why it is not done.

5. Populate the database by using MariaDB statements, or with some GUI interface such as PhPMySQLAdmin.

6. Write an interface in HTML, with embedded PhP script(s).
   - Implement the password security mechanism as described in Section 5.1.1 in the PhP Notes.
   - The Information page might contain something like general announcements, news information, etc..
   - The administrative page should include such functions as add/delete/update faculty, form/dismiss/update committees, as well as add/delete/update programs, etc..
   - The report page should include such features as print various documents, print a list of faculty members/committee members, and check out the assessment results (maybe some statistics should be provided), etc..
   - Describe some typical UX session of user’s experience, and discuss possible improvement, given more resource, including time.

   The group should include in the final documentation a list of questions a user of this system might want to ask, together with a list of MariaDB queries that help to answer them.

7. Document the project, containing at least the pieces as pointed out in the above.
2.6 Grade Book Database

This is supposed to develop a database to manage a grade book. You product should contain information about courses, students, grades for homework, quizzes, midterm, final, and various letter grades.

The group should go through the following steps in completing this project:

1. Design the database, following an E/R approach; then go through the normalization process to come up with a collection of tables that are in Boyce-Codd normal forms.

   The team has to include the original design in terms of E/R diagrams and paper work to show the normalization process in the final documentation.

2. Describe some realistic constraints such as primary keys, foreign keys, check constraints, and not null constraints, for the tables and attributes, etc..

   The team has to include a requirement document in the form of the one as discussed in [1, 14.2], a preliminary analysis and a list of final constraints.

3. Use MariaDB to create the normalized tables.

   The team has to come up with a list of print-outs of the table structure and the content, similar to those as contained in the lab notes.

4. Do a research on how the most recent version of MariaDB implements the concept of triggers and then create appropriate triggers for your database, to maintain integrity of the database and to perform appropriate actions on database updates.

   For example, one such after triggers could be that when an ‘F’ is generated as the grade for a student, generate a sympathetic email message to the student. How should this be done exactly?

   The team has to come up with a list of issues, and a discussion as whether an issue can be resolved with a trigger, before, after or instead; and why it is not done.

5. Populate the database by using MariaDB statements, or with some GUI interface such as PhpMySqlAdmin.

6. Write an interface in HTML, with embedded PhP script(s).

   • Implement the password security mechanism as described in Section 5.1.1 in the PhP Notes.
   
   • The administrative page should include such functions as add/delete /update courses/students/grades. Certain security measure, such as password, should be included. Certain feature on curving should also be included.
• The report page should include such features as printing out grades for courses, with certain restrictions such as printing out only those who fail the course, and given a name, or a student number, looking for his/her grade, and randomly generating unique pseudo name for students for a course, and printing out labels for the whole class, etc..

• Describe some typical UX session of user’s experience, and discuss possible improvement, given more resource, including time.

The group should include in the final documentation a list of questions a user of this system might want to ask, together with a list of MariaDB queries that help to answer them.

7. Document the project, containing at least the pieces as pointed out in the above.

2.7 Come up with your own project

A project team can certainly come up with their own non-trivial proposal, consistent with these sample proposals. In particular, you need to think through the application area of your project. You must have a real customer in mind. You then need to go through the following process:

1. Identify the needed data times for this database. Design the database, following an E/R approach; then go through the normalization process to come up with a collection of tables that are in Boyce-Codd normal forms.

   The team has to include a design in terms of E/R diagrams and paper work to show the normalization process in the final documentation.

2. Describe some realistic constraints appropriate for this project such as primary keys, foreign keys, check constraints, and not null constraints, for the tables and attributes, etc..

   The team has to include a requirement document in the form of the one as discussed in [1, 14.2], a preliminary analysis and a list of final constraints.

3. Use MariaDB to create the normalized, and related, tables for this database.

   The team has to come up with a list of print-outs of the table structure and the content, similar to those as contained in the lab notes.

4. Do a research on how the most recent version of MariaDB implements the concept of triggers and then create appropriate triggers for your database to maintain integrity of the database and to perform appropriate actions on database updates.

   For example, one possible trigger could be placed and then acted upon after the last copy of a movie is being rented out in the case of the movie project.
The team has to come up with a list of related issues, and have a discussion as whether an issue can be resolved with a trigger, before, after or instead; and why it is not done, and how could it be done if given more resource including time.

5. Populate the database by using MariaDB statements, or with some GUI interface such as PhpMySqlAdmin.

6. Write an interface in HTML, with embedded PhP script(s). The main interface should contain a Main menu, including Member functions, Administrative functions, and Reporting functions.

   - Implement the password security mechanism as described in Section 5.1.1 in the PhP Notes.
   - The Member page should include such functions as Check out, New member sign-up, list of videos for a member that have yet to be returned, and Membership cancellation.
   - The administrative page should include such functions as add/delete employees, buy new tapes, , as well as open new stores, etc..
   - The report page should include such features as print the whole catalog, print a due list of tapes, print the employee list, print rental summary (ordered by rental frequency, etc..
   - Describe some typical UX session of user’s experience, and discuss possible improvement, given more resource, including time.

The group should include in the final documentation a list of questions a user of this system might want to ask, together with a list of MariaDB queries that help to answer them.

7. Document the project, containing at least the pieces as pointed out in the above.

3 What to hand in...

Hand in a general description of the project, the database design, interface design, the source code (a hyperlink when applicable), as well as the database tables, and any other supporting material, by 10 p.m., Wednesday, December 5, 2018.

Check out the course page for a sampler writing, which is one way to summarize all the work that you will have done for this project.

A presentation will be held at the end of this semester to the class, on Friday, December 7, 2018.
4 Grading criteria

This project will add up to 15 points towards the total grade of the course, and is graded by the following criteria and guidelines:

1. *Database design:* A well developed database, as described in a well written and readable document, including the following items (8):
   
   (a) a set of appropriate ER charts,
   (b) a set of well chosen integrity constraints,
   (c) a collection of normalized tables obtained through a normalization process,
   (d) appropriate keys and foreign keys consistent with,
   (e) usage of triggers,
   (f) a set of FD equivalents,
   (g) appropriate population with non-trivial data, and
   (h) password encryption.

2. *Queries:* Develop a collection of non-trivial and application oriented queries and/or triggers, addressing users’s needs, and a correct implementation in *MariaDB.* (5)

3. *Presentation:* A user-friendly interface (2)

References
