CS 6360 - 2014 Spring
Database Design Term Project

Project Description

Design, develop, and test ***ABC Laboratory Management System*** that supports people to do experiments, workshops and financial transaction based on combined database. The project is in four parts: conceptual design and requirements analysis (Phase I), database design requirements (Phase II), normalization (Phase III), and final report &demo (Phase IV).

1) The lab has its unique Lab_ID (from "L000" to "L999"), Name, Department Name that belongs to, Building name and room number (like "ECSS2102"). Three kinds of person are allowed to access the laboratory: Faculty, Student and Employee. A lab can have many people, but a person can only join in one lab. All the people share some common attributes: P_ID (like "qwe123456", unique), Name (includes First Name, Mid Name and Last Name), Gender, Phone Number (one or more phone numbers), and Email (can be multiple values). Faculties have their own Position, Office and Department information. Students have information about Major and Degree. One student may pursuit multiple degrees, which include Department, Program ("B.S.", "M.S." or "Ph.D.") and Year. One faculty may supervise several students or not. One student has at least one, at most two supervisors.

2) The lab offers equipment to users. Users can be faculties or students. Equipment has its unique Equipment ID (from "EQ00000" to "EQ99999"), Type ("computer", "projector", "server" or "router"), Status ("Available " or "In use"), Price, User's ID, Check-in time (such as 4-Feb-14) and Check out time.

3) There are some Sponsor supports the lab. Each sponsor has it unique Organization Name (such as NSF, companies, etc.), Address, Phone number, Email and Initial Sponsor Date.

4) The lab often has special events for students, like experiment result presentation, tutor, workshop etc. The event id EV_ID is unique. Held Date, Time and rough Introduction of each event will be recorded. Usually holding one event must need sponsors and event holders. The Event Holders can be employees or faculties. These events may be held in different rooms. Every student can attend every event alone or with a friend who is not in the university. The corresponding friend' name, gender, email, age information need to be registered for the event. And attendees need to evaluate the events they attend. The evaluation score varies from 1 to 10.

5) Users conduct and analyze experiments. Experiments has information about unique Experiment ID (from "EXP00000" to "EXP99999"), Subject, Project that belongs to, Name, experiment Description and Start Date. Each experiment uses at least one piece of equipment in the lab. Experiment may contain several Experiment Results or not. Experiment Result has its Serial number (NOT UNIQUE, from 00 to 99), Submission Date and Score (from 0 to 100). Some experiment results participate in events that the lab held. One experiment result can only be presented in one specific event.

6) Employees need to manage financial Transaction in the lab. There are three kinds of financial transaction in the lab. The first part is Experiment Cost. The second part is Fine. The third part is Funding. All transactions have unique transaction ID (TR_ID from T00000 to T99999), amount, transaction Date and brief Description. Sponsors give funding. Each funding has its Start time and Expire time. Some experiments create experiment cost. Transactions about experiment cost also contain Cost Type information (Buying equipment, expert Evaluation, etc.). Users who broke the equipment need to pay fine to the lab. Since there may be several users pay the fine, one unique Fine record needs transaction id and payer's id to confirm it.

Project Questions

a) Can you think 5 more rules (other than the one explicitly described above) that are likely to be used in the system?

b) Is the ability to model super-class/subclass relationships likely to be important in such environment? Why or why not?
c) Justify using a Relational DBMS like Oracle for this project.

Project Phases

I. Draw an EER to accurately represent this set of requirement. This will be your Conceptual Design. Clearly specify any assumption that you are making. You can use any tools (software) to draw the EER. You don't need describe the value constraints of the attributions in the EER diagram. (20%)

II. Use a relational DBMS to implement the database. Perform the following steps. (20%)
- **a)** Convert your Conceptual model to a Logical model that can be implemented in a relational DBMS like Oracle. During this process you replace M-N relationships and multi-valued attributes with constructs that can be implemented in the relational DBMS. Draw EER for the logical model after your modifications. Feel free to change your conceptual model (first delivery) if needed.
- **b)** Convert the EER to a database design. Document your design in Database Schema format like the one we discussed in the class.

III. Use appropriate naming conventions for all of your tables and attributes. (45%)
- **a)** Normalize all of your tables to third normal form. Make any necessary changes to the EER. Explain why these changes needed to be made.
- **b)** Draw a dependency diagram for each table.
- **c)** Write SQL statements to create database, tables and all other structures. Primary keys and foreign keys must be defined appropriately. The quantity constraints of the relation between the entities, which should be described in EER diagram, are not required.
- **d)** Use the Create View statement to create the following views:
    1. View 1: This view returns all Equipment ID be used by each person's id, no matter used by faculties or students.

2. View 2: This view returns all Equipment ID and report date associated with any fine transaction with at least $50 fine cost.
3. View 3: This view returns the id and the theme of the event that has more grades above or equal to 5 than those below 5.
4. View 4: This view returns the equipment used by each student id on 4-Feb-14.

e) Answer the following Queries. Feel free to use any of the views that you created in part (d).

1. Add Ada Montes as an employee to the system.
2. Return the equipment id that have more than 10 checking out history records.
3. Return the experiments' names that need to use more than 5 pieces of equipment.
4. Retrieve the equipment id and the id of person who uses the equipment before 29-Jan-14.
5. Retrieve the Experiment Ids whose experiment result having the most "satisfying" feedback in the show events, where "a satisfying feedback" means the event has more grades above or equal to 6 than those below 6.
6. Retrieve the id and name of the employee who takes charge of 3 pieces of equipment.
7. Show all experiments' ID in order of their cost effectives. Cost effectives refer to Experiment Result Score / (Experiment Cost+1).
8. Retrieve the name of employee who holds most events.
9. Add a buying transaction for equipment "EQ40305" record to employee "mxl1235" on 20-Dec-13.
10. Retrieve the faculties who supervise least students in experiments.
11. Add a broken equipment record (QA0001) by a person id "cld0890".
12. Find the average and variance score of experiments' result to determine gender factors (group by users' gender).
13. Retrieve the id of the event, the id of the holders hosting the events and the id of the attendees participating the events on 10-Oct-13.

14. Retrieve the id and the last name of the person who does not invite any friends to any events.
15. Retrieve the person's id that only attends the events with his/her friend, that is, the persons never attend any events alone.
16. Retrieve the attendees' first name and last name that participate events of all events.

IV. Document the final term project report. (15%)

a) Problem description (Copy it from Web Site).
b) Project questions (Answer questions listed in this project).
c) EER diagram with all assumptions.
d) Relation schema after normalization. All relations must be in 3NF. The relation schema should include primary keys as well as foreign keys (if any) for all relations.
e) All requested SQL statements.
f) Dependency diagram.

DEMO (TBD)