Database Design Term Project (CS6360)

Project Description

Dallas Care is a hospital and medical care center. Dallas Care would like one relational database to be able to smoothly carry out their work in an organized way. The hospital has following modules: Person, Employee, Patient, Visitors, Pharmacy, Treatment, Rooms, Records and Medical Bill Payment.

A Person can be an Employee or a Class 1 Patient. Details of a person such as Person ID, Name (First, Middle, Last), Address, Gender, Date of Birth, and Phone number (one person can have more than one phone number) are recorded. A person ID should be in the format, 'PXXX', where XXX can be a value between 100 and 999. A Class 1 patient is a person who visits the hospital just for a doctor consultation. A person can be both an employee and a Class 1 patient.

Employee is further classified as Doctors, Nurses or Receptionists. The start date of the employee is recorded. The specialization of the doctor is stored and doctors are further classified into Trainee, Permanent or Visiting. Every Class 1 patient consults a doctor. A Class 1 patient can consult at most one doctor but one doctor can be consulted by more than one Class 1 patient.

A Class 2 patient is a someone who is admitted into the hospital. A Class 2 patient can be an Employee or a Class 1 Patient or both. A doctor attends Class 2 patients. One doctor can attend many Class 2 patients but a Class 2 patient can be attended to by at most 2 doctors. The date of patient being admitted into the hospital is recorded.

A Visitor log is maintained for the Class2 Patients, which stores information such as patient ID, visitor ID, visitor name, visitor's address, and visitor's contact information.

Pharmacy details such as Medicine code, Name, Price, Quantity and Date of expiration is recorded. The database also stores the information of the various kinds of treatments that are offered in the hospital. The treatment details such as ID, name, duration and associated medicines are recorded. When a treatment is assigned to a Class 2 patient, the treatment details, medicine details and patient details are recorded so that the doctor can easily access this information.

Nurses governs rooms. Each nurse can govern more than one room, but each room has only one nurse assigned to it. The room details such as room ID, room type and duration is recorded. Each Class 2 patient is assigned a room on being admitted to the hospital.

A records database is maintained by the receptionist who keeps record of information such as record ID, patient ID, date of visit, appointment and description. The receptionist also records the payment information with the patient's ID, date of payment and the total amount due. Payment is further classified into Cash or Insurance. A person can pay by cash, or by insurance or pay via a combination of both. The cash amount is recorded if a person pays by cash. For Insurance, the insurance details such as Insurance ID, Insurance Provider, Insurance coverage and the amount is recorded.

Project Questions

1. Is the ability to model superclass/subclass relationships likely to be important in a hospital environment such as Dallas Care? Why or why not?

2. Can you think of 5 more business rules (other than the one explicitly described above) that are likely to be used in a medical care environment? Add your rules to the above requirement to be implemented.

3. Justify using a Relational DBMS like Oracle for this project.

Project Exercises

Phase I. Draw an EER to accurately represent this set of requirements. This will be your Conceptual Design. Clearly specify any assumptions that you are making. You can use any tools (software) to draw the EER.

Phase II. It has been decided to use a relational DBMS to implement the database. Perform the following steps.

a. Convert your Conceptual model (Phase I) 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 (item a) to a database design. Document your design in Database Schema format like the one we discussed in the class.

Phase III. Now, you are ready for implementation. Use appropriate naming conventions for all of your tables and attributes.

a. Normalize all of your tables to third normal form. Make any necessary changes to the EER from Phase II b. Explain why these changes needed to be made.
b. Draw a dependency diagram for each table from Phase III a.
c. Write SQL statements to create database, tables and all other structures. Primary key and foreign keys must be defined as appropriate.
d. Update data dictionary from previous delivery (phase III c.) to add data type for each attribute in addition to specifying if it is primary key, foreign key, NULL is permitted, or its value is UNIQUE.
e. Use the Create View statement to create the following views:
    1. TopDoctor- This view returns the First Name, Last Name and Date of Joining of those doctors who have made more than 5 Class 1 patients and over 10 Class 2 patients.

2. TopTreatment- This view returns the treatment name of the most common treatment in Dallas Care along with the bill payment amount when a person receives that treatment.
3. ReorderMeds- This view returns the medicines that need to be reordered. A medicine needs to be reordered if the expiration date is 1 month from current date or quantity is less than 1000.
4. PotentialPatient- This view returns the name, phone number and ID of patients who visited the hospital more than 3 times as a Class 1 patient but has not been admitted yet.
5. MostFrequentIssues - This view returns the maximum frequency of the reason that patients visit the hospital for and the associated treatment for the same. For example, if patients visit the hospital mostly complaining about heart issues then what are the treatment associated with heart issues.

f. Answer the following Queries. Feel free to use any of the views that you created in part (e.):
    1. For each Doctor class, list the start date and specialization of the doctor.
    2. Find the names of employees who have been admitted to the hospital within 3 months of joining.
    3. Find the average age and class (trainee, visiting or permanent) of top 5 doctors in the hospital.
    4. Find the name of medicines associated with the most common treatment in the hospital.
    5. Find all the doctors who have not had a patient in the last 5 months. (Hint: Consider the date of payment as the day the doctor has attended a patient/been consulted by a patient.
    6. Find the total number of patients who have paid completely using insurance and the name of the insurance provider.
    7. Find the most occupied room in the hospital and the duration of the stay.
    8. Find the year with the maximum number of patient visiting the hospital and the reason for their visit.
    9. Find the duration of the treatment that is provided the least to patients.
    10. List the total number of patients that have been admitted to the hospital after the most current employee has joined.
    11. List all the patient records of those who have been admitted to the hospital within a week of being consulted by a doctor.
    12. Find the total amount paid by patients for each month in the year 2017.
    13. Find the name of the doctors of patients who have visited the hospital only once for consultation and have not been admitted to the hospital.
    14. Find the name and age of the potential patients in the hospital.

Phase IV. Document the final term project report.

a. Problem description (Copy it from Web site).
b. Project questions (Answer 3 questions listed in the project, justify your solution).
c. EER diagram with all assumptions (Solution for Phase II a).
d. Relational Schema after normalization. All relations must be in 3NF. The relational schema should include Primary key as well as foreign keys (if any) for all relations. (Solution for Phase III a).
e. All requested SQL statements (Solution for Phase III-c, e and f).
f. Dependency diagram (Solution for Phase III-b).