Chapter 13 Problems and Exercises

Background

Chapter 13 problems 1 through 7 are based on a University Library System case. The problem definition in Chapter 13 indicated that the University Library System case could be found as part of the Problems and Exercises in Chapter 5. However, the case was left out of Chapter 5. This document provides that University Library System case description as well as a class diagram and use case diagram.

Chapter 13 problems 8 through 14 are based on a Dental Clinic System case. The problem definition in Chapter 13 indicated that the Dental Clinic System case could be found as part of the Problems and Exercises in Chapter 5. However, the case was left out of Chapter 5. This document provides that Dental Clinic System case description as well as a class diagram and use case diagram.
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University Library System

(Chapter 13. Use for Problems 1 through 7)

This case is a simplified version of a new system for the University Library. Of course, the library system must keep track of books. Information is maintained both about book titles and the individual book copies. Book titles maintain information about title, author, publisher, and catalog number. Individual copies maintain copy number, edition, publication year, ISBN, book status (whether it is on the shelf or loaned out), and date due back in.

The library also keeps track of its patrons. Because it is a university library, there are several types of patrons, each with different privileges. There are faculty patrons, graduate student patrons, and undergraduate student patrons. Basic information about all patrons is name, address, and telephone number. For faculty patrons, additional information is office address and telephone number. For graduate students, information such as graduate program and advisor information is maintained. For undergraduate students, program and total credit hours are maintained.

The library also keeps information about library loans. A library loan is a somewhat abstract object. A loan occurs when a patron approaches the circulation desk with a stack of books to check out. Over time a patron can have many loans. A loan can have many physical books associated with it. (And a physical book can be on many loans over a period of time. Information about past loans is kept in the database.) So, in this case, an association class should probably be created for loaned books.

If a patron wants a book that is already checked out, the patron can put that title on reserve. This is another class that does not represent a concrete object. Each reservation is for only one title and one patron. Information such as date reserved, priority, and date fulfilled is maintained. When a book is fulfilled, the system associates it with the loan on which it was checked out.

Patrons have access to the library information to search for book titles and to see whether a book is available. A patron can also reserve a title if all copies are checked out. When patrons bring books to the circulation desk, a clerk checks out the books on a loan. Clerks also check books in. When books are dropped in the return slot, clerks check in the books. Stocking clerks keep track of the arrival of new books.

The managers in the library have their own activities. They will print reports of book titles by category. They also like to see (online) all overdue books. When books get damaged or destroyed, managers delete information about book copies. Managers also like to see what books are on reserve.
Figure 1. Class Diagram for the University Library System
Figure 2. Use Case Diagram for the University Library System
Dental Clinic System

(Chapter 13. Use for Problems 8 through 14)

A clinic with three dentists and several dental hygienists needs a system to help administer patient records. This system does not keep any medical records. It only processes patient administration. Each patient has a record with his or her name, date of birth, gender, date of first visit, and date of last visit. Patient records are grouped together under a household. A household has attributes such as name of head of household, address, and telephone number. Each household is also associated with an insurance carrier record. The insurance carrier record contains name of insurance company, address, billing contact person, and telephone number.

In the clinic, each dental staff person also has a record that tracks who works with a patient (dentist, dental hygienist, x-ray technician). Because the system focuses on patient administration records, only minimal information is kept about each dental staff person, such as name, address, and telephone number. Information is maintained about each office visit, such as date, insurance copay amount (amount paid by the patient), paid code, and amount actually paid. Each visit is for a single patient, but, of course, a patient will have many office visits in the system. During each visit, more than one dental staff person may be involved by doing a procedure. For example, the x-ray technician, dentist, and dental hygienist may all be involved on a single visit. In fact, some dentists are specialists in such things as crown work, and even multiple dentists may be involved with a patient. For each staff person does procedure in a visit combination (many-to-many), detailed information is kept about the procedure. This information includes the type of procedure, a description, the tooth involved, the copay amount, the total charge, the amount paid, and the amount the insurance company denied.

Finally, the system also keeps track of invoices. There are two types of invoices: invoices to insurance companies and invoices to heads of household. Both types of invoices are fairly similar, listing each visit, the procedures involved, the patient copay amount, and the total due. Obviously, the totals for the insurance company are different from the patient amounts owed. Even though an invoice is a report (when printed), it also maintains some information such as date sent, total amount, amount already paid, amount due and the total received, date received, and total denied. (Insurance companies do not always pay all they are billed.)

The receptionist keeps track of patient and head-of-household information, and will enter this information in the system. The receptionist will also keep track of office visits by the patients. Patient information is also entered and maintained by the office business manager. In addition, the business manager maintains the information about the dental staff.

The business manager also prints the invoices. Patient invoices are printed monthly and sent to the head of household. Insurance invoices are printed weekly. When the invoices are printed, the business manager double-checks a few invoices against information in the system to make sure it is being aggregated correctly. She also enters the payment information when it is received.
Dental staff are responsible for entering information about the dental procedures they perform. The business manager also prints an overdue invoice report that shows heads of household who are behind on their payments. Sometimes dentists like to see a list of the procedures they performed during a week or month, and they can request that report.

Figure 3. Class Diagram for Dental Clinic System
Figure 4. Use Case Diagram for Dental Clinic System