CMSC 23500 Introduction to Database Systems

Spring 2010 S. Salveter

Web DB Project

Electronic copy due Wednesday May 19, 2010 at 7:00pm
No hard copy required.

For this homework you will design and implement a database and a series of web applications to manage your database. The design and implementation of the database, and the design of the web applications will be done individually, not in groups.

Following is an example of the WebDB problem. You can choose to implement this database, or choose another database problem of your own domain. If you choose your own domain, see the last section "Requirement For Other WebDB Schemas".

Example DB: The Hyde Park Buyers Club

The Hyde Park Buyers Club (HPBC) is an association that was formed so Hyde Parkers could buy certain products at a reduced price by buying in bulk once a month directly from certain providers. The way the club works is the following:

1. On a given month, members submit orders to the HPBC for products listed in a catalog.

2. At the end of the month, the HPBC pools all the orders together and combines them into what is called the "master sheet". This sheet specifies what amount of each product must be ordered from each provider.

3. When the order arrives at the HPBC, members can pick it up and pay the price charged by the provider (plus a 10% markup to defray administrative costs). Generally, members will end up paying less than if they had bought that same item in a supermarket or a store.

So far, this process has been carried out mostly by hand. The HPBC wants to automate most of this process using a database-driven web application. The HPBC has provided the following information to help us design the database schema:

- The HPBC has multiple members, each with a unique member number. The database must also keep track of each name, telephone number, and e-mail address.

- The HPBC has a catalogue of items that it can provision for its members. Items have a unique identifier, assigned by the HPBC, a name and a description. Items don't have a single price, since the price of an item will depend on what provider the item is bought from.

- The HPBC works with a number of providers to provision the items ordered by its members. An item can be sold by more than one provider, and each item can be assumed to be identical across providers. However, providers will offer items at different prices. For example, provider A and provider B may both stock "Foobar toothpaste", but provider A might sell it at $2.00 while provider B might sell it at $3.00.

However, this doesn't mean that the HPBC will always use provider A, since each provider only stocks a certain amount of each item. So, if provider A has 10 boxes of toothpaste and provider B has 50 boxes of toothpaste, and the members ordered 25 boxes, then 10 must be ordered from A and 15 from B. The cost of each item is the average of different purchases.

- The price and the quantity of an item stocked by a provider can change from month to month. However, providers notify the HPBC at the beginning of the month of what these prices and quantities will be, and that's the only values that are taken into account for that month.

- Each member can place multiple orders throughout the month. Each order includes a list of items that the member wants, and the quantities for each. Note that when a member places an order, the HPBC can't quote a price for the order because this will depend on what provider supplies the items for that specific order.

- At the end of the month, the HPBC takes all the orders and prepares the master sheet. This is currently done like this:

  1. The orders are sorted in the order in which they were received.

  2. The master sheet starts off as a list of all the items supplied by the HPBC. Next to each item there is a list of the providers that supply that item, the quantity they could supply, and the price the HPBC would have to pay for it.

  3. For each order, an HPBC staff member takes the quantity of each item and deducts it in the master sheet. The staff member also makes a note in the order of what provider is supplying the item, and at what price, so that the member will know how much to pay HPBC.

  4. An item may have to be supplied by multiple providers if a single provider doesn't have enough of it in stock. When a provider's stock is exhausted, the HPBC staff member checks the next cheapest one. The staff member makes a note of the different providers (and what amount was supplied by each), as this will affect the final price of the order.

  5. If an item cannot be supplied at all, the HPBC staff member substitutes it by the first comparable item. Note that an order should not be fulfilled by ordering part of the original item and the remaining quantity with comparable items. If the original item cannot be provisioned in the specify quantity, then the entire quantity is substituted by a comparable item.

- Based on the master sheet, purchase orders are sent to the providers.

- Based on the notes written on the member's order, the final price of the order is determined based on the provider each item was bought from.

- The HPBC wants to keep historical data of all member orders and all purchase orders sent to providers.

Web Applications

You will develop the following three applications using PHPs and SQLite:

1. A web application that allows members to submit new orders (30 points)

2. An application that will generate and display the master sheet (40 points)

3. An application that, after the master sheet has been produced, generates a report showing what items a member has ordered and what the final price for those items will be (30 points)

Simplifying Assumptions

The description of the HPBC and the web applications is intentionally vague. Before you write a single line of code, you will have to design the database schema, which will require probing for more information than we've provided here. As you code up your solutions, you can make the following assumptions:

- The Hyde Park Buyer's club is unconcerned with the appearance of your web pages. Make your web pages pretty only if you have free time after you've finished all your work.

- Someone else is taking care of "login" functionalities. For example, when writing up the application that generates the master sheet, you can assume that an administrator has been correctly logged in.

- Security is not a concern. All your users are going to use the system exactly the way you tell them to use it. No one is trying to game the system. No one will try to modify HTTP headers in–flight. No one is trying to do SQL injection on your forms. And no, there are no ninjas in the backyard.

Requirement For Other WebDB Schemas

You can also choose your own domain, e.g. my favorite weblinks, my favorite songs, photos, file organizer for your desktop, book stores, investment portfolio, patents, etc. But your database should satisfy following requirements.

- There should be at least three entities with primary keys, each of which should have at least 10 rows, and two weak entities. (30 points)

- WebDB should support queries: 1. join; 2. subqueries; 3. IN/EXISTS/UNIQUE(pick one); 4. aggregation with Having; 5. set operation. Note: pay attention to possible duplicated rows problem. (50 points)

- WebDB should support 1. insert; 2. update; 3. delete. (20 points)

Put descriptions of each requirement on your final webpage. For example, "The following query finds the most expensive books in this book store."

Submitting Your Solution

Please hwsubmit the directory including your SQlite database file, schema diagram, and php files (and other necessary files) by the due date.

See "http://www.cs.uchicago.edu/info/services" cgi programming session for PHP server settings. We use "cgi-cmsc" server.