Conceptual database design (using E-R data model)

Knowing your expertise in databases, a close friend who runs a local second-hand bookshop asked for your help. In the long run, he plans to start trading used books via Internet, but as a first step he wants have a proper database for this purpose. At the moment, the books are sold mostly in the shop, but your friend also accepts orders by phone, and when the payment is cleared, he sends them by post.

Your friend keeps data about the books in stock on a spreadsheet. This allows him to check quickly when someone asks about a book on phone, and allows him to produce some reports. On the other hand, post-it notes seem to be the primary medium of processing the orders.

Your task in this homework is to help out your friend with a conceptual database design using entity-relationship diagrams. Your friend's requirement's seem to match roughly the following:

- He wants database to store common bibliographical records and the condition of the book (like, 'new', 'as new', 'very good condition', 'marked', . . .).

- He wants his catalog to be browsable by author, genre, and alphabetical order, and searchable via a web page.

- He wants customers to be able to order books via this web page. If a customer orders multiple books at once, they are shipped in a single package.

- The posting price of the books are determined by the total weight of the package.

- He wants to keep information about customers to make future orders faster.

- Information about the orders should be kept after they are completed. They are useful in case of returns, they help your friend to keep statistics about what sells at what price, and he likes very much the feature of big online stores that suggests books based on previous purchases.

- The customers should also be able to create 'wish lists' for the books that are not in the stock. Customer should be notified by an email if/when any of the books in their wish list becomes available.

The spreadsheet your friend keeps looks like the following:

ISBN	title	author	year	pages	publisher	in_stock	price	binding	condition	weight
1857230744	The Left Hand of Darkness	Ursula K. Le Guin	1969	286	Orbit	0	5.50	soft	NA	200
055338256X	I, Robot	Isaac Asimov	1950	272	Spectra	2	2.50,4	soft,hard	good,as new	210,250
0575070536	Roadside Picnic	Arkady & Boris Strugatsky	1972	145	Orbit	1	4.50	hard	good	190
0553383043	A Wizard of Earthsea	Ursula K. Le Guin	1968	192	Spectra	3	3.50	soft	1: as new,2: good	190

You are free to make additional assumptions (be careful not to make it too complex!). State them if you do so.

(40%) 1. Design an E-R data model for this book shop. Present your design using an E-R diagram.

(10%) 2. Your friend, seeing you starting to scribble E-R diagrams, wonders why cannot you just put his spreadsheet into a database. How would you explain him the possible problems with his table structure?

(10%) 3. Convert your E-R diagram to a relational database schema. State the primary and foreign keys.

(40%) 4. Write down the SQL statements to create the tables in your DB schema.

Practical matters

- Submit your homeworks electronically via Nestor, preferably as a single PDF file.

- How to draw your E-R diagrams?

  - Paper & pencil: it may not look very 'professional' but it rarely frustrates. If you do so, please scan your E-R diagram and embed into your report, and make sure that they are readable.

  - Dia has E-R and UML libraries that may be helpful. Dia is installed on the machines in the computer labs (Certainly on LWP/Linux, maybe on UWP/Windows as well).

  - The shapes in E-R diagrams are relatively simple. Any other vector drawing program such as MS Visio, or even the utilities provided by word processors and presentation programs should be OK.

  - If you use LATEX, the TikZ package does a fine job that may look quite pretty at the end. It also has some built-in/external libraries for drawing E-R diagrams. But be warned if you are new: the learning curve for TikZ is rather steep.

- Grading:

  - You should to try to answer all questions as best as you can.

  - Unless you have a strong reason (such as illness), you have to submit your homework on time. Deadline is Monday 2012-09-17, before the course hour (13:00). Late homeworks will not be accepted.

- The homeworks should be done individually: no team work. Naturally, you can discuss/communicate with each other, and of course, you can look up relevant work available on the Internet. However, **everything you submit should be your own work**.

Optional/bonus challenge

> Define a 'custom Dia shapes library' for the E-R diagram notation used in the textbook.

For this exercise, the deadline is the end of the course. You can do this as a team of up to three people (but note the bonus calculation). If you succeed, you will get a bonus of $\frac{5+2\times N}{N}\%$ added to for your final grade, where N is the number of people in the team. If you want to take this challenge, contact me first for the details.