

ITWS-4250/6250 — Database Applications and Systems

Homework 2

Data Model Design

This homework will focus on concepts related to the creation of a data model.

It is due on Friday September 25 at 11:59PM and should be submitted electronically on the class Submittity site.

1. You have been hired to help develop a database for the local public library to keep track of its catalog and patrons. The system should support the following:
 - Book catalog (what books and other media—DVDs, CDs, etc.—the library has, whether they’re checked out and for how long)
 - Patron management (information on library patrons)
 - Checkouts and holds (what books are checked out to what patrons, whether patrons have placed a hold on a book, etc.). A “hold” is used when a patron would like to check out a book but someone else has it. It allows it to be set aside for the requesting patron when it’s returned, rather than being placed back on the shelf.
- (a) (12 points) Draw an Entity-Relationship diagram for your system.
- (b) (8 points) Convert your Entity-Relationship diagram into a relational model

2. Assume the existence of a database schema being developed to track the operations of a Fitness Club (membership, different locations (branches), programs, trainers, etc.). Given the relation $Gym(id, nickname, branch, lockerNumber, program, trainer, fee)$, abbreviated $G(i, nb, l, p, t, f)$ and the functional dependencies $nbp \rightarrow tf$, $bl \rightarrow n$, $pt \rightarrow f$, $t \rightarrow b$, and $ib \rightarrow l$.

(a) (2 points) What are the keys of the relation?

(b) (1 point) Why is the FD $pt \rightarrow f$ a violation of BCNF?

(c) (9 points) Decompose the relation into sub-relations that are in BCNF using the algorithm presented in class, using the violating FD above as the starting point for your first decomposition. Make sure you list any FDs that hold for your sub-relations.

- (d) (2 points) Which of the original FDs isn't (aren't) preserved by your decomposition? How do you know?
- (e) (6 points) Decompose the original relation into sub-relations in 3NF, using the synthesis algorithm described in class.