

CS348: Introduction to Database Systems
(Spring 2018)
Assignment 4 (due at 5pm on Tuesday, July 17th)

Overview: This assignment consists of three questions. As an aid to scheduling your work on this assignment, you should plan on spending three to 6 hours total on the questions.

Assignment submission: A PDF file “a4.pdf” containing your answers to all questions:

Page 1: an ER diagram, the first part of Question 1,

Page 2: the second part of Question 1,

Pages 3, 4 and 5: SQL DDL defining the relational schema, the first part of Question 2,

Pages 6 and 7: the second part of Question 2, and

Page 8: Question 3.

Question 1.

Assume your company is developing a digital camera online purchasing system for sale to camera stores. An initial analysis phase of the project has resulted in the following informal description of relevant data for the system.

- A store will be selling a variety of digital cameras and lenses. The digital cameras can have a combination of the following features.
 1. An ability to replace lenses.
 2. Cameras with an electronic viewfinder.
 3. Cameras with an optical viewfinder.
 4. Cameras with a “through the lens” optical viewfinder.
 5. Cameras with an optical rangefinder.

Note that any combination of these features is possible with the exception that no camera will have more than one feature from the following set: {3, 4, 5}.

- Properties of all cameras that are relevant include the manufacturer, model number, date of product release, sensor size, pixel number, retail price and the number currently in stock.
- Properties of cameras without an ability to replace lenses that are relevant include a focal length range and an aperture range.
- Cameras with an ability to replace lenses are related to at least two or more lenses.
- Properties of a lens that are relevant include the manufacturer, model number, date of product release, focal length range, aperture range, retail price and the number currently in stock.
- A prime lens is any lens with only one possible value for a focal length range, i.e., will have the low end of the range equal to the high end of the range.
- Online customers are either domestic customers or foreign customers.
- Properties of customers that are relevant include a unique customer number, a customer name, an email address and a shipping address.
- Each customer has any number of purchase orders (including possibly none at all). A subset of the purchase orders are in the process of being prepared for shipment and are therefore outstanding.
- Each purchase order is for either a camera or a lens, and will also have a selling price.
- Each camera or lens will have at least one customer evaluation.
- A customer evaluation is given by an individual customer and consists of a score between 1 and 5 (from bad to good) and a customer comment.

Do each of the following two parts:

1. Specify a conceptual design with an ER diagram that is capable of storing such information that formalizes as much of the informal description as possible.
2. Clarify any parts of the above informal description that are not captured by your ER diagram.

Question 2.

Do each of the following two parts:

1. Translate the ER diagram you produced for the previous question into SQL DDL commands that define a relational schema. The commands should include primary and foreign key constraints where appropriate.
2. Write relational algebra queries that compute violations of any parts of your ER specification or the informal description above that are not otherwise enforced by the relational schema.

Question 3.

Assume a relation R has four attributes $\{A, B, C, D\}$. For each of the following sets of FDs, assuming in each case that the dependencies in that set hold for R , do the following: (a) identify the candidate key(s) for R , and (b) identify the best normal form among $\{1NF, 3NF, BCNF\}$ that R satisfies.

1. $\{ABC \rightarrow D, D \rightarrow A\}$
2. $\{A \rightarrow B, BC \rightarrow D, A \rightarrow C\}$
3. $\{AB \rightarrow C, AB \rightarrow D, C \rightarrow A, D \rightarrow B\}$