McMaster University
SFWRENG 3DB3, Fall 2021
Assignment 1
Due: Oct 6, 2021 at 10:00pm

September 17, 2021

Relational Model (15 marks)

1. (3 marks) State the two properties of data independence provided in a DBMS. Why are they important? Given an example situation of when data independence is useful.

2. (12 marks) Consider the relations in a banking database given by the schemas below.

   - `BRANCH (branchName, address, city, sales, manager)`
   - `CUSTOMER (cID, firstName, lastName, address, city, birthDate, phoneNum, totalAssets)`
   - `LOAN(loanNum, branchName, amount, duration, interest)`
   - `BORROWER(cID, loanNum)`
   - `ACCOUNT(acctNum, branch, balance, type)`
   - `DEPOSITER(cID, acctNum)`

   `BRANCH` provides information on the branch name, it's street address, city, total sales thus far for the year, and the branch manager. `CUSTOMER` records customer information such as a customer ID (cID), their name, street address, city, birth date, telephone number, and total assets recorded. `LOAN` records information about loans, specifically, the loan number, the branch that opened the loan, the amount, duration period, and yearly interest rate. `BORROWER` associates a customer to a loan. `ACCOUNT` provides details about bank accounts such as the account number, the home branch, the current balance, and the type of account. Finally, `DEPOSITOR` associates a customer to an account.

   Given these schemas, answer the following questions:

   a) Identify a primary key for each relation. For each key, briefly state the assumptions or conditions under which each key would be valid.

   b) Given your choice of primary keys in (a), define four referential integrity constraints. State the appropriate primary to foreign key references.

E-R Modeling (35 marks)

3. Online retailer, StuffNOW, has hired you to design their database management system. StuffNOW would like to start by recording information about all entities and their relationships. The first entity they would like you to record are products. A product has a product ID, name, model number, brand, price, and description. A product belongs to at least one product category, which is described by an identifier, category name, and description. A product category may contain zero or more products. A product may have at most one warranty associated to it, and a warranty covers at least one product. A warranty is described by an ID, a type (express, implied, extended, special), and a duration of time the warranty covers. Products may be part of a promotion, which is described by a name, start and end dates of the promotion. These three attributes together are used to identify a unique promotion, but unfortunately, it does not work all the time, as different products may fall under the same time duration and promotion name. A promotion contains exactly one product.

   StuffNOW allows other sellers to also sell items on their platform (e.g., similar to Amazon). A seller is described by an ID, description, URL, and the year the seller joined the platform. A seller must sell at least one product, and a product is sold at exactly one seller's site.

   A person may be an owner (of a seller's online store), an employee, or a customer. Each person is uniquely identified in the database by their surname, first name, and birthdate. In addition, we record for each person their street, city, postalCode, country, and gender. A person has at least one contact phone number, and if there is more than one (e.g., home, work, cell number), they are all recorded along with the type. Each phone number is assigned to exactly one person. An owner has expenses, and owns at least one seller (online store), and a seller is associated to exactly one owner. An employee has a salary and years of service, and works for at least one seller, who may have zero or many employees. A customer has a membership number that allows them to receive special benefits from sellers.

   A customer may place zero or many orders, but an order must be placed by exactly one customer. An order is described by an orderID, the order date, and the time of the order. Orders consist of at least one product, and a quantity attribute recording how many of that product was purchased. A product may be part of many orders or none. Orders are fulfilled via a single shipment. Shipments must contain at least one order to save time and money. Shipments have a tracking number (a 10-digit alphanumeric number), a carrier that delivers the order(s), and a delivery date.

   Lastly, customers may provide reviews of their purchased products to express their likes and dislikes. A review consists of a rating number, and a comment. A review is for exactly one product, and is written by exactly one customer. A product can have zero or many reviews.

   a) `ER.pdf`: Draw the E-R diagram capturing the described requirements. You may use any drawing tool of your choice, but please ensure your E-R diagram is clearly readable, and the notation you use is clear and consistent (i.e., notation from the lecture slides or textbook). Handwritten models will not be accepted (i.e., receive a mark of zero).

   b) `ERDesc.pdf`: Give a brief (one sentence) description of each of your entities and relationships, and any constraints that exist. For example, X is a weak entity with attributes (a, b, c), and has a many-one relationship with Y.

c) `StuffNow.ddl`: Provide the corresponding DB2 'CREATE TABLE' statements describing the relational schema. Please include all your statements in an executable script (`StuffNow.ddl`) that can be run on the DB2 command line, in a single command. Ensure that your script runs on the CAS DB2 servers. Scripts that do not execute on these servers will not be marked. A sample script template has been provided in the assignments folder to help you get started.

Grading

This assignment is worth 12% towards your final grade.

Submission

All files are to be submitted via the Avenue system. Please ensure you submit all files with the correct names, as described below:

1. For Q1-Q2: Please include all your answers in a file `relation.pdf`.
2. For Q3: Submit files `ER.pdf, ERDesc.pdf, StuffNow.ddl`.