

Assignment #1: Part I — Foundations

Due date: Friday Oct 7 at 6PM (in the appropriate assignment box),

Note: to do in groups of 2.

Value: 5% of final marks.

HINT: Look at the examples in the text book.

The topic of these exercises is mainly conceptual and logical database design, as well as SQL queries. Some of the exercises are (either straight or adapted) from the textbook.

1. – **40%**. In this exercise, you will give a database design for a banking company called *Main Savings Inc.*. Note that not every aspect of a realistic design is modelled. You rather consider a few aspects that illustrate some of the main ER design concepts seen in class. Below are the requirements for the banking database:

- Main Savings Inc. is organized into several branches. Each branch has a unique name and is located in a particular city. Moreover, each branch has an asset.
- Customers of Main Savings Inc. are known through a unique customer identifier, a first and last name, a street address, and a city where they live. Customers must have a dedicated employee at the bank, who acts as that customer's banker. The latter supervises both the customer's borrowing of loans and the customer's possession of accounts. Such a supervisory role has a type (that may be a personal banker or a loan officer).
- Employees of Main Savings Inc. are identified by their employee ids. Moreover, the bank stores the first and last name, and the telephone number of each employee, and the employee's start date. Also, Main Savings Inc. keeps track of which employees works for which manager.
- Main Savings Inc. offers loans to its customers. A loan originates at a particular branch and can be held by one or more customers. Each loan has a unique loan number, along with a loan amount. Main Savings Inc. keeps track of loan payments as follows: a loan payment number identify a particular payment for a specific loan; each payment has such a loan payment number, together with a payment date, and a payment amount.
- Main Savings Inc. offers both savings and checking accounts to its customers. Each customer can have more than one account and one account can be held by more than one customer. Each account is identified by an account number and has a balance, as well as the last date on which it was accessed by each owner. Finally, each savings account has an interest rate and each checking account has an indication of the allowed overdraft limit.

Based on the information given above, do the following.

- (a) Draw an ER diagram for the Main Savings Inc. database. Doing so, indicate the various attributes of each entity and relationship set; also specify the key and participation constraints for each relationship set. Specify any necessary overlap constraints.

- (b) Translate your ER diagram into a relational database schema by showing the SQL statements needed to create the relations, using only (primary and foreign) key and null constraints. Should you encounter any constraint from the ER diagram that you cannot capture in your SQL statements, do document it.

2. **(Exercise 5.2 modified) – 30%**: Consider the following relational schema with the obvious meaning (primary keys are underlined):

Suppliers(sid : int, sname : string, address : string, rating : real)

Parts(pid : int, pname : string, color : string)

Catalog(sid : int, pid : int, cost : real)

Based on this schema, formulate the following queries **both** in relational algebra and in (domain) relational calculus:

- (a) Find the names of parts for which there is some supplier.
- (b) Find the names of suppliers who supply every red part.
- (c) Find the ids of parts that are supplied by at least two different suppliers.
- (d) Find the ids of suppliers who supply a red and a green part.
- (e) Find the ids of suppliers who supply only red parts.

Also, express the following integrity constraints in SQL (as a domain, key, or CHECK constraint; or as assertion) or as a trigger.

- (a) Suppliers must have a minimum rating of 5.
- (b) Every part has a minimum number of 2 suppliers and a maximum number of 5 suppliers.
- (c) Every supplier must supply the part with part id P111.
- (d) Whenever a supplier's rating is increased, the costs of all the parts supplied by that supplier must be increased by 10%. (Hint: Use a trigger for this.)

Finally, express the following queries in SQL.

- (a) For each part, find the (supplier) name of the supplier who charge the most for that part.
- (b) Find the ids of suppliers who supply only red parts.
- (c) For every supplier that only supplies green parts, print the name of the supplier and the total number of parts that he supplies.
- (d) Find the ids of suppliers who supply a red part and a green part.
- (e) Find the names of suppliers who supply every red part.

3. **(Exercises 2.8 and 3.18) – 30%**: See textbook pages 55 and 97.