TOPIC: Modelling a Cheese Dairy's Milk Collection

CS-A1153 Project – Designing a Relational Database

26 April, 2022

(1/5) Description: dairy farms and the milk truck

Modelling a Cheese Dairy's Milk Collection

Feel free to come up with a name for your cheese dairy.

- Milk is collected from dairy farms using a tanker or *milk truck* (with a capacity of about 11 000 - 28 000 litres of milk, depending on whether a trailer is used) from dairy farms driven by one of **four** drivers.
- There are **ten** different dairy farms, two of which are organic. An organic farm is assumed to produce only organic milk.
- Associated to each farm is a (1) unique integer ID (e.g. 1001, 1002, ...1010), (2) the name of the farm, (3) its address, (4) a checkmark on whether the farm is organic or not, as well as its coordinates: (5) latitude and (6) longitude in degrees.

(2/5) Description: the milk route

- A *planned milk route* is the route the driver uses to visit the dairy farms, collect the milk and then return to the dairy. A route consists of 2-5 stops at one of the farms. The database uses **three** different routes with one route devoted to organic farms only.
- Each planned milk route is stored in the database as information that is adjusted only a few times each year. Each route has a unique identifier (the route number).
- A *milk route run* or simply *run* is when the driver follows a planned milk route and returns with the collected milk to the dairy. Note that a run always visits the farms in the planned milk route in the same particular order.
- You can assume that no driver will follow the same planned milk route more than once per day. In other words, if a driver generates two (or more) runs per day, they must be from different planned milk routes.

(3/5) Description: the driver collects the milk

- Each truck driver is identified by a (1) unique 4-character employee ID, (2) first name, (3) surname, (4) gender, (5) home address, (6) phone number and (7) date when employment at the dairy started.
- The truck stops at each dairy on its planned milk route, the driver checks that the fresh raw milk meets certain standards and if s/he accepts the milk, takes a sample of the milk that will be analyzed back at the dairy. The analysis will be for the *MFat%* (the fat% in the milk), for *MProt%* (the total protein% in the milk) and for *SCC*, the so-called somatic cell-count (units are no of cells per ml), it's a measure of the bacterial residue in the milk.
- For each dairy farm stop or visit, the following data is stored: (1) the date, (2) the ID of the dairy farm stopped at, (3) the amount of milk picked up at the farm, (4) the MFat%, (5) the MProt% and (6) the SCC. Optional: (7) the time the truck arrived at the farm.

(4/5) Description: the driver returns to the dairy

- When the truck returns to the dairy plant, the milk in the truck is pumped into one of three silos: S1,S2 and S3.
- We assume for simplicity that each silo receives its milk *from a single milk truck* and once a day only. Thus each of the silos S1, S2 or S3 can receive a maximum of one milk load per day.
- After the silo receives its milk from the truck, the final composition of the milk is analyzed. You are also given this data.
- The following is recorded in a separate milk route run log: (1) date the truck arrived back at the dairy, (2) the ID of the driver (3) the planned milk route used, (4) the silo into which milk was pumped, (5) the MFat% in the silo, (6) the MProt% in the silo, (7) the SCC of the milk in the silo and (8) the total amount of milk in the silo (ltrs). Optional: (9) the time the truck arrived back at the dairy.

(5/5) Description: final points

- Note that each dairy stop is always part of one planned milk route and the date the milk is picked is the same as the date on which the milk truck returns to the dairy and pumps the milk into a silo.
- Once the milk is in the silos, it can be prepared for cheesemaking (standardized to a certain MFat% level and quickly heated) before pumped into the cheese vats. This part is **not** included in the design.
  The database can be used to monitor the quality and quantity of the milk collected. Generally, the higher the MFat% and MProt% levels and the lower the SCC values in milk, the better the milk is for cheesemaking.
- You are given sample data, which is not needed for the UML, but it should give you an idea of what kind of data to expect when designing the tables later on.

Requirements for Part 1

Using the description of collection of milk, design a database using the UML class diagrams as specified below.

- Draw an UML diagram for the collection of milk at the dairy based on the information defined in this document. Use the notations taught in the course.
- Convert the UML diagram to the relational data model. Present the schemas of the relations and underline the attributes which form the key for each relation.
- Provide answers to the following questions: What are the functional dependencies of the database? Are there any form of redundancy or other anomalies in the database structure? Is your database in the Boyce-Codd Normal Form? If it is not, use the decomposition algorithm (submit both original and decomposed version).