German University in Cairo
Media Engineering and Technology
Prof. Dr. Slim Abdennadher

Databases I, Winter term 2017-2018
Practice Assignment1

Discussion: 16.9.2017 - 21.9.2017

This assignment is intended to help you design a proper ERD for a database system. This can be acquired by reading the description of each system carefully and identifying all relevant information.

For each of the following exercises, you are required to draw an Entity-Relationship-Diagram.

Guidelines:

1. Read the problem thoroughly.
2. Identify relevant information about the database and discard the rest.
2. Identify the required entities, and their attribute(s). Note that you may add any attributes you find relevant.
3. Identify each entity's primary key.
4. Identify relationships between entities, and specify their cardinalities.
5. Take a look at your ERD and the different entities and relations making sure they represent the scenario described precisely.

Note: Each entity should have at least one attribute other than the primary key.

Exercise 1-1

Airlines

`Masreya Airlines (MA)` is an airlines company that manages daily flights between cities around the world. In order to optimize its performance and due to the frequent scheduling problems `MA` has faced, the manager decided to build a database system that can help improve the company's performance. Although important, the database built should not be big in size since the budget for buying the required software and to hire the specialized staff is low. The system should keep track of airplanes, flights and flight employees. Each airplane has a unique name, type, manufacturing year, and a capacity. Each flight has a unique flight number, a departure time, a destination and a departure location (*gate 1*, *gate 2*...). Each scheduled flight has exactly one pilot and at least one flight attendant (*steward*, *stewardess*). Pilots can be scheduled to more than one flight. Pilots and flight attendants have respective home bases, to which they return at the end of an assigned flight. For both pilots and flight attendants, other information should be stored such as the staff ids and personal data (*name*, *address*, *email*...). Only in the case of pilots, it is important to keep track of the number of experience years.

Exercise 1-2

Employees

We need to store some information about a company. It contains different employees. Each employee has a manager that he/she has to report back to. Each emloyee is identified by the combination of their first and last names. They also have an address and phone nuumber(s). The company has different projects. Each project has a location and budget. Employees are involved on at least one project. Each project has a manager.

Exercise 1-3

ITI

`ITI Center` is a training center that provides programming courses. Many courses are popular, each of which has a unique code, name and fee. *Introduction to UNIX* and *Java Programming* are two of the most popular courses. The courses offered vary in length from one week to a month. The center keeps track of each instructor's name, phone number and email. Each course is taught by only one instructor while an instructor may teach several courses. The students can attend several courses over time, and may register for many courses at the same time as long as their timings do not conflict. `ITI Center` also records contact information about the students and instructors, although some refuse to give their phone numbers.

Exercise 1-4

Justiz

Justiz is a large law firm known for managing many important and sophisticated lawsuits. Since the firm serves a huge number of clients, the owner decided to start automating the lawsuits handling process using a centralized database system. This would definitely help him keep track of the different lawsuits and clients as well as spotting any problems.

You are required to propose a design for the new automated database system. After visiting the different personnel within the Justiz law firm, you managed to collect the following information:

- Each lawsuit has a unique ID, name, registration date and subject.
- Each client has a unique ID, name, phone(s) and address, the address consists of: street number, street name, district, city and country.
- Each firm lawyer has a unique ID, name, phone(s) and address.
- For each lawsuit the firm keeps track of the following information:
  - Information about the enemy and enemy's lawyer.

  - Information about the court, witnesses and the trials held for each lawsuit.

- A trial has a unique number, date, start time, end time, duration, notes (important notes on witnesses, enemy's defense and so on...), hall (the number of the hall inside the court where it's to be held), defense summary (a summary on what is said by the lawyer during the trial) and role (the role of this trial within the lawsuit; is it a hearing trial or a final trial)
- A court has a unique name, a type (it indicates whether it's a summary court, court of the first degree, court of appeal or a supreme court) and region (Cairo, Alexandria...etc).
- For each enemy the following information is stored: Name, Address and Phone(s).
- For each enemy's lawyer the name, address, phone(s) and the name of the firm he/ she is working for should be stored.
- Witnesses' contact information is stored, such as witness name, phone(s) and address.
- A lawsuit can belong to more than one client and be held by many lawyers.
- Many trials can be held for one lawsuit, yet a trial will belong only to one lawsuit.
- The lawsuit can only be held in one court, on the other hand the court can host many lawsuits per day.
- A lawsuit can be filed against one or more enemies and each enemy can hire one lawyeronly.

(You might need to make some assumptions or additions to make your system realistic.)

Exercise 1-5

CTA

Cairo Transport Authority CTA is an Egyptian governmental organization that is responsible for all the public transportation all over Cairo. Due to some recent incidents of theft and unauthorized trips, the organization decided to build an automated system to keep track of all the trips and relevant information.

You are hired to design and implement the database system. After visiting their head office, you manage to collect the following information from the different personnel:

- Each driver has a unique employee number, name, hire date, phone number(s), and address. They are also interested in the years of experience of each driver, since they need this -among other things- to decide whether a driver should be promoted or not.
- Each bus has a manufacturer (e.g. Mercedes-Benz, Toyota ...etc), manufacturing year and capacity.
- Each bus is assigned to a specific route and performs many trips on that route. Each route has a starting point, ending point, and a description. Drivers may use different busses, i.e. a driver is not always assigned to the same bus.
- A trip has a departure time, arrival time, and a direction (from Dokki to Haram or from Haram to Dokki).
- One or more emergency-contacts are stored for each bus driver. Their names, addresses, and telephone number(s) should be stored.

Design the most appropiate ERD for the described system.

Exercise 1-6

Employees

A company database needs to store information about its employees.

The following information has been collected:

- Every `employee` has an SSN, salary and phone number(s).
- Every `department` has a department number, name and budget.
- If an employee has a `child` (or more), his/her name and age should be recorded.
- Each employee *works* in exactly one department.
- Each department is *managed* by exactly one employee.
- A child must be identified uniquely by name when the parent-employee is known(assume that only one parent works for the company). We do not need to keep track of information about a child if his/her parent leaves the company.

Exercise 1-7

Given a relational schema R and two different super keys `K1` and `K2`. Prove or disprove the following statements:

a) `K1` $\cap$ `K2` is a super key.

b) `K1` $\cup$ `K2` is a super key,

c) Assume `K1` and `K2` are candidate keys, `K1` $\cup$ `K2` is a candidate key.