Exercise for *Database System Concepts for Non-Computer Scientist* im WiSe 19/20

Alexander van Renen (renen@in.tum.de)

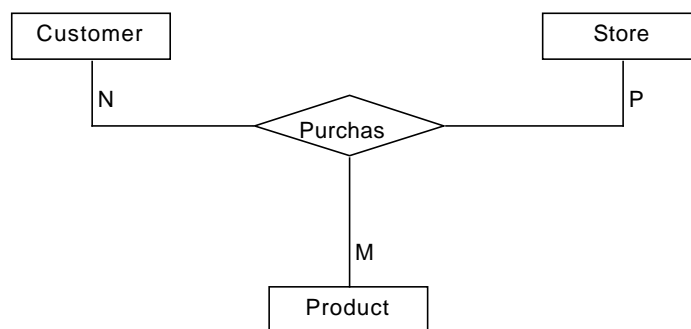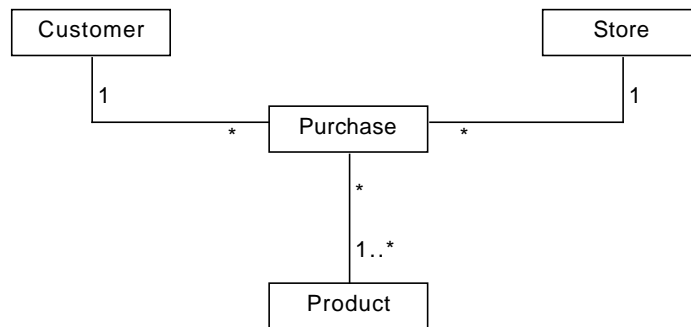http://db.in.tum.de/teaching/ws1920/DBSandere/?lang=en

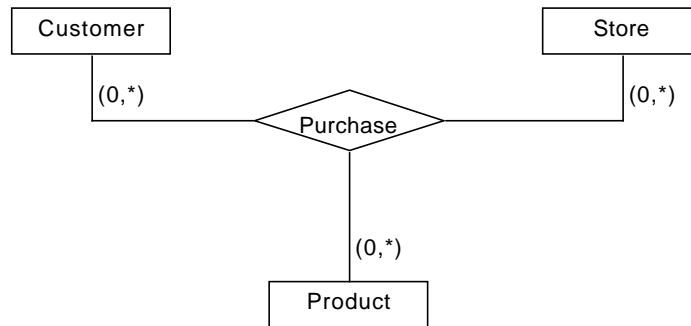**Sheet 03**

Exercise 1

Consider a super market where customers can buy products. Model the "purchase" relationship between customers, products and stores using:

- Entity relationship diagrams with functionalities

- Entity relationship diagrams with min/max notation

- UML class diagrams with multiplicities

Think about what constraints on your database you can enforce with different choices.

One possible solution:

```
  Customer                          Store
     |                                |
   (0,*)                            (0,*)
     _____< Purchase >_____/
                  |
                (0,*)
                  |
               Product
```
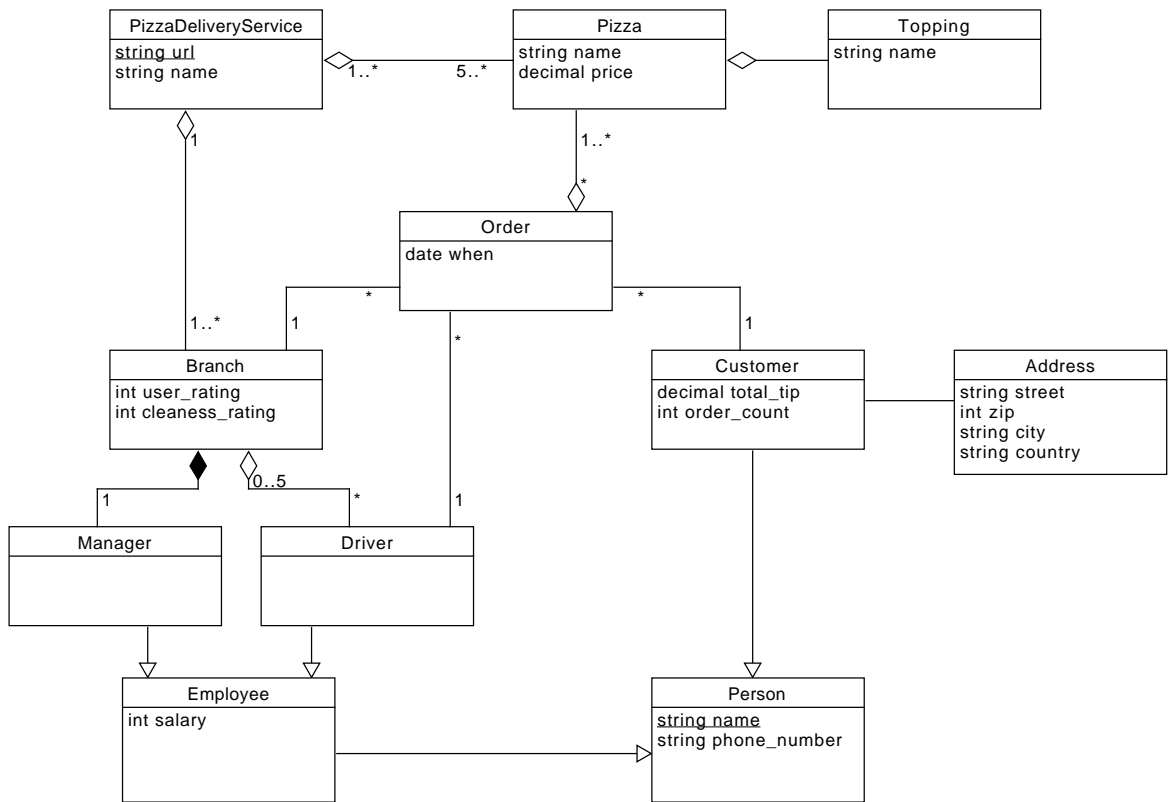
Exercise 2

In this exercise we model an online pizza delivery service. Use the following details and create a descriptive UML class diagram (including multiplicities):

- A pizza delivery service has a name and a website (modeled as a url). Each delivery service has at least one branch.

- A branch has a user and a cleanness rating and two types of employees: one manager and many drivers. Each employee has a salary, a name and a phone number.

- When a branch closes, the manager is automatically fired. Drivers, in our system, are independent of branches and are allowed to contract for up to five different branches at a time. They should remain in the system, even if they are currently not working for any branch.

- Each pizza delivery service offers at least five different pizzas. Each pizza has a name, a price and a list of toppings.

- Customers have a name, an address, a phone number and it should be stored how much money they tip on average (For simplicity, we assume that no employee is also a customer).

- A customer can place an order at a delivery service. The order is executed by a concrete branch, delivered by one driver and it involves at least one pizza. It should be possible to tell the total price for an order.

Solution:

Exercise 3

Consider the following description of a hospital and create an entity relationship diagram. Use generalization when appropriate.

- Hospitals consist of departments. Each hospital has an address (which can be used to identify it) and a number of beds. Departments have a name, which is unique only within a hospital.

- Departments in turn consist of rooms which are numbered. Such a number is unique within a department.

- Every hospital employs staff. Employees have a salary. This will determine which salary will be paid. Staff can be employed in various hospitals.

- Staff is identified by a personnel number and can be divided among other things into doctors and nurses. A doctor is associated with a department and can be a supervisor for nurses. A nurse can not be a doctor. However, nurses can have several supervisors.

- A department can be run by several doctors. A doctor can also run several departments. It is also known whether a doctor has a room and if she does, the room number is known. No doctor has to share his office with another doctor.

- Staff works in departments in shifts. A shift can be uniquely identified by date and time period. A person can work in one shift on only one department.

Solution:

An Entity-Relationship diagram for a hospital database with the following components:

Entities and attributes:
- Hospital — attributes: address (key), #beds
- Department (double box, weak entity) — attribute: name (partial key)
- Employee — attributes: salary, id (key)
- Shift (weak entity) — attributes: date (key), from (key), to (key)
- Doctor — attribute: area
- Nurse
- Room (double box, weak entity) — attribute: number (partial key)

Relationships:
- Hospital 1 — consists_of (identifying, double diamond) — N Department
- Hospital M — employs — N Employee
- Department 1 — works — M Shift
- Department 1 — contains (identifying, double diamond) — N Room
- Department M — runs — Doctor N
- Room N — Room — 1 has — 1 Doctor
- Nurse N — supervises — M Doctor
- Nurse — is_a — Employee
- Doctor — is_a — Employee