

Introduction to Data Management AY2023

Exercise 5. ER Diagramming Basics

Dates

Class session: July 7th (Fri). Submission due: **July 13th (Thu)**.

Task 1 (up to 5 points)

You extend the sample diagram describing the basics of university academic process. Please download this sample from Moodle (academic-er.xml). You are about including some more entities with their attributes and relationships so that to extend the given model.

Instructions

We use the browser-based **draw.io** editor, which works on any platform we have in computer classes.

Please access the editor at <https://www.draw.io/>. Before working on your own project read the user manual at <https://support.draw.io/display/DO/Draw.io+Online+User+Manual>. Try to experiment with the basic shapes available by using the palette toolbox. Try to put some texts inside the shapes and connect them. Save your diagram as *xml* file and try to open the saved file. Learn how to export your diagrams in other formats, particularly such as *png*.

1. Download the sample diagram **academic-er** from Moodle.
2. Open this diagram in draw.io.
3. Extend the diagram according to the requirements (see *Problem Description* below).
4. Save the extended diagram.
5. Export the diagram to PNG image.

DO NOT FORGET TO SAVE YOUR DIAGRAM, before leaving the draw.io page. Unsaved diagrams could not be restored. Please be careful.

Task 1 Problem Description

The given sample diagram describes the following:

The university offers one or more programs. A program is made up of one or more courses (at least one). A student must enroll in one program. The courses are parts of the program. A program has a name attribute. A course has the following attributes: name, capacity and course ID. Students have names and IDs.

The following entities and relationships are used in the sample diagram:

- `Student` is a strong entity, with an `ID` attribute used to distinguish between students, and `name`.
- `Program` is a strong entity, with the program name.
- Each student must be enrolled in a program, so the `Student` entity participates totally in the many-to-exactly one `enrolls_in` relationship with `Program`. A program can exist without having any enrolled students, so it participates partially in this relationship.
- `Course` has meaning only in the context of a `Program`, so it's a weak entity with weak attributes. As a weak entity, `Course` participates totally in the many-to-one identifying relationship with its owning `Program`. It is assumed that the program must include at least one course.

Extend this diagram by supporting the following:

1. A Program has total credit points required to graduate (attribute).
2. A Teacher teaches one or more courses.
3. A Course must have at least one teacher.

4. A Student has the year of first enrollment (attribute).
5. A Manager coordinates the Program and notifies students (use a simple directed association relationship).
6. There are Compulsory and Elective Courses.
7. A Program consists of Compulsory Courses.
8. A Teacher can teach several Elective Courses (but may have no Elective Courses at all).

Task 2 (up to 5 points)

For a suggested subject domain and its description, you define and describe a possible ER model containing major entities with their attributes and basic relationships between the entities. Unlike in task 1, for task 2, you create **your own diagram from scratch** (no sample diagram provided).

Instructions

1. Select your problem according to individual assignments (see below how to know your problem).
2. Read the problem description (find below the Problem Description assigned to you).
3. Design your model and draw the corresponding ER diagrams.
4. Export the diagrams to a PNG image.
5. Write your explanations in a separate document.

Assignment

Your individual assignment is as follows:

Your student ID ends with...	Your problem
0 or 5	A
1 or 6	B
2 or 7	C
3 or 8	D
4 or 9	E

Example: if the student ID is s129003**3** (thus, the last digit is 3), the assigned problem is **D**. Use the problem description according to your assignment. Below you can find all the problem descriptions.

Every problem description gives you some orientation about the suggested subject domain for your ER modeling exercises. **We encourage you to be creative and to think about possible extensions of the suggested problem.**

Task 2 Problem Descriptions

Problem A. Bus company

A bus company is interested to digitize its entire infrastructure. They have a fleet of buses, each with a specified seating capacity. In addition, the company has hired multiple drivers to operate the buses. The business operates through multiple routes that have specific departure points, destinations, and a series of stops. Routes can have multiple stops, some of which may be shared among different routes. The company provides trips based on a specific date, departure time, and seat price, associated with a specific bus, route, and driver. Passengers must purchase a ticket to ride the bus. For simplicity, ticket prices per seat have a flat rate for the ride regardless of the stops covered. Each trip may accommodate multiple passengers. Passengers have the flexibility to reserve tickets for numerous trips and can book multiple seats per trip. Furthermore, the company offers diverse payment options for tickets, including payments at the station or through various online methods.

Problem B. Music streaming platform

A record label is interested in developing a music streaming platform that features songs from the artists they've signed. Each song on the platform must identify the name of the artist who performed it. It's important to note that a single song may feature multiple artists, and the role each artist played in the song must be specified. Artists can assume different roles across various songs. Songs can be organized into albums. However, an album cannot exist without at least one song included in it. Users of the platform will need to sign up, provide a user ID, password, email, and select a subscription plan. The platform will offer a variety of subscription plans, each with a specific cost. Nonetheless, each user can only subscribe to one plan at a time. Users will also have the ability to create their own playlists, which can either contain songs or remain empty. To identify popular songs and keep a history of played songs, the platform will keep track of the number of times each song has been played by a user and the most recent date of play.

Problem C. Hospital system

A prefecture wants to digitalize the entire healthcare system so information can be shared easily between hospitals. Each hospital will have its location, capacity, and departments. Several doctors are affiliated with a particular department, but they are restricted to working exclusively within that department. Patients have the ability to be registered at multiple hospitals, and the system's records must include their date of birth and age. Patients can schedule appointments with specific doctors. Subsequent to the appointment, the doctor will provide a diagnosis and may prescribe medication or order tests. These prescriptions and tests can only be authorized following an appointment. In situations where a specific test is unavailable at the patient's current hospital, they may be referred to a different hospital to undergo the required test as requested by their doctor.

Problem D. Rental car

We are planning to create a new rental car company with multiple branches across the country. Each branch will house its own fleet of cars, sorted by categories such as sedans, vans, trucks, etc. For simplicity, cars have a flat rate per day depending on the type of car. In addition to location tracking via GPS, every car will also have a recorded history of maintenance. Customers will have the option to reserve a specific car type from a designated branch. Payments will be made on-site when the car is collected and customers must present a valid driver's license. To discourage bookings without follow-through, we will require customers to prepay for the vehicle's insurance. They will have the freedom to choose the rental date and their preferred insurance plan. We intend to provide a wide variety of insurance options.

Problem E. Food delivery app

A start-up is planning to create a food delivery platform for countryside cities. They lack this service and sometimes food establishments are too far! Restaurants wishing to participate on this platform will be required to register their location and pickup establishment addresses. They can display their food menus along with the respective prices for each item. Users wishing to utilize the service must register, providing details such as a user ID, password, email, and address. Similarly, delivery personnel are also invited to sign up for the application. On this platform, customers have the option to order varying quantities of food from multiple restaurants in a single order. Post-purchase, customers are encouraged to leave a review for an specific restaurant from which they ordered. Likewise, delivery personnel can rate customers, which helps in identifying and possibly banning disruptive users.

Points to note

1. Please think about the necessary attributes of each entity you decide to include in your model.
2. Please pay attention to the relationships between the entities you define.
3. Feel free to extend the suggested model with respect to your own experience. Show your creativity!

Useful Sources

In order to learn more about ER diagrams, please use the lecture materials.

In addition, for your self-study and better preparation for the exercise, the following sources are very helpful:

https://en.wikipedia.org/wiki/Entity%E2%80%93relationship_model

<https://www.smartdraw.com/entity-relationship-diagram/>

<https://creately.com/blog/diagrams/er-diagrams-tutorial/>

Grading

The grading criteria are as follows:

- Your design contains a relevant number of entities and relationships with their necessary attributes. Just for your orientation: a good solution should include 5-10 entities.
- You appropriately used strong and weak entities/attributes.
- You correctly decided on whether the relationships are one-to-one, one-to-many, zero-to-many, mandatory-one-to-many, etc.
- Your diagram is well-structured and readable, you provided clear explanation about your models, you organized your submission as requested.

The diagram gives you up to 60% of your score, and your explanation file and submission give you up to 30% of your score. 10% of your score is about your submission preparation.

Submission

Please submit your solution as the zip package containing the following:

1. *xml* file (containing your extended version of academi-er diagram for task 1;
2. image file (*png*) – your academic-er diagram converted to a PNG image;
3. *xml* file(s) containing your ER diagram or diagrams for your solution of task 2;
4. image files (*jpg* or *png*) containing your diagram(s) converted to images;
5. text file with a brief description of your ER models for task 2. Please write some explanation of your model. You can use any document editing software.