UNIT 1
CONCEPTUAL MODELING (EER)

BASES DE DATOS 2023/2024
CFGS DAW

WORKSHOP B: MEDIUM LEVEL ER

Reviewed by:
Sergio Badal
Author:
Paco Aldarias
Date: 09/28/23

GENERAL RECOMMENDATIONS ON ER MODELING:

1. Be consistent with the type of notation you choose (filled diamonds or max N, double lines or min 1, ...).
2. Include EVERY **participation (a,b)** and **cardinality (c:d)**.
3. Justify and describe EVERY **weakness** and every **ternary** relationship.
4. Do not create an **existence weakness** unless it is stated explicitly.
5. Do not cross lines or make a small bend in every cross if you can't avoid them.
6. Include just the **attributes explicitly mentioned** on the exercise and an **identifier** for each entity.
7. If you are not sure of which identifier attribute to choose, just set cod_xxx or id_xxx.
8. Name all entities in plural or singular (do not mix both), all relationships using verbs, and all attributes in singular.
9. An attribute should become an entity when it's multivaluated or it has more than one attribute.
10. Two binary relationships become one ternary when the three entities are always participating.

Although we all love to type and tinker with our computer, for this section I advise everyone to have a pen and paper nearby to make drafts until we get the model that seems most appropriate.

It is also very important to keep in mind that when the E-R model has already some complexity, surely the solution is not unique. It is possible that one may be better than the other, but this is like programming, two different programs can solve the same problem, one may be more optimal than the other, but both work.

Draw now the most suitable ER diagram for every context of the following.

YOU MUST HAND ONLY EXERCISES: 2, 3, 4, 5

EXERCISE 1: LIBRARY (solved)

The responsible for the library of your High School duty has noticed that the database that manages the library is not working properly, generates duplicates, and sometimes when deleting an item, creates inconsistencies in the system.

The management, which relies heavily on DAW/DAM students, has asked you to redesign and implement a new library database. The following assumptions are made:

- For each student registered at the library we will store the NIA (student number), name, surname, id-card (DNI), address and telephone number (only one).
- The library lends different publications. For each copy of a publication a copy number is stored. That is, if we have three copies of the book "Don Quixote", each of them will be identified by the code of the book (cod_pub) and the copy number (cod_copy).
- In addition we store, for each work, the name, id or code (cod_pub), year in which it was published and the data of the author(s) of the publication (can be more than one), for whom we want to store just full name and country of birth.
- We note if a particular item (copy) is deteriorated and make a comment on the possible deterioration.
- When an item is loaned, the pick-up date and the deadline (date) for returning are saved with the loan. When the student returns the item, the actual date is saved so, managing all dates, that we can track overdue loans.
- There is no limit on the number of copies that can be lent to a student and even the same student could take the same item several times in different loans.

CHECK THE SUGGESTED SOLUTION AT THE END OF THIS DOCUMENT

EXERCISE 2: NEIGHBORS

Your town council aims to keep records of the neighborhood associations and its members. Every member will obtain a membership number that will recognize them within their respective association. Each association has a unique registration number assigned by the city hall. Every resident must only be part of one association.

EXERCISE 3: ASSESSMENTS

The high school database course instructors have chosen to establish a database with test result information, based on the following conditions.

- The students are defined by their registration number, their name and only the group they are in. We don't need any additional information about the groups.

- These students take two types of exams during the academic year:

1. Written tests: each student takes several tests (test-exam) during the course and they are defined by the number of the test, the number of questions it consists of and the date of the test (the same for all students taking the same test). Obviously, it is important to keep the grade of each student for each test.

2. Assessable tasks (AT): an unspecified number of assessable tasks are carried out during the academic year, some of them in groups and others individually. They are defined by a task code, a title and a level of difficulty. In this case, the students can do these tasks whenever they want, recording the date and the grade obtained. As for the teachers, we are only interested in knowing (in addition to their personal data: ID and name) who created each AT, knowing that several teachers can collaborate in the creation of an AT and that one teacher can create more than one AT.

EXERCISE 4: YACHTING

A yachting association requires data on its facilities, staff, members, and boats. The club is structured as follows:

- The members belonging to the association (partners) are defined by their name, address, id-card (DNI), telephone and date of entry into the association.
- The boats are defined by its registration plate, name, type and dimensions.
- The moorings have as data of interest the number of the mooring, the reading of the water and electricity meter, and whether or not they have contracted maintenance services.
- A boat belongs to a partner, although a partner can have several boats. One vessel will occupy one mooring and one mooring is occupied by a single vessel. The date on which a vessel is assigned to a mooring is important.
- Partners can own moorings, the date of purchase of the mooring being important. Please, note that a mooring belongs to a single member and that there is NO direct relationship between the date a mooring is purchased and the date a boat is assigned to a mooring.
- The club is divided into several zones/areas defined each one by a letter (A, B, C...), the type of boats that have (long, short...), the number of boats it contains (calculated), the maximum depth and width of its moorings. It’s important to state a zone can have several moorings, all coded sequentially (M1, M2, M3...), and a mooring must belong to only one zone. For instance, mooring C-3 will be the third mooring of zone C.
- As for the employees, they come defined by a code, name, address, telephone and specialty. An employee is assigned to several zones and in a zone there can be more than one employee.
- Finally, we would like to know the number of ships that each employee is in charge in each of his/her assigned zones at any moment. We don’t care about which specific boats he/she is in charge, just how many.

EXERCISE 5: FLIGHTS

A company wishes to have a database that stores information related to the lodging and air travel details of their booked tourists.

The data to be taken into account are as follows.

- The agency consists of a number of branches. Each branch is defined by a branch code, an address and a telephone number.

- The agency has contracted a number of hotels on an exclusive basis. Each hotel is defined by code, name, address, town, telephone number and number of beds.

- The agency has also contracted a number of scheduled flights on an exclusive basis. Each flight is defined by flight number, date and time, origin and destination, total number of seats and economy class seats available.

- The information to be stored for each tourist is the tourist code, name and surname, address and telephone number.

On the other hand, the following information must be taken into account:

- The agency is interested in which branch the tourist has contracted with, forcing a tourist to contract with only one branch at a time.

- At the time of travel, the tourist can choose any of the flights offered by the agency and the class in which he/she wishes to travel (economy or first class).- Similarly, the traveler can choose to stay in any of the hotels offered by the agency and choose the type of accommodation (half board or full board). The dates of arrival and departure are relevant.

EXERCISE 6: FLATS (OPTIONAL; NOT ASSESSABLE)

Assume the following situation concerning cities, flats and individuals.

1. Each individual can only reside in one flat (or not reside in any flat at all) and can own several flats (or not own any flat at all).

2. Each flat must be owned by one or more persons.

3. Each flat must belong to only one city.

4. We are interested in knowing the persons legally linked to another person, and the linkage can be of two types: One person can be dependent on another (dependency situation) and one person can be married to another (marriage).

NOTE: If a city is no longer important for the database, the flats related to it will not be important either and will be automatically deleted.

=> READ AGAIN THE RECOMMENDATIONS SET ON THE FIRST PAGE <=

EXERCISE 7: FORMULA 1 (OPTIONAL; NOT ASSESSABLE)

The Federation Internationale de l'Automobile (FIA) comes to you with a request to build its brand new database with these requirements.

- An F1 team uses tires of a single brand and each brand can supply tires to more than one team, but If the brand is removed so the whole team has to be removed as well.
- One team can be present in more than one GP and vice-versa.
- Every F1 Grand Prix (GP) have place in a specific circuit and a circuit can hold more than one GP. For each GP, we want to save the number of laps to complete in order to finish each Grand Prix, as well as the date on which it will take place. Both data depend only on the GP, not on the circuit.
- Each circuit is in a specific country, but the same country can have more than one circuit (for example, in Spain we have Montmeló and Cheste). It’s important to reflect that, if a country is removed all its circuits have to be removed too and, recursively, its related GP.
- Each team, each brand, each GP and each circuit have their own identifiers (codT, codB and so on).

Additionally:

- The FIA wants to keep, for every GP and for each driver, the best time achieved, the position, as well as the total time elapsed from the start to the finish line.
- For the driver, we just want name and id-card and he/she doesn’t need to be associated to a team (for now). It means drivers and teams are not related.

SUGGESTED SOLUTIONS

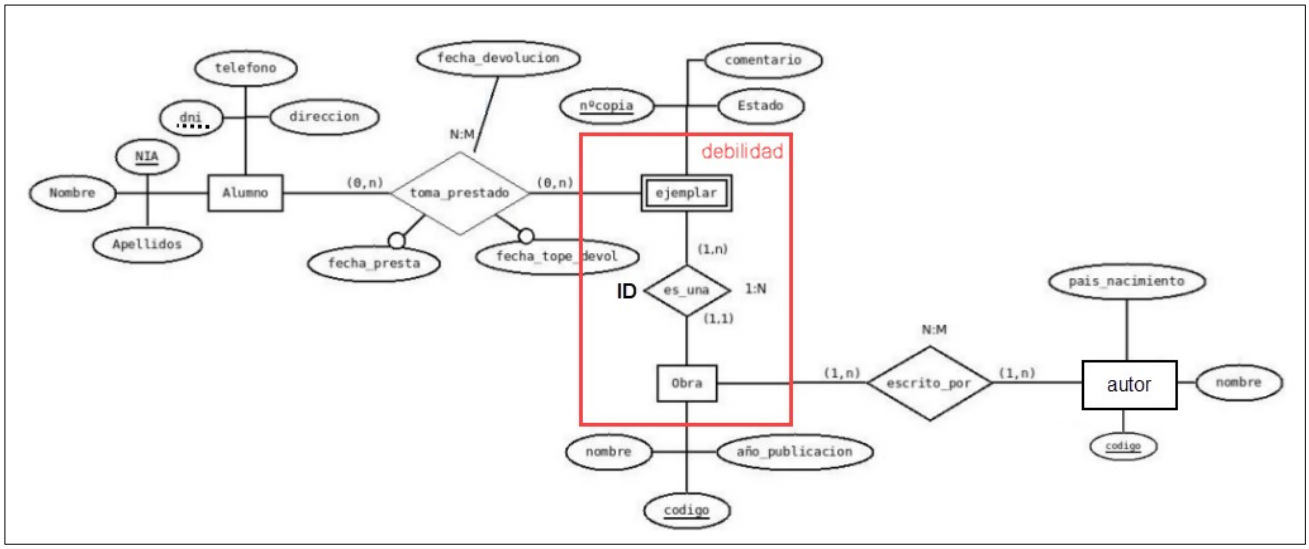
SOLUTION EXERCISE 1

KEYS OF THIS EXERCISE:

1. Identify the relationship attributes

2. Detect, classify and justify the weakness!

This is our proposed solution:



RELATIONSHIPS

Regarding cardinality ....

Since we need a student can take the same copy several times, we could use attributes in the relationship. Minimums are always subjective.

Regarding weaknesses ...

A weak entity called COPY (ejemplar) that has an identity dependency (which includes existence dependency) against the strong entity PUBLICATION (obra).

All this is due to the following:

- If we eliminate an instance of PUBLICATION we should remove all related instances of entity COPY (existence).
- **Every instance of COPY needs an instance of PUBLICATION since the "exemplar number" (nº copia) could be repeated from one PUBLICATION to another (identity).**