

## ERD – Exercises

1. You are required to create a conceptual data model of the data requirements for a company that specializes in IT training. The Company has 30 instructors and can handle up to 100 trainees per training session. The Company offers five advanced technology courses, each of which is taught by a teaching team of two or more instructors. Each instructor is assigned to a maximum of two teaching teams or may be assigned to do research. Each trainee undertakes one advanced technology course per training session.

(a) Identify the main entity types for the company.

(b) Identify the main relationship types and specify the multiplicity for each relationship.

State any assumptions you make about the data.

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(c) Using your answers for (a) and (b), draw a single ER diagram to represent the data requirements for the company

2. Read the following case study, which describes the data requirements for a video rental company. The video rental company has several branches throughout the USA. The data held on each branch is the branch address made up of street, city, state, and zip code, and the telephone number. Each branch is given a branch number, which is unique throughout the company. Each branch is allocated staff which includes a Manager. The Manager is responsible for the day-to-day running of a given branch. The data held on a member of staff; is his or

her name, position, and salary. Each member of staff; is given a staff; number, which is unique throughout the company. Each branch has a stock of videos. The data held on a video is the catalog number, video number, ~~file~~ title, category, daily rental, cost, status, and the names of the main actors, and the director. The catalog number uniquely identifies each video. However, in most cases, there are several copies of each video at a branch, and the individual copies are identified using the video number. A video is given a category such as Action, Adult, Children, Drama, Horror, or Sci-Fi. The status indicates whether a specific copy of a video is available for rent. Before hiring a video from the company, a customer must first register as a member of a local branch. The data held on a member is the first and last name, address, and the date that the member registered at a branch. Each member is given a member number, which is unique throughout all branches of the company. Once registered, a member is free to rent videos, up to maximum of ten at any one time. The data held on each video rented is the rental number, the full name and number of the member, the video number, title, and daily rental, and the date the video is rented out and date returned. The rental number is unique throughout the company.

a) Identify the main entity types of the video rental company.

b) Identify the main relationship types between the entity types described in (a) and represent each relationship as an ER diagram.

c) Determine the multiplicity constraints for each relationship described in (b). Represent the multiplicity for each relationship in the ER diagrams created in (b).

d) Identify attributes and associate them with entity or relationship types. Represent each attribute in the ER diagrams created in (c).

e) Determine candidate and primary key attributes for each (strong) entity type.

f) Using your answers (a) to (e) attempt to represent the data requirements of the video rental company as a single ER diagram. State any assumptions necessary to support your design

3. A manufacturing company produces products. The following product information is stored: product name, product ID and quantity on hand. These products are made up of many components. Each component can be supplied by one or more suppliers. The following component information is kept: component ID, name, description, suppliers who supply them, and products in which they are used.

Create an ERD to show how you would track this information.

#### 4. Car Dealership

Create an ERD for a car dealership. The dealership sells both new and used cars, and it operates a service facility. Base your design on the following business rules:

- A salesperson may sell many cars, but each car is sold by only one salesperson.
- A customer may buy many cars, but each car is bought by only one customer.
- A salesperson writes a single invoice for each car he or she sells.
- A customer gets an invoice for each car he or she buys.
- A customer may come in just to have his or her car serviced; that is, a customer need not buy a car to be classified as a customer.
- When a customer takes one or more cars in for repair or service, one service ticket is written for each car.
- The car dealership maintains a service history for each of the cars serviced. The service records are referenced by the car's serial number.
- A car brought in for service can be worked on by many mechanics, and each mechanic may work on many cars.
- A car that is serviced may or may not need parts (e.g., adjusting a carburetor or cleaning a fuel injector nozzle does not require providing new parts).

#### 4. A University Registration

Here is a statement of the data requirements for a product to support the registration of and provide help to students of a fictitious e-learning university.

- An e-learning university needs to keep details of its students and staff, the courses that it offers and the performance of the students who study its courses. The university is administered in four geographical regions (England, Scotland, Wales and Northern Ireland).
- Information about each student should be initially recorded at registration. This includes the student's identification number issued at the time, name, year of registration and the region in which the student is located. A student is not required to enroll in any courses at registration; enrollment in a course can happen at a later time.
- Information recorded for each member of the tutorial and counseling staff must include the staff number, name and region in which he or she is located. Each staff member may act as a counselor to one or more students, and may act as a tutor to one or more students on one or more courses. It may be the case that, at any particular point in time, a member of staff may not be allocated any students to tutor or counsel.

- Each student has one counselor, allocated at registration, who supports the student throughout his or her university career. A student is allocated a separate tutor for each course in which he or she is enrolled. A staff member may only counsel or tutor a student who is resident in the same region as that staff member.
- Each course that is available for study must have a course code, a title and a value in terms of credit points. A course is either a 15-point course or a 30-point course. A course may have a quota for the number of students enrolled in it at any one presentation. A course need not have any students enrolled in it (such as a course that has just been written and offered for study).
- Students are constrained in the number of courses they can be enrolled in at any one time. They may not take courses simultaneously if their combined points total exceeds 180 points.

*Design a suitable ERD model.*