ER Modelling Exercises

**Exercise ER-1**

What is the cardinality and optionality of each of the following relationships in just the direction given? State any assumptions you have to make.

1. Student to degree
2. Child to parent
3. Player to team
4. Student to course

**Exercise ER-2**

For each of the following pairs of rules, identify two entity types and one relationship. If you don't think enough information is available to define either of these, then state an assumption that makes it clear. Draw the ER model.

1. A department employs many persons. A person is employed by one department.
2. A manager manages one department. A department is managed by one manager.
3. An author may write many books. A book may be written by many authors.
4. A team consists of many players. A player plays for only one team.
5. A lecturer teaches, at most, one course. A course is taught by exactly one lecturer.
6. A flight-leg connects two airports. An airport is used by many flight-legs.
7. A purchase order may be for many products. A product may appear on many purchase orders.
8. A customer may submit many orders. An order is for exactly one customer.

Optionality Exercises

In the following exercises, optionality makes a difference to the design. Produce ER Diagrams suitable to the scenarios given; explain your choice of participation conditions based on the context provided and assumptions you make.

1. Patients see a doctor at the practice.

*In a group medical practice, each doctor has a number of patients. A patient is registered with one doctor but may have appointments with any doctor at the practice. In an emergency, the patient will be given a time to come in and see the first available doctor.*

*A patient is now allowed to change their registered doctor at the practice. If we wished to record the registration history of the patient, would this change the Entity model?*

1. Cars are driven by people. People drive cars.

*An insurance company keeps information about cars and their drivers. Insurance is for a given car usually for one year; sometimes the driver (or drivers) are designated in the insurance contract, but not always.*

*A car hire company provides cars on demand to customers. Customers book and say when they will need a car. They can give some details about the car they need, but which car they use exactly is decided as the customer collects the car, depending on what cars are in the car park.*

1. In a company, some employees are given mentors to support them. A mentor is an experienced employee who supports some new colleagues. The employees who have a mentor only have one.
2. A company keeps information about its employees and its clients. Much information is identical between the two; some are simultaneously clients and employees.

**PROBLEM - 1**

A company database needs to store information about employees (identified by ssn, with salary and phone as attributes), departments (identified by dno, with dname and budget as attributes), and children of employees (with name and age as attributes). Employees work in departments; each department is managed by an employee; a child must be identified uniquely by name when the parent (who is an employee; assume that only one parent works for the company) is known. We are not interested in information about a child once the parent leaves the company.

Draw an ER model that captures this information.

Entities: Employees, Departments, ChildrenOfEmployees

Employee: SSN, SALARY, PHONE

Department: DNO, DNAME, BUDGET

ChildrenOfEmployee: NAME, AGE

**PROBLEM - 2**

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

Draw an ER model that captures this information.

Show entity names, primary keys, attributes for each entity, relationships between the entities and cardinality.

Assumptions

A supplier can exist without providing components.

A component does not have to be associated with a supplier.

A component does not have to be associated with a product. Not all components are used in products.

A product cannot exist without components.

**PROBLEM - 3**

Create an ER model 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 carburettor or cleaning a fuel injector nozzle does not require providing new parts).

**PROBLEM - 4**

You have just moved to Washington, D.C., to work for the U.S. House of Representatives (the “House”) as a database specialist. For your first job, they want you to design a database to keep track of votes taken in the House. A counterpart to you working for the U.S. Senate is designing a similar database for tracking votes in the Senate. The database will track votes taken in the House during the current two-year congressional session. It should record each U.S. state (for instance, Texas) with its name, number of representatives, and region in which the state is located (northeast, mid-atlantic, midwest, and so forth). Each congress-creature, err, I mean representative, in the House is to be described by his or her name, the district (by district number) that he or she represents, the year when he or she was first elected, and the political party to which he or she belongs (for instance, Republican, Democrat, Independent, Green, Reform, Other). The database should track each bill (legislation) with its name, the date on which its vote was taken, whether the bill passed or failed (so the domain is yes and no), and its sponsors (the representatives who proposed the bill). The database should track how each representative voted on each bill (yes, no, abstain, absent).

Draw an ER model that captures this information.