1. **ER diagram with one case study**
2. **Design**
3. **Functional Design**
4. **Database design**

Database design is the process of producing a detailed [data model](https://en.wikipedia.org/wiki/Data_model) of a [database](https://en.wikipedia.org/wiki/Database). This [logical data model](https://en.wikipedia.org/wiki/Logical_data_model) contains all the needed logical and physical design choices and physical storage parameters needed to generate a design in a [data definition language](https://en.wikipedia.org/wiki/Data_definition_language), which can then be used to create a database. A fully attributed data model contains detailed attributes for each entity.

1. **Conceptual database design**
2. **Logical database design**
3. **Physical database design**
4. **Characteristics of Relation**
5. **ER to relational mapping algorithm**

A relation is a table that holds the data we are interested in. It is two-dimensional and has rows and columns. Each entity type in the ER model is mapped into a relation.

* The attributes become the columns.
* The individual entities become the rows.

## Mapping of regular entity

* For each regular (strong) entity type E in the ER schema,create a relation R that includes all the simple attributes of E.
* Choose one of the key attributes of E as the primary key for R.
* If the chosen key of E is composite, the set of simple attributes that form it will together form the primary key of R.
* For example, we create the relations EMPLOYEE, DEPARTMENT, and PROJECT for the regular entity types EMPLOYEE, DEPARTMENT, and PROJECT in COMPANY ER schema. Then, we choose SSN, DNUMBER and PNUMBER as primary keys for the relations EMPLOYEE, DEPARTMENT, and PROJECT, respectively. Foreign keys are not included yet.

## Mapping of weak entity type

## For each weak entity type W in the ER schema with owner entity type E, create a relation R & include all simple attributes (or simple components of composite attributes) of W as attributes of R.

## Also, include as foreign key attributes of R the primary key attribute(s) of the relation(s) that correspond to the owner entity type(s).

## The primary key of R is the combination of the primary key(s) of the owner(s) and the partial key of the weak entity type W, if any.

* For example, We create the relation DEPENDENT in this step. Include the primary key SSN of the EMPLOYEE as a foreign key attribute of DEPENDENT. The primary key of DEPENDENT is the combination {ESSN, DEPENDENT\_NAME} because DEPENDENT\_NAME is the partial key of DEPENDENT.5

## Mapping of binary 1:1 relation types

For each binary 1:1 relationship type R in the ER schema, identify the

relations S and T that correspond to the entity types participating in R.

➲ There are three possible approaches:

* **Foreign Key approach:** Choose one of the relations-say S-and include a foreign key in S the primary key of T. It is better to choose an entity type with total participation in R in the role of S.
* **Merged relation option:** An alternate mapping of a 1:1 relationship type is possible by merging the two entity types and the relationship into a single relation. This may be appropriate when both participations are total.
* **Cross-reference or relationship relation option:** The third alternative is to set up a third relation R for the purpose of cross-referencing the primary keys of the two relations S and T representing the entity types.

## Mapping of binary 1:N relation types

* For each regular binary 1:N relationship type R, identify the relation S that represent the participating entity type at the N-side of the relationship type.
* Include as foreign key in S the primary key of the relation T that represents the other entity type participating in R.
* Include any simple attributes of the 1:N relation type as attributes of S.

## Mapping of binary M:N relationship types

## For each regular binary M:N relationship type R, create a new relation S to represent R.

## Include as foreign key attributes in S the primary keys of the relations that represent the participating entity types; their combination will form the primary key of S.

## Also include any simple attributes of the M:N relationship type (or simple components of composite attributes) as attributes of S.