



CIIIA®

Data bases Introduction

CA

CONTENIDO

01 HISTORY DATA BASES

02 DATA BASES

Database Management System

DBMS functions

Database models

Entity-relationship model (ER model)

Entity

Relationships

Attribute

03 EXERCISES

What is data base?

W W W . C I I A . X Y Z



DATA BASE = ?

What is data base?



DATA BASE= ?

Formally, a *database* refers to a set of related data and the way it is organized. The databases are managed by a database management system (DBMS). [\[2\]](#)

DBMS= ?

What is data base?



DATA BASE= ?

Formally, a *database* refers to a set of related data and the way it is organized. The databases are managed by a database management system (DBMS). [\[2\]](#)

DBMS= ?

A database management system (DBMS) is a computer program (or more typically, a suite of them) designed to manage a database, a large set of structured data, and run operations on the data requested by numerous users. [\[3\]](#)

HISTORICAL CONTEXT

HISTORICAL CONTEXT

Before databases, the information was stored in files.

Problems of using files:

- Sequential access to the data.
- High probability of inconsistency in the data.
- Additional problems caused by the previous one.



Example:

In the 60's:

- The companies made a digital version of their physical records.
- The physical digital storage were magnetic tapes.
- Sequential access.
- The data had to be stored sorted.
- Programs had to read the whole file before processing it.
- Same data spread over different files.



HISTORICAL CONTEXT

WWW.CIIIA.XYZ



PROBLEMS?

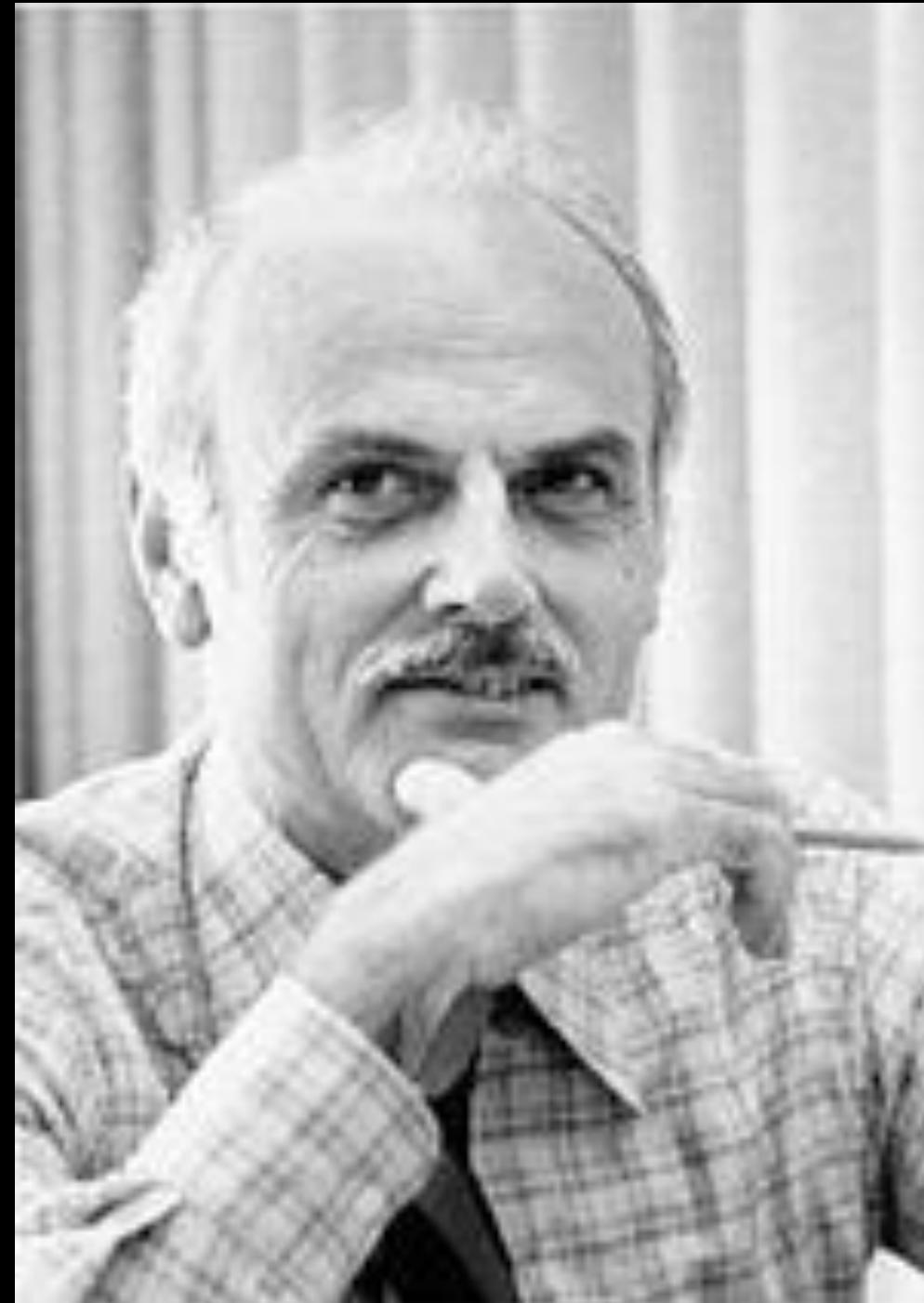
HISTORICAL CONTEXT



- Only one user can access a file at the same time; no concurrent access.
- The permissions were set at file level; different files for the same information, duplicity.
- There wasn't a proper software that checks whether the inserted data is correct; no protection against failures.
- If the structure of the file changed, all the dependent programs had to be changed.
- Couldn't perform queries. Programs worked with files, not with data.

PROBLEMS?

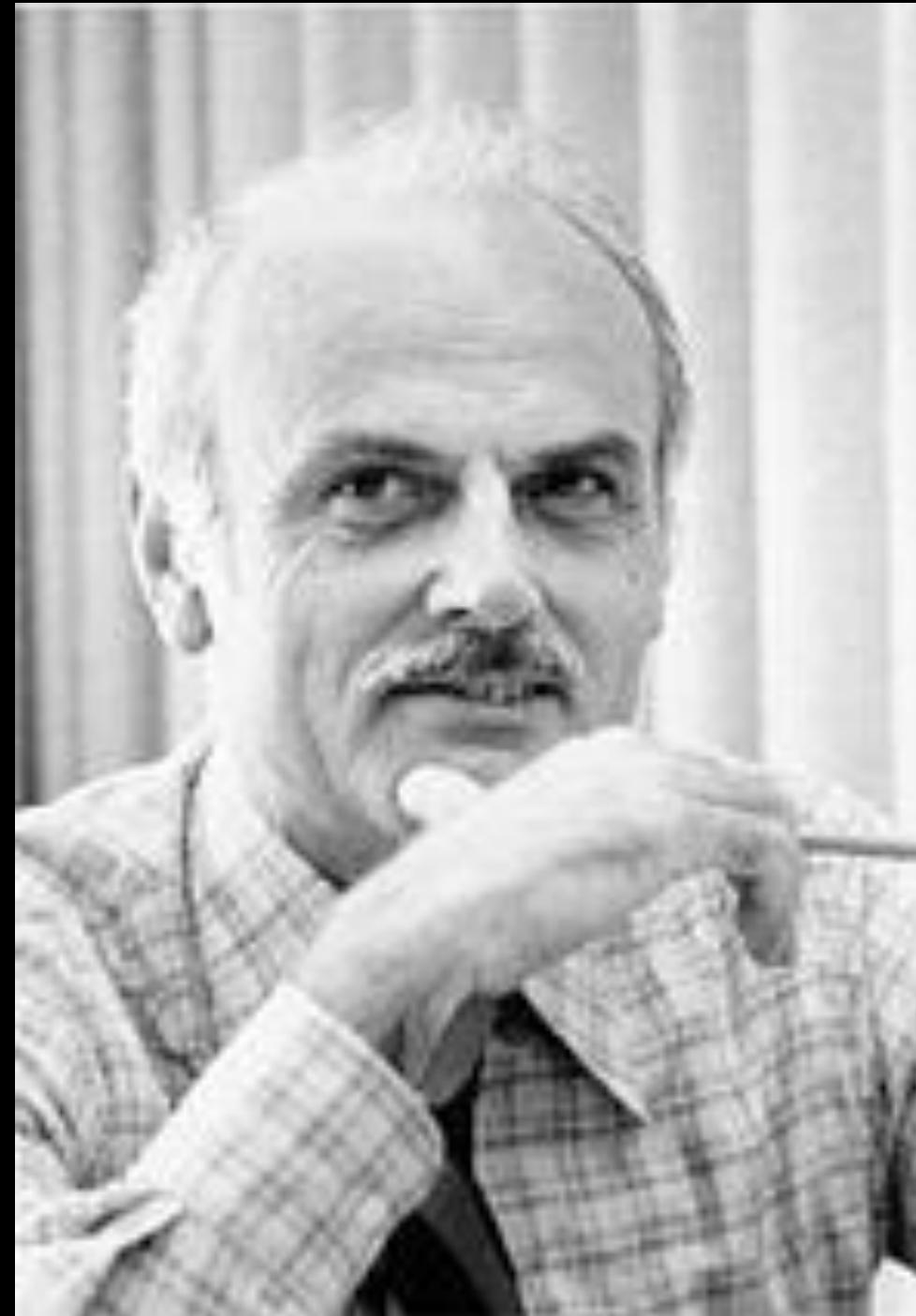
HISTORICAL CONTEXT



Edgar Frank "Ted" Codd (19 August 1923 – 18 April 2003) was an English computer scientist who, while working for IBM, invented the **relational model** for database management, the theoretical basis for relational databases and **relational database management systems**.

He made other valuable contributions to computer science, but the relational model, a very influential general theory of data management, remains his most mentioned, analyzed and celebrated achievement.

HISTORICAL CONTEXT



In the 70's Codd proposed a [relational model of data for large share data banks](#). A new approach to work with data: databases. This new powerful approach solved:

- Concurrent access to the data: Many users can access and/or modify the data at the same time.
- Different profiles for viewing or modifying the data.
- Confidence or security.
- Protection against failures, inconsistency, ...
- Logic independency: The existing relationships between the stored data can be modified without affecting the programs that use them.
- Queries.
- High abstraction of the database.
- Flexible system.

What is data base?



DATA BASE

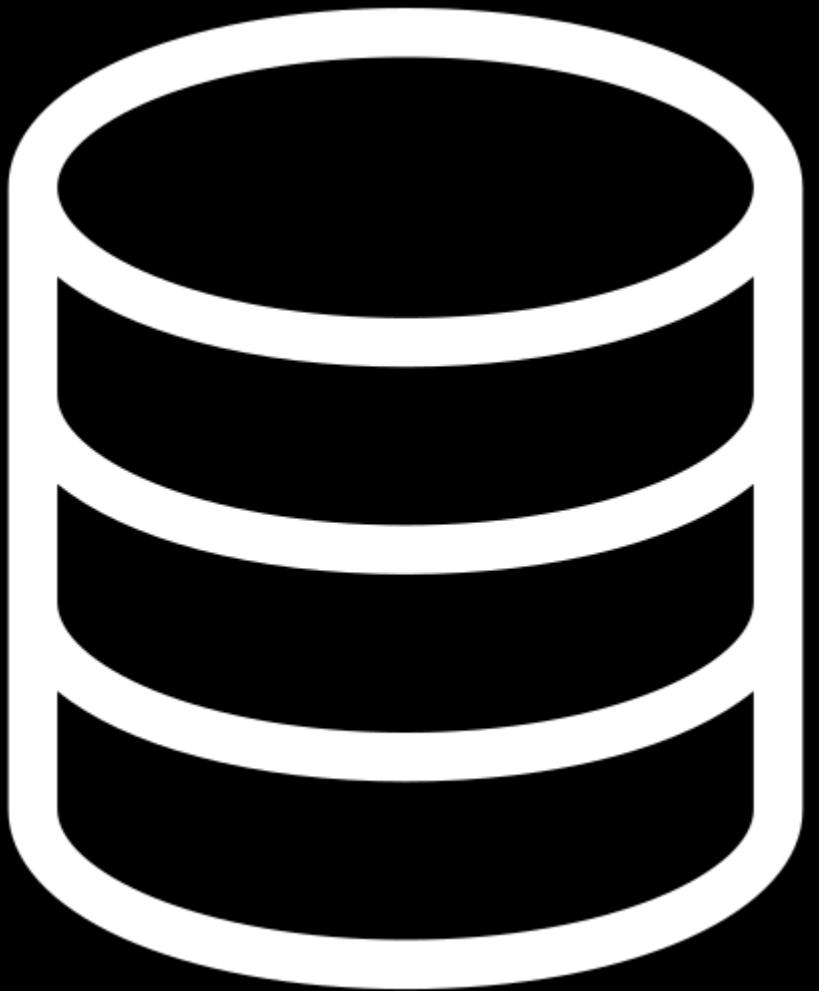
Formally, a *database* refers to a set of related data and the way it is organized. The databases are managed by a database management system (DBMS). [\[2\]](#)

DBMS

A database management system (DBMS) is a computer program (or more typically, a suite of them) designed to manage a database, a large set of structured data, and run operations on the data requested by numerous users. [\[3\]](#)

What is data base?

WWW.CIIIA.XYZ



DBMS FUNCTIONS

Data definition

Update

Retrieval:

Administration



What is data base?



DBMS FUNCTIONS

Data definition:

Creation, modification and removal of definitions that define the organization of the data.

Update:

Insertion, modification, and deletion of the actual data.

Retrieval:

Providing information in a form directly usable or for further processing by other applications. The retrieved data may be made available in a form basically the same as it is stored in the database or in a new form obtained by altering or combining existing data from the database.

Administration:

Registering and monitoring users, enforcing data security, monitoring performance, maintaining data integrity, dealing with concurrency control, and recovering information that has been corrupted by some event such as an unexpected system failure.

DATA BASE MODELS

E - R

(ENTITY RELATIONSHIP MODEL)

E - R

- The **objects** are entities (rectangles).
- The entity's properties are the **attributes** (ellipses).
- A **relationship** between entities is represented by a diamond that connects them.
- The lines represent the actual **connection** between these objects.



E - R

The main organizational structure of an ER model is the table.

Example:

Title	Year	Author	Country
1001 Nights	1706	NULL	SA
The Tragedy of Hamlet	1602	William Shakespeare	UK
Don Quijote de la Mancha	1605	Miguel de Cervantes	ES
Hänsel und Gretel	1893	Engelbert Humperdinck	DE
Pedro Páramo	1959	Juan Rulfo	MX

Country	Code	Capital	Population
Saudi Arabia	SA	Riyadh	32
United Kingdom	UK	London	66
España	ES	Madrid	48
Deutschland	DE	Berlin	83
Estados Unidos Mexicanos	MX	Ciudad de México	124

E - R

- A table has a **unique name** that identifies its content.
- A table must have, **at least, one column**.
- A table can be empty.
- Each **row** identifies only one and a **unique entity**.
- Each **column** must have a **unique name**.
- Each **column** represents an **attribute**.
- Each column has a domain and a type.

E - R

- The data it's stored on the most efficient way, therefore, the data is never sorted. We need to specify a column that will have a unique value for each row. This column is called **primary key**.
- A column in a table whose values match a primary key in some other table is called a **foreign key**.
- NULL represents a missing value.
- The primary key attribute can't be NULL.
- The administrator can set restrictions and permissions to every kind of user for each table and each column (views).

ENTITY

An entity must:

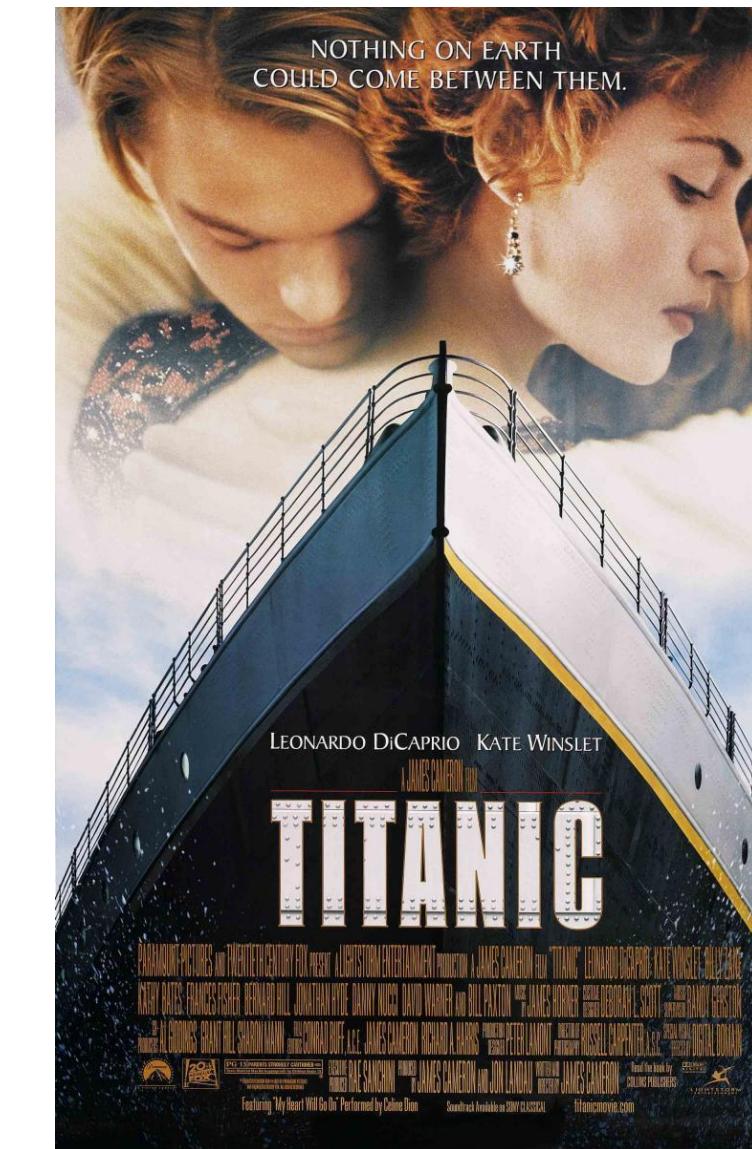
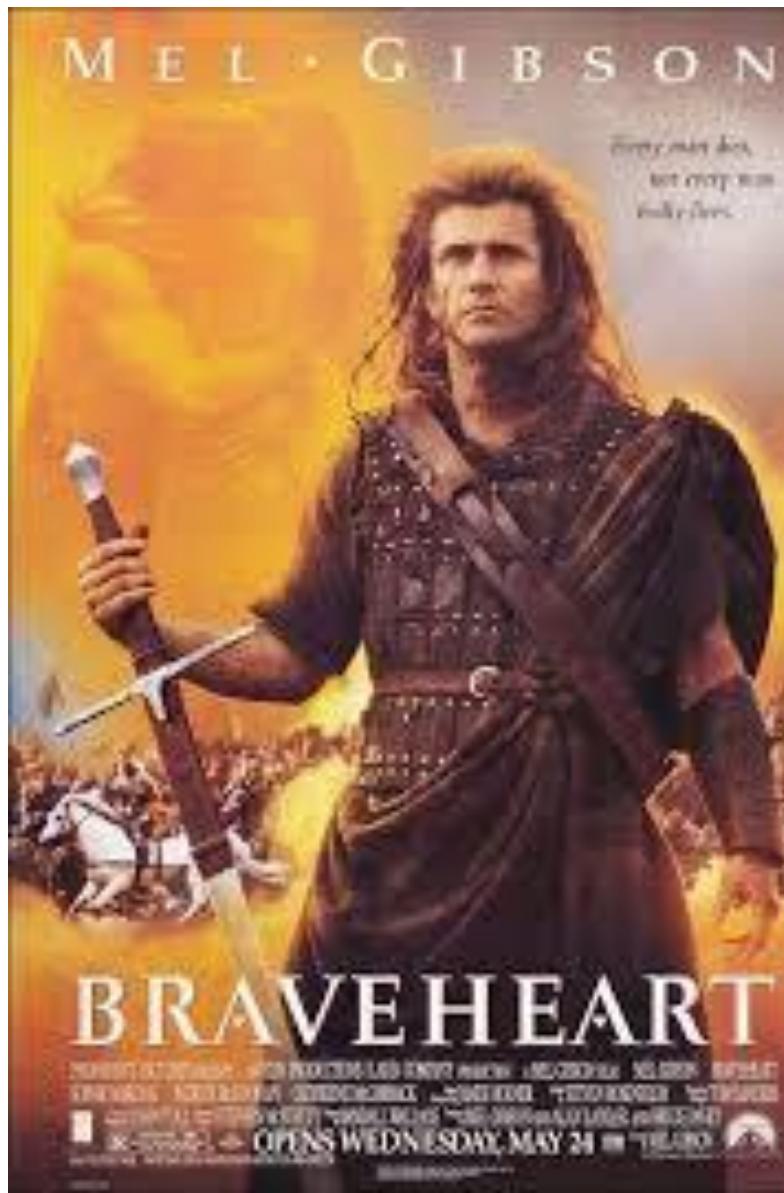
Exist.

Each instance of an entity must be unique and be distinguishable from the others.

All the instances of the same entity must have the same attributes.

EXAMPLE:

An *instance* is a single occurrence. E.g.: If we have an entity called "**Movie**", instances of "Movie" are: *Braveheart*, *Titanic*, *Star Wars*, ...

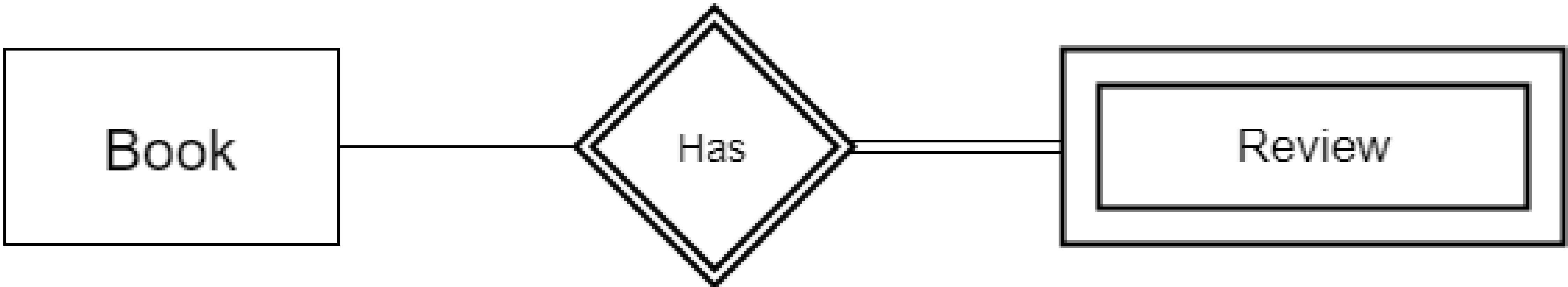


WEAK ENTITY

An entity whose existence depends on another entity is called 'weak entity'.

If we delete a book, its reviews should be also deleted. Weak entities and their weak relationships are represented with a double line.

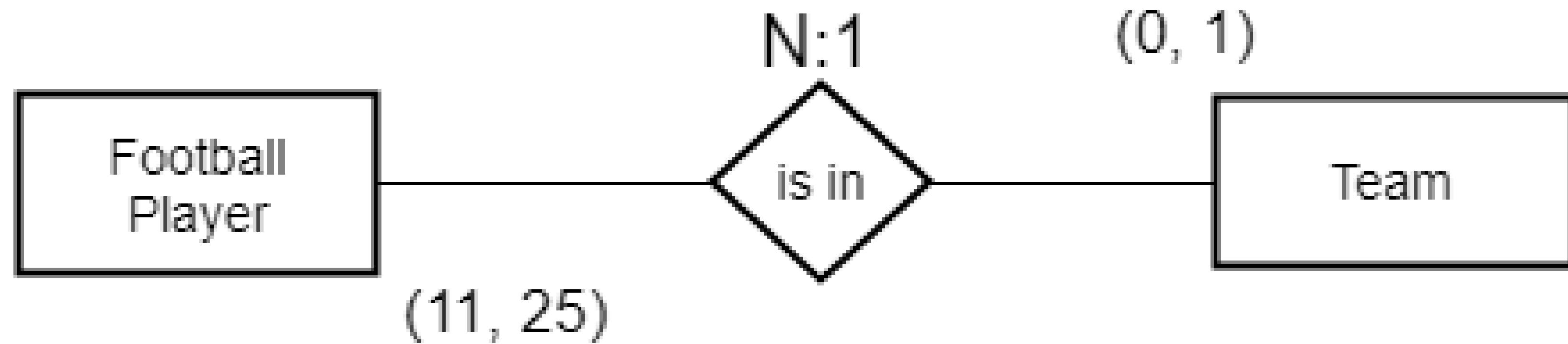
EXAMPLE:



RANGE OF ENTITY

In some ER diagrams, the entity has noted between brackets its maximum and minimum value. For instance, the number of football players in a team is restricted; it has to be between 11 and 25..

EXAMPLE:



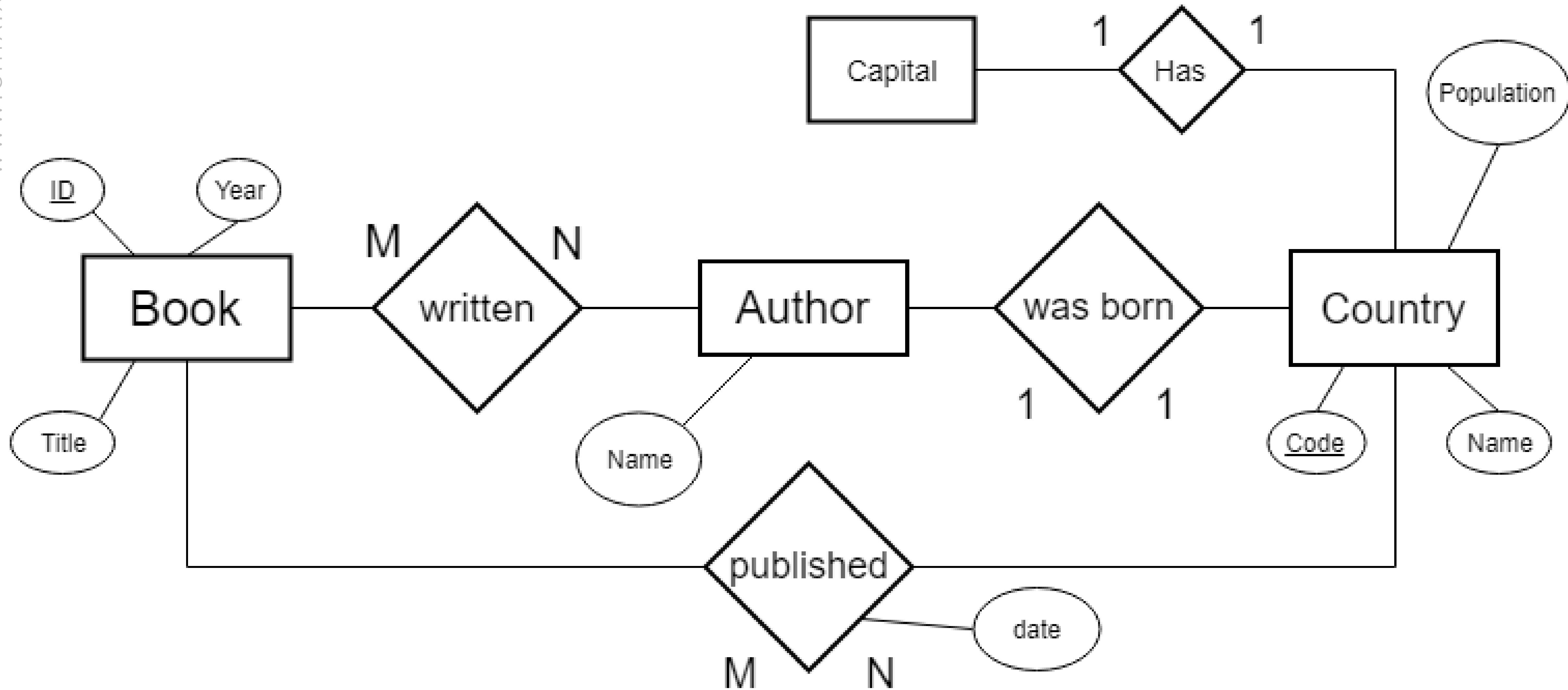
EXERCISE

www.CIIA.XYZ



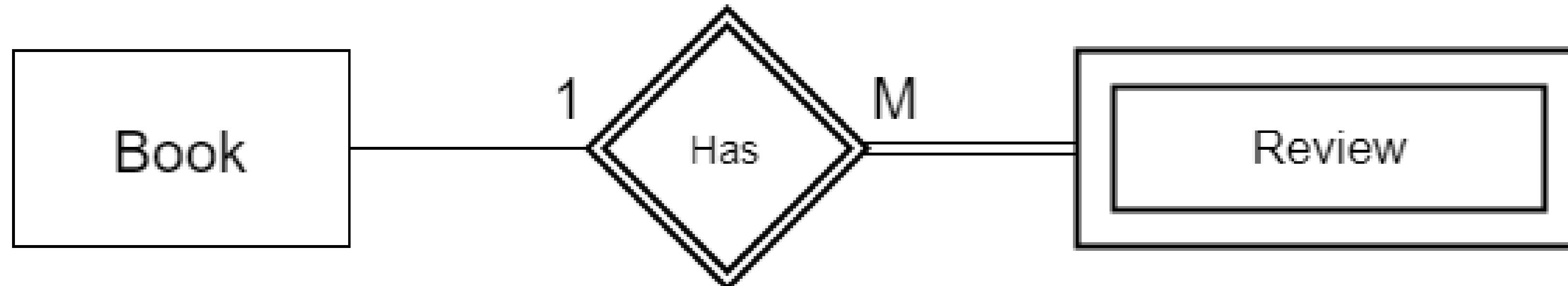
Title	Year	Author	Country
1001 Nights	1706	NULL	SA
The Tragedy of Hamlet	1602	William Shakespeare	UK
Don Quijote de la Mancha	1605	Miguel de Cervantes	ES
Hänsel und Gretel	1893	Engelbert Humperdinck	DE
Pedro Páramo	1959	Juan Rulfo	MX

<https://www.draw.io/>



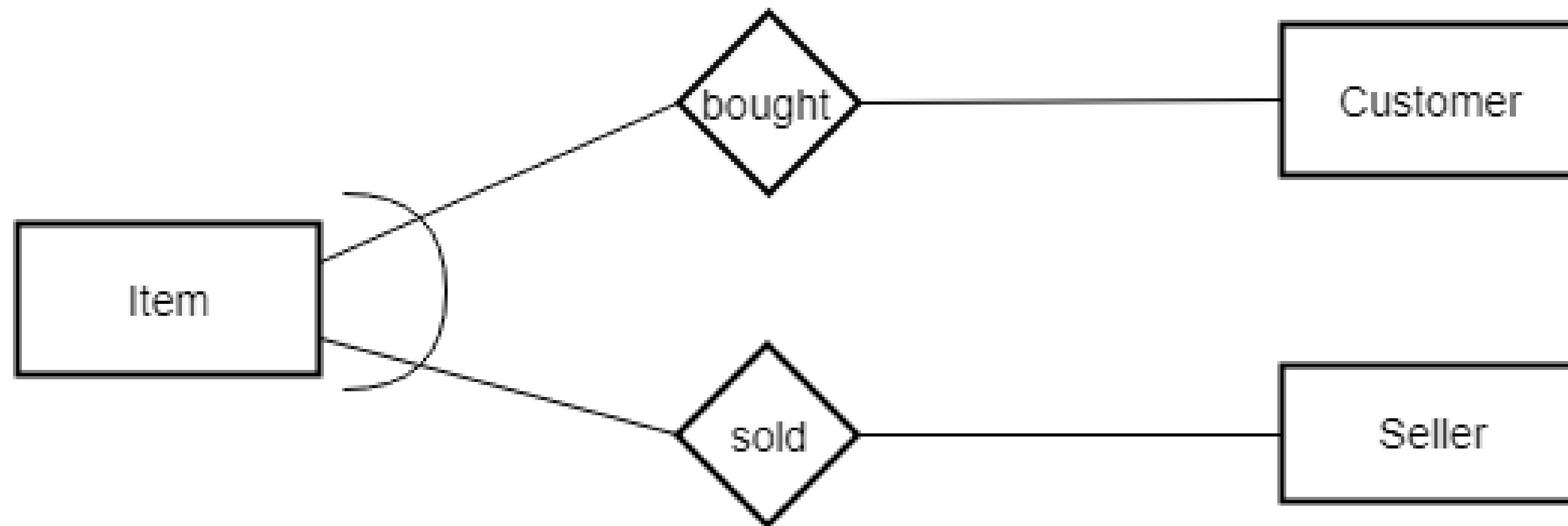
RELATIONSHIPS

- 2 entities may have more than 1 relation.
- A relationship has a cardinality: 1:1, 1:N or N:M. Relationship's cardinalities can be represented in different ways, depending on the convention that we are following.
[5]
- Cardinality indicates how quantitatively related entities are.
- **EXAMPLE:**
- A book may have 0 or many reviews.
- If the book is deleted, the reviews associated will be deleted



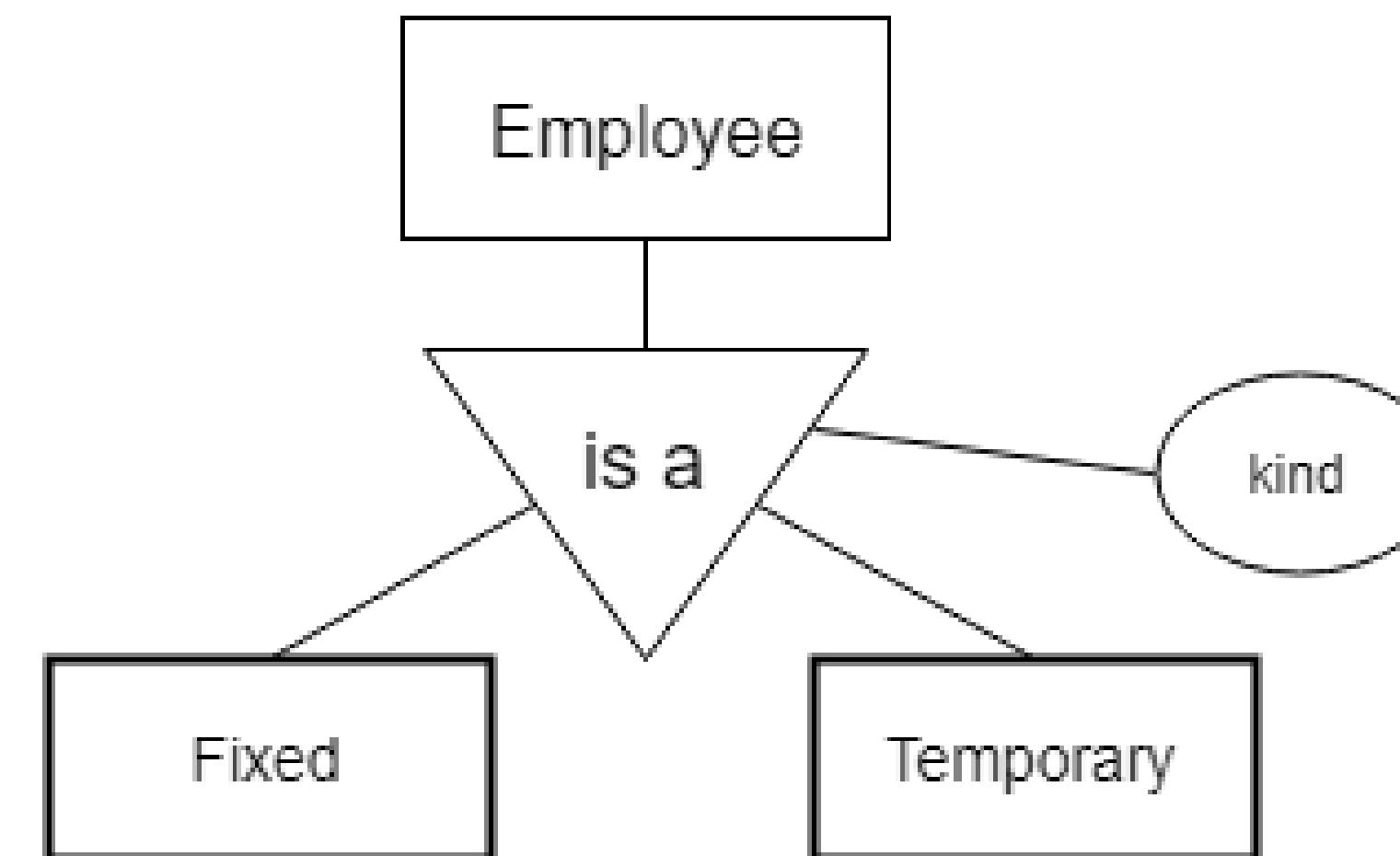
OTHER RELATIONSHIPS

- **Exclusive relationships**
- A relationship is exclusive when each instance of an entity can only be related with one of them.
- An item is either sold or bought:



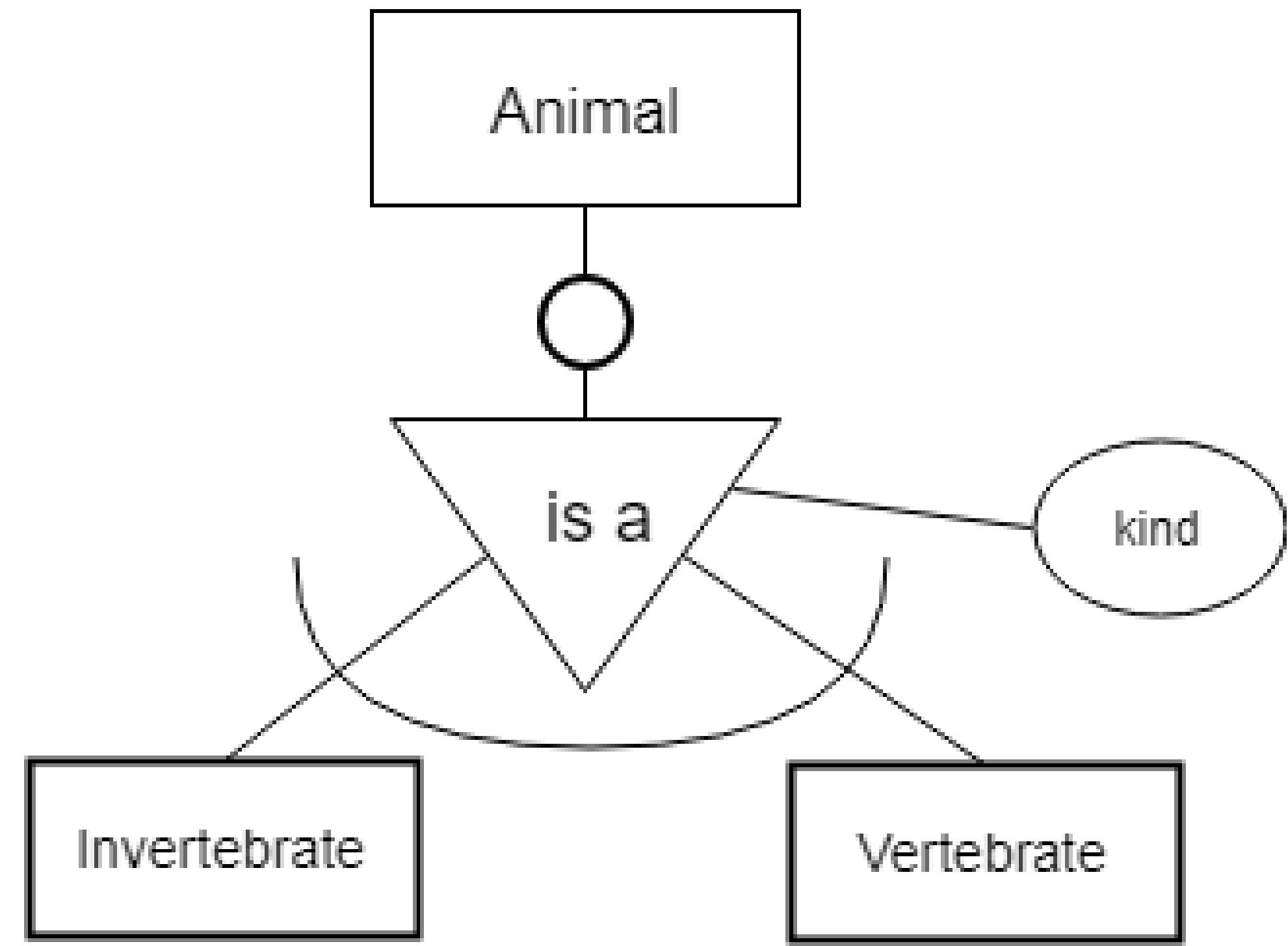
OTHER RELATIONSHIPS

- SUBCLASSES/SUPER CLASSES
- If an entity is decomposed in many subclasses, every instance of a subclass is an instance of a superclass.
- Note that a superclass is not an instance of all subclasses. It is represented with a reverse triangle.
- An employee can be fixed or temporary:



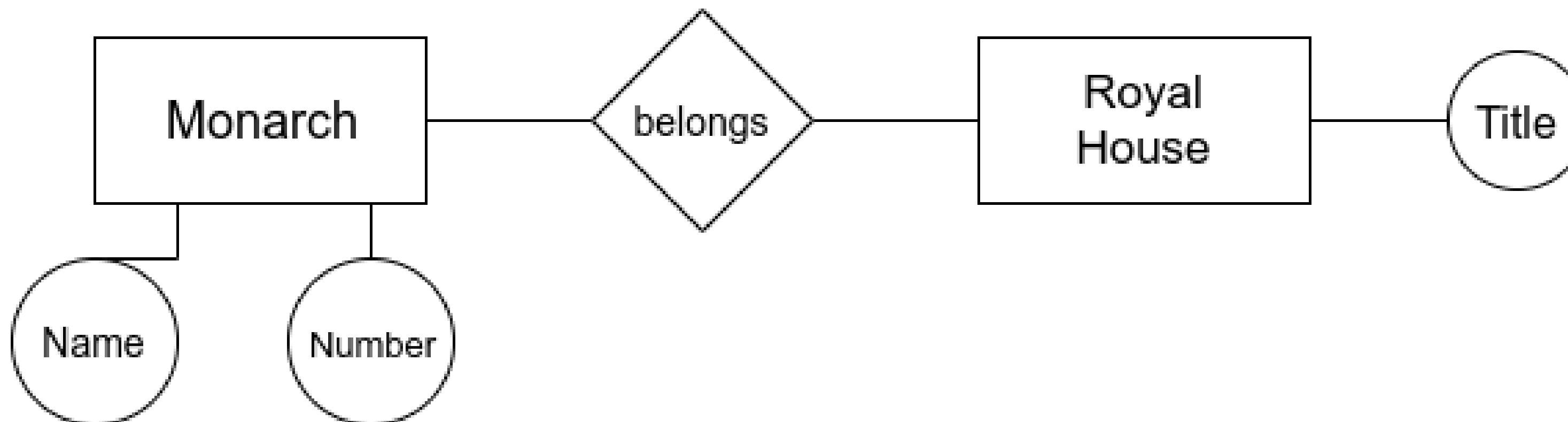
OTHER RELATIONSHIPS

- If there's a tiny circle between the superclass and the reverse triangle, every instance of the superclass must be an instance of subclass.
- The arc indicates that the subclasses are exclusive.
- There is no animal that is vertebrate and invertebrate at the same time:
- $\{\text{Invertebrate}\} \cap \{\text{Vertebrate}\} = \emptyset$



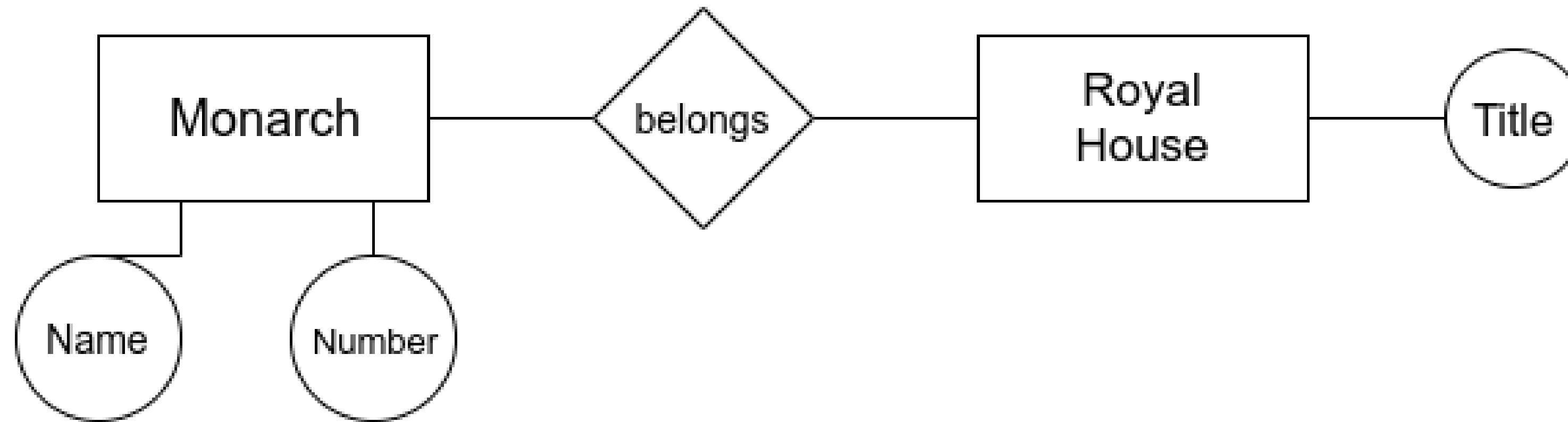
OTHER RELATIONSHIPS

- Attribute
- The set of (1 or more) attributes that allows us to identify a unique instance is called **super-key**.
- The minimum expression of a super-key (a super-key which has the minimum possible number of attributes) is called **candidate key**.
- The chosen **candidate key** by the designer is called **primary key**.



Name	Number	Royal House
Edward	II	Plantagenet
Edward	III	Plantagenet
Richard	III	Plantagenet
Henry	IV	Lancaster

OTHER RELATIONSHIPS



Name	Number	Royal House
Edward	II	Plantagenet
Edward	III	Plantagenet
Richard	III	Plantagenet
Henry	IV	Lancaster



ATRIBUTOS

Types of attributes

- Simple:
 - Their information cannot be split.
- Composite:
 - They can be divided but we prefer to keep them together. E.g.: dates have day, month and year information.
- Single-valued:
 - Attributes that holds exactly one value.
- Multivalued:
 - Attributes that can have more than 1 value. They are represented with a double ellipse. E.g.: numbers of telephone.
- Null:
 - An attribute is null when its entity hasn't that information available.
- Derived:
 - Its value can be inferred from another attribute. Derived attributes are represented with a dashed ellipse. They should be avoided because they are considered a duplicity of information.



THANK YOU

#SHORTCUTTOTHEFUTURE