

# Data Bases

## Relational Model

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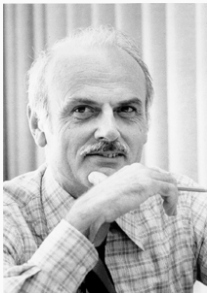
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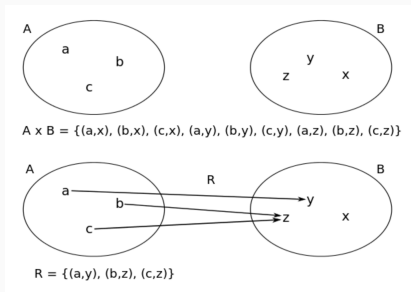
# Introduction

- Created by **E.F. Codd** in 1970 (Turing Award in 1981).
- **First commercial systems** at the end of the **70's**
- **First efficient systems** at the beginning of the **80's**.



# Introduction

- Model based on
  - **Set theory** (e.g.,  $A = \{1, 2, 3\}$  is a set)
  - **Relation** (maths);  $n$ -ary relation on  $n$  sets:  
**Subset of the Cartesian product of the  $n$  sets.**



- There are **formal operations** applied to **relations**.
- **Relational operations** output relations

# Definitions

- Relational Database  $\Rightarrow$  Set of relations.
- Relation  $\Rightarrow$  Unordered table.
  - Column  $\Rightarrow$   
Named attribute having particular **type** or **domain**.
  - Row (or tuple)  $\Rightarrow$   
Instance, each row has one value for each attribute.  
(Missing values  $\rightarrow$  special value "NULL" in SQL).

# Definitions

- Schema  $\Rightarrow$  Structural description of the DB relations.
- E.g. Schema of a relation:  $R(A_1 : D_1, A_2 : D_2, A_n : D_n)$ :
  - $R$  = Relation's name.
  - $A_i$  =  $i$ -th attribute's name.
  - $D_i$  =  $i$ -th attribute's Domain (set of possible values)
  - $n$  = Relation's cardinality
- Two relations  $A$  and  $B$  are **compatible** iff:
  - $A$  and  $B$  have the **same cardinality**.
  - $\forall i$ ;  $i$ -th **domain** of  $A$  =  $i$ -th **domain** of  $B$ .

# Conceptual model → Relational model

## Transform entities (I)

- An **entity** becomes a **relation**.
- The **entity's id** becomes the **relation's primary key**.
- The **entity's attributes** become the **columns' names**.
- **Exercise:** Apply this step to the Entity-Relation model of the previous chapter.

# Conceptual model → Relational model

## Transform associations (II.1)

Associations with at least 1 cardinality 0:1 or 1:1.

- Identify the **relation** corresponding to the **entity** next to the cardinality 0:1 or 1:1.
- Assign to this relation the **ids** of the **other entities** connected by the **association**.
- **Same rule** for **weak entities**.

# Conceptual model → Relational model

## Transform associations (11.2)

- Each **remaining association** becomes a **relation**.
- The **ids of the entities** involved in the association are used as the **relation's primary keys (composite key)**.
- The **association's attributes** become the **columns' names**.
- **Exercise:** Apply this step to the Entity-Relation model of the previous chapter.

# Conceptual model → Relational model

## Special cases (I)

- An **entity** that has its **id** as **only attribute** does **not** become a **relation**.
- It becomes an **attribute** of the **relations** linked to it.
- It is **part** of the **primary key**.

# Conceptual model → Relational model

## Special cases (II)

- Reflexive associations follow the same rules.
- An **attribute** may be **included twice** in the **same relation**.
- Give **different names** to each **attribute**.

# Conceptual model → Relational model

## Exercise

Create a **relational model** from the **Entity-Relation model** of the **previous chapter**.