

### 1 Relational Model concepts

- Was proposed by E.F. Codd
- It's a mathematical concept based on the ideas of sets.
- Relation looks like a table  $\Rightarrow$  contains a set of rows.
- Schema of a relation  $\Rightarrow K(A_1, A_2, \dots, A_n)$ 
  - $K$ : name of relation
  - $A_1, \dots, A_n$ : the attributes
  - Each attribute has a domain
- Relation state  $r(R)$ : subset of the cartesian product of the domains of its attributes.
  - $\hookrightarrow$  Example slide 13.

### 2 Character of relations

- The tuples are not considered to be ordered
- We consider the attributes in  $K(A_1, A_2, \dots, A_n)$  and the values in  $t = \langle v_1, v_2, \dots, v_n \rangle$  to be ordered.
- All values are considered atomic (indivisible)
- Each value in a tuple must be from the domain of the attribute for that column.
- Null value is used to represent values that are unknown, or not available or inapplicable in certain tuples.

### 3 Constraints

- Inherent or implicit constraints: based on the data model itself.
  - Domain constraint: set of valid values for each attribute.
  - Key constraint  $\Rightarrow$  Key and superkey
    - $\hookrightarrow$  a 'minimal' superkey.
  - Entity integrity  $\Rightarrow$  The PK of each relation cannot have null values in any tuple.
  - Referential integrity  $\Rightarrow$  A constraint involving two relations.
    - $\hookrightarrow$  Tuples in the referencing relation  $R_1$  have attributes FK (Foreign Key) that reference the PK of the referenced relation  $R_2$ .
      - $\hookrightarrow$  True value in the FK column in  $R_1$  can be:
        - a) PK in  $R_2$
        - b) null
- Application based or semantic constraints
  - Cannot be expressed by the model per se
    - $\hookrightarrow$  We will see in SQL

### 4

- The set of relation schemas that belongs to the same DB.
- $S$  is the name of the whole DB schema.
- $S = \{R_1, R_2, \dots, R_n\}$  and a set of IC
- $R_1, R_2, \dots, R_n$  are the names of the individual relation schemas within the database  $S$ .
- Is the set of relation states  $DB = \{r_1, r_2, \dots, r_n\}$  such that  $r_i$  is a state of  $R_i$ .
- Is sometimes called snapshot
- A DB state that does not meet the constraints is an invalid state.

### 5

- Operations on relations
  - INSERT may violate any of the constraints
    - $\hookrightarrow$  slide 40
    - Domain constraint
    - Key constraint
    - Referential integrity constraint
    - Entity integrity
  - DELETE may violate only referential integrity
    - $\hookrightarrow$  slide 41
    - If the PK value of the tuple being deleted is referenced from other tuples in DB.
      - Can be remedied by
        - Restrict: reject the deletion
        - Cascade: set null / set default.
  - UPDATE may violate domain constraint and not null constraint
    - $\hookrightarrow$  slide 42
    - Any of other constraints may also be violated, depending on the attribute being update:
      - Updating the PK (Primary Key)
      - Updating the FK (Foreign Key)
      - Updating an ordinary attribute.