شُروع اَللہ کے پاک نام سے جو بڑا مہر بان نہایت رحم والا ہے

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Database Systems

Lecture 9

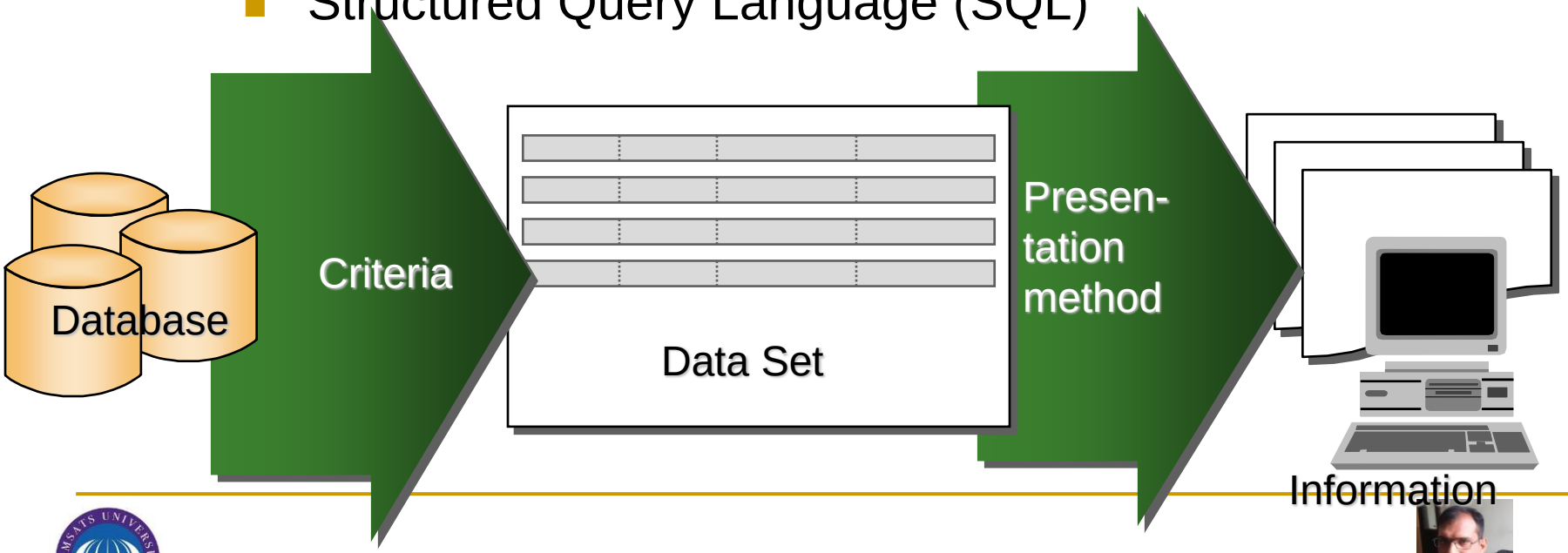
Relational Data Model
Relation/Table in Relational Model
Keys and Constraints

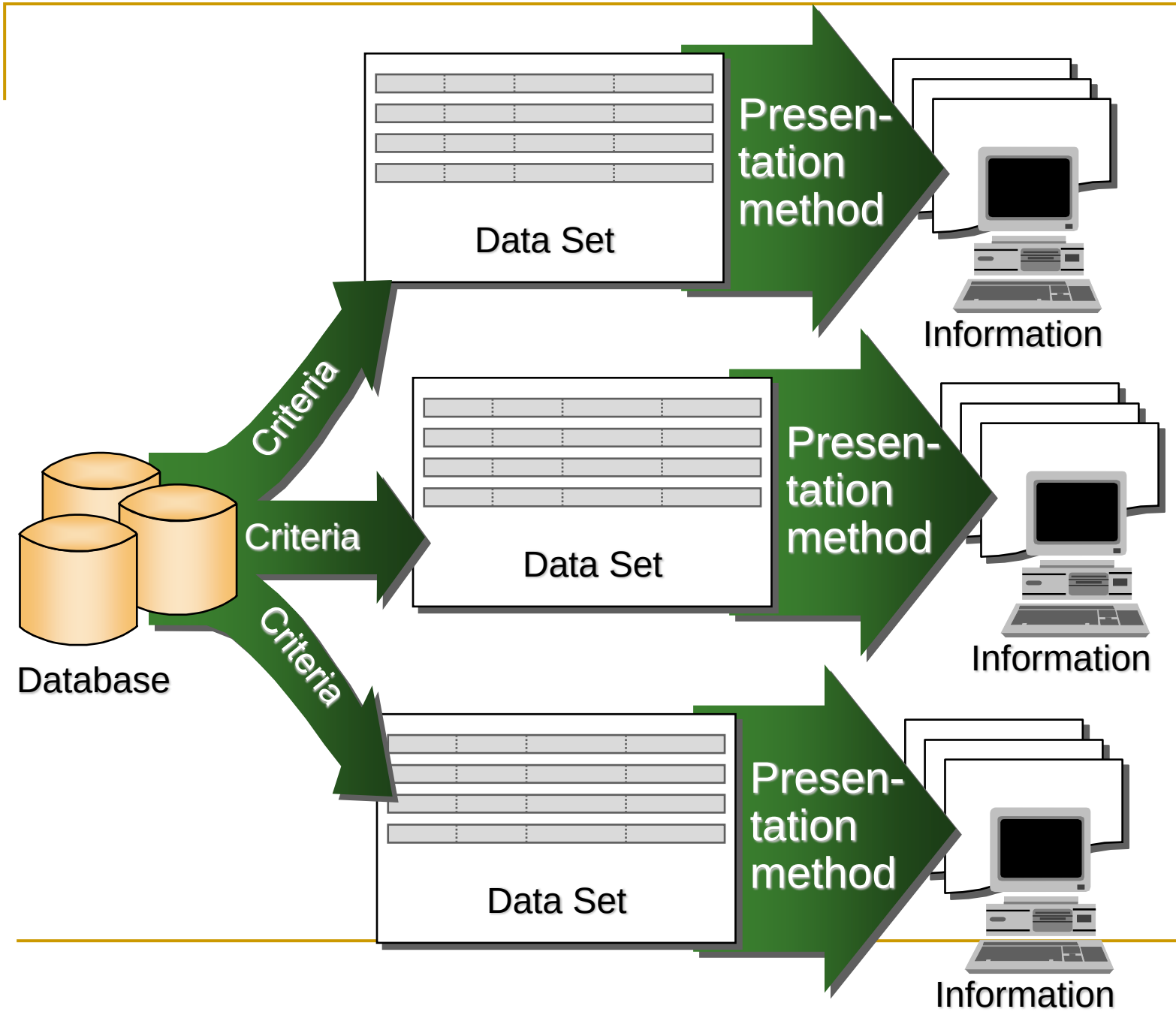
Recall Lecture 8

- Functions of DBMS,
- DBMS Architecture
- Metadata (Data Dictionaries)

Relational Model

- Objectives
  - A degree of data independence
  - Address data semantic, consistency and redundancy problems
  - Set-oriented data manipulation language
    - Structured Query Language (SQL)

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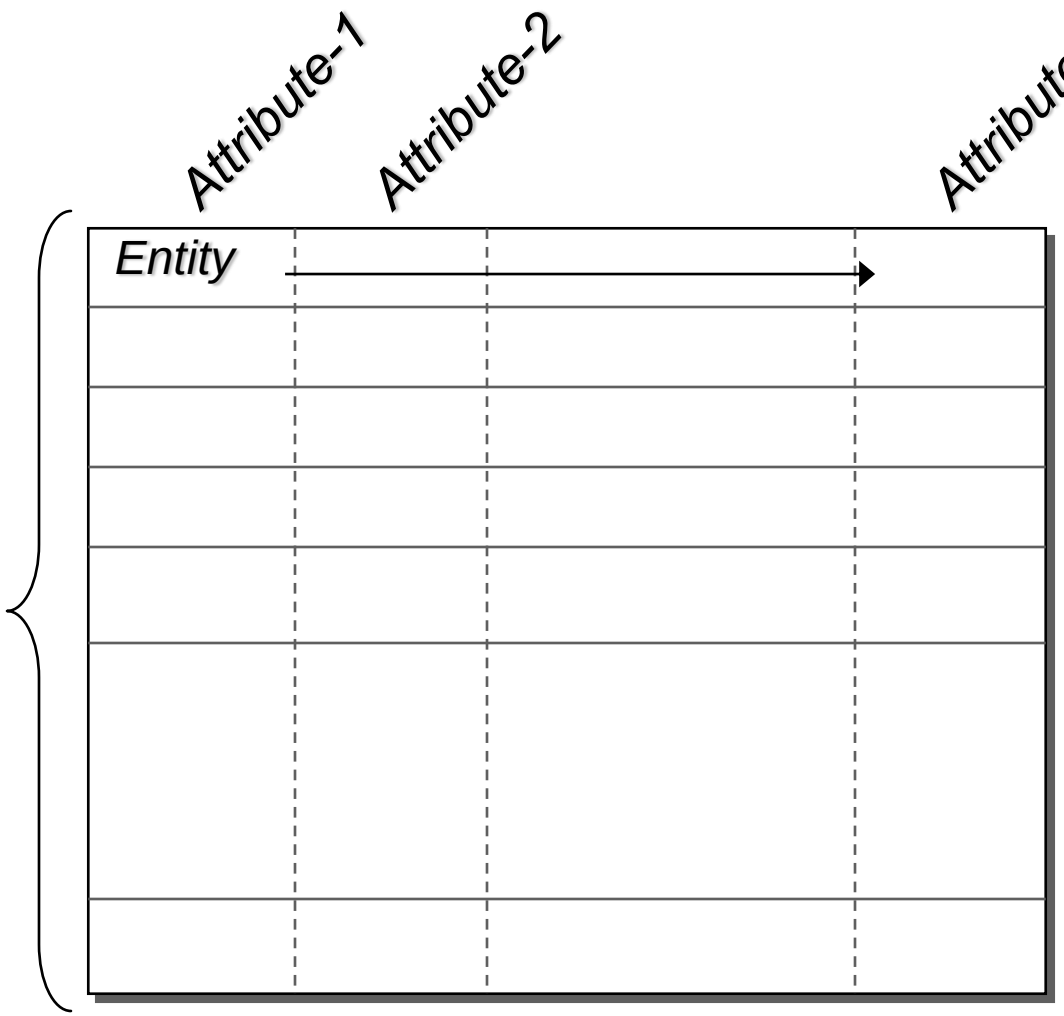
Domain = all values an attribute can assume



Relation

Tuples (rows)

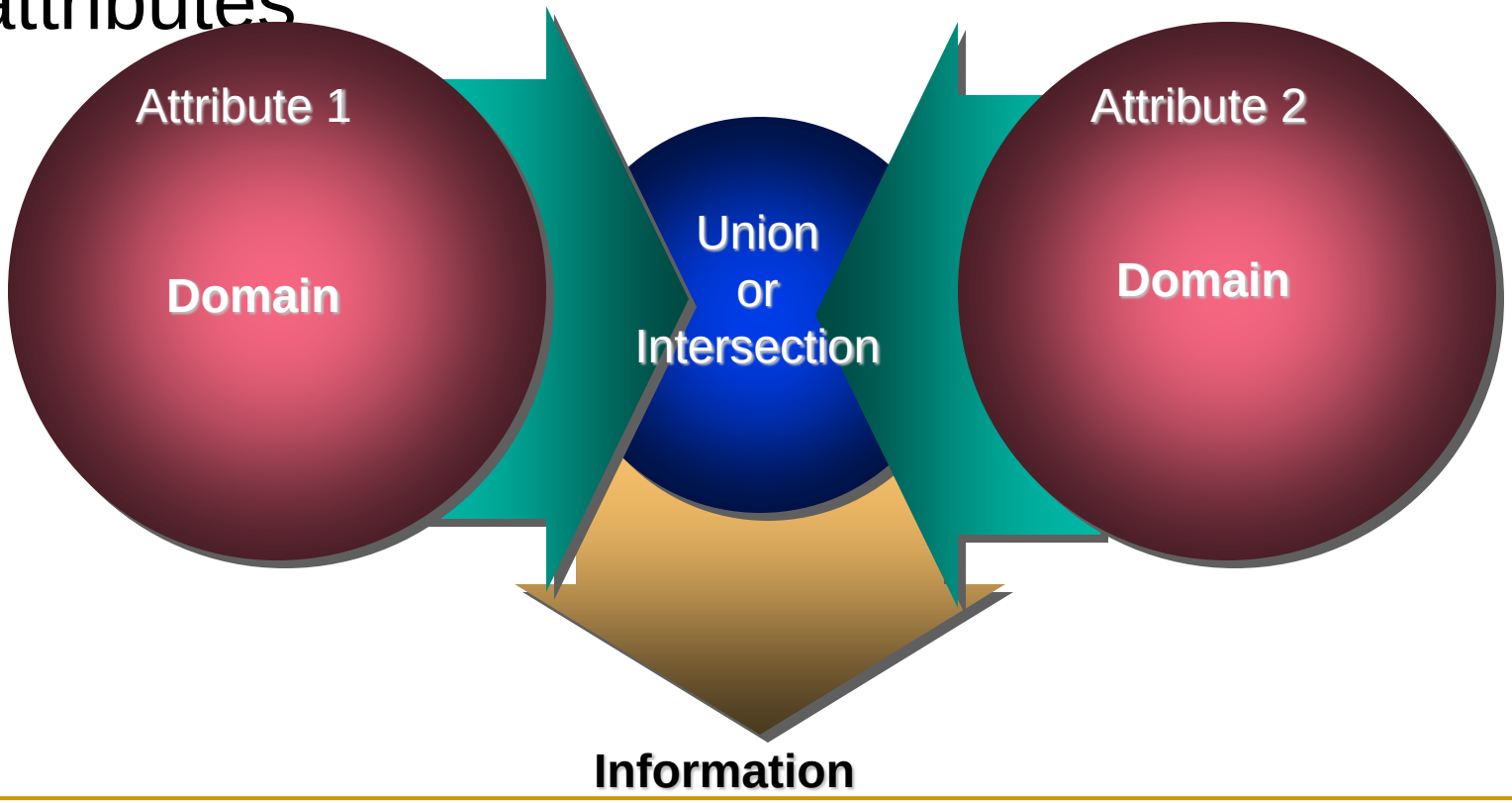
- Cardinalitiy = number of tuples

Attributes (columns)

- Degree of a relation = number of attributes

Domain of an Attribute

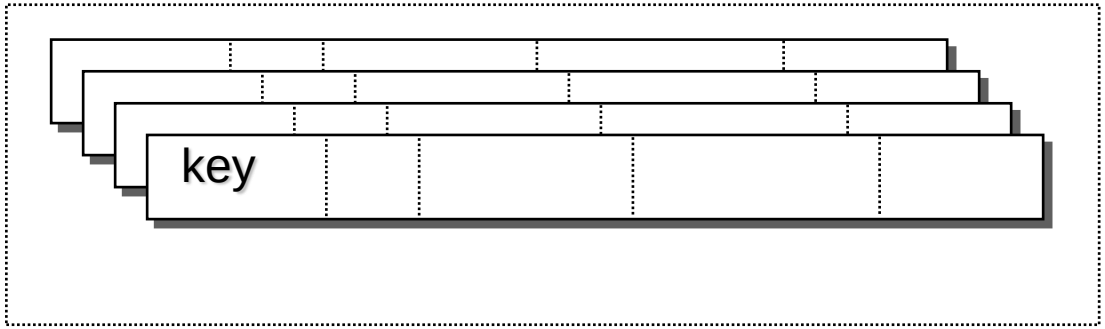
- Set of allowable values for one or more attributes



Properties of Relations

- Distinct (i.e., unique) relation name
- Each cell contains exactly one atomic (single) value
  - No repeating groups
- Distinct attribute name
- The values of an attribute come from the same domain
- Order of attributes has no significance
- Each tuple is distinct (i.e., unique)
  - No duplicate tuples
- Order of tuples has no significance

Unique Identification of a Relation



Relation

?

KEYS Identifications

How to Identify a Tuple

- **Super key**
- **Candidate key (Unique_ Constraint)**
  - Unique key
- **Primary key (PK_ Constraint)**
  - Single Value Primary Key (PK_ Constraint)
  - Composite Primary Key (PK_ Constraint)
  - Surrogate Key (PK_ Constraint)
- **Foreign Key (FK_ Constraint)**

Identifying a Tuple

- **Super key**
  - An attribute or a set of attributes that uniquely identifies a tuple within a relation
- **Candidate key**
  - A super key such that no proper subset is a superkey within the relation
    - Uniquely identifies the tuple (uniqueness)
    - Contains no unique subset (irreducibility)
- **Primary key**
  - The candidate key that is selected to identify tuples uniquely within a relation
    - Should remain constant over the life of the tuple
    - Most *efficient* way of identifying a tuple

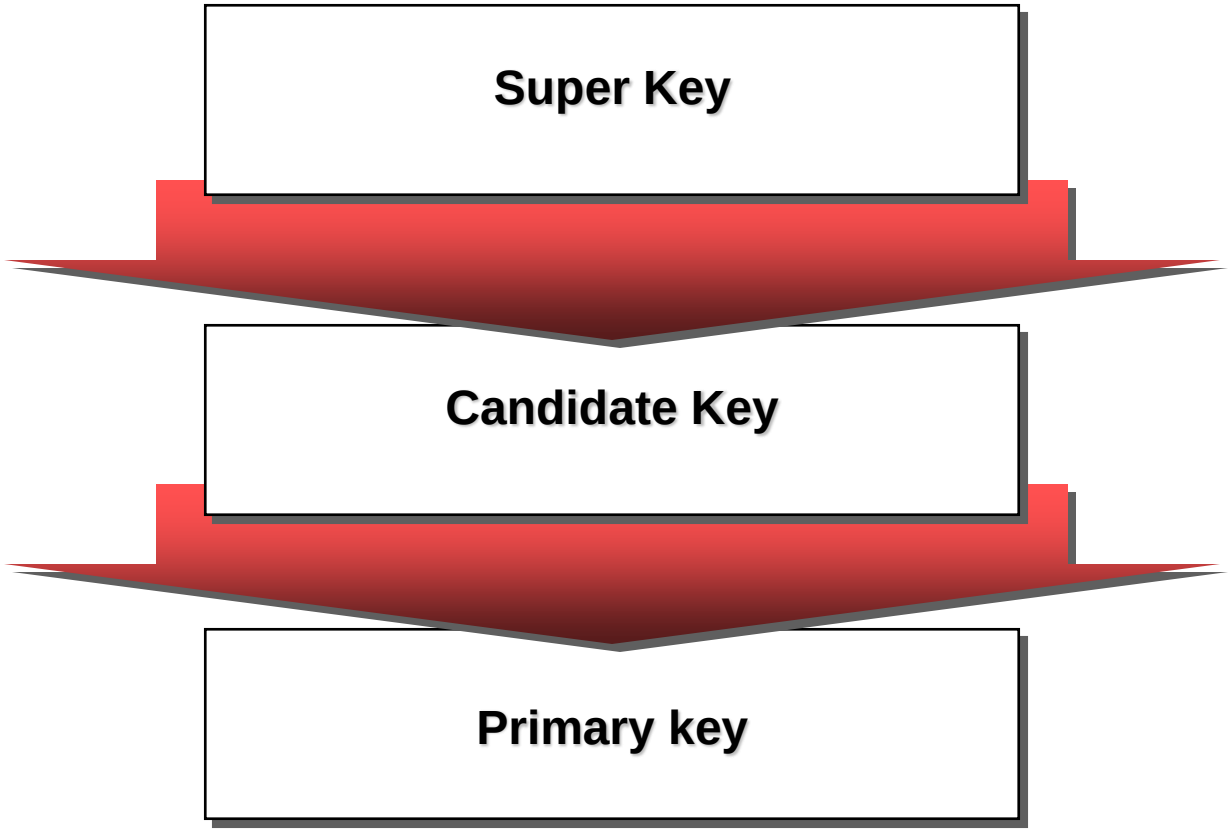
Selecting a Unique key

- The candidate key or unique key is identified when
  - The attribute (value) behavior is unique
    - CREATE TABLE Persons (
      ID int **NOT NULL,**
      LastName varchar(255) **NOT NULL,**
      FirstName varchar(255),
      Age int,
      CONSTRAINT UC_Person UNIQUE (ID,LastName)
      );

Selecting a Primary Key

- Criteria
  - An *efficient* way of identifying an entity
  - The attribute (value) remains constant over the life of the entity
    - Never changes
      - CREATE TABLE Persons (
        ID int **NOT NULL,**
        LastName varchar(255) **NOT NULL,**
        FirstName varchar(255),
        Age int,
        CONSTRAINT PK_Person PRIMARY KEY (ID,LastName)
        );

Finding the Right Primary Key



Self Assignment

1. How to change the value of primary Key for an entity ?
2. How to change the Primary key for a table?

Composite Primary Key

- Composite key consists of more than one attributes.
  - Example: Consider a Relation or Table R1. Let A,B,C,D,E are the attributes of this relation.

    R(A,B,C,D,E)

  - A→BCDE This means the attribute 'A' uniquely determines the other attributes B,C,D,E.
  - BC→ADE This means the attributes 'BC' jointly determines all the other attributes A,D,E in the relation.

    Primary Key :A
    Candidate Keys :A, BC
    Super Keys : A,BC,ABC,AD

SURROGATE KEY

- A surrogate key is like a artificial **primary key** which is generated automatically by the system and the value of surrogate key is numeric and it is automatically incremented for each new row.

- A **surrogate key** is any column or set of columns that can be declared as the primary **key** instead of a "real" or natural **key**.

SURROGATE KEY

- Generally a DBMS designer needs a surrogate key when
  - To Avoid Composite PK
  - The primary key is used inappropriately
  - Mostly used in De-normalized DBs

Syntax for MySQL

```
CREATE TABLE Persons (
    Personid int
        NOT NULL AUTO_INCREMENT,

    LastName varchar(255) NOT NULL,
    FirstName varchar(255),
    Age int,
  PRIMARY KEY (Personid)
);
```

Syntax for SQL Server

- CREATE TABLE Persons (
  Personid int
  IDENTITY(1,1) PRIMARY KEY,
  LastName varchar(255) **NOT NULL,**
  FirstName varchar(255),
  Age int
  );

Advantages and Disadvantages of Surrogate Keys

- Advantages
  - Reduced Composite key complexities
  - Flexible retrieval in Denormalized DB
  - Can be good for management of Multi versions of Data
- Disadvantages
  - Value with no business meaning
  - User can add duplicated records

In Next Lecture

- SQL Constraints
- Creation of Subschemas using Views
  - SQL Views
- INDEXES
  - SQL Indexes

Thanks