Database Development & Design

ATTRIBUTES, KEYS, AND CONSTRAINTS

Outline

- Attributes
- keys Types
- Keys Categories
- Database constraints

Attributes

Attribute: attributes are the describing characteristics or properties that define all items pertaining to a certain category applied to all cells of a column.

- **Simple attribute**: are atomic values, which cannot be divided further; For example, SSN or Sex.
- **Composite attribute**: are made of more than one simple attribute; For the example the Address attribute of the EMPLOYEE entity can be subdivided into (Street_address, City, State, and Zip). Another example the Full Name can be subdivided into (FirstName, MiddleName, and LastName).
- **Derived attribute**: are the attributes that do not exist in the physical database, but their values are derived from other attributes present in the database. For example, the value of Age can be determined from the current (today's) date and the value of that person's Birth_date.
- **Multi-value attribute**: Multi-value attributes may contain more than one values. For the example a College_degrees attribute for a person: one person may not have a college degree, another person may have one, and a third person may have two or more degrees. Another example, color of a car; a car may have more than one color.
- **Complex attribute:** multi-value attribute and composite attribute. For example, an employee with two addresses.

Keys

A **key** is a field in a table that is used in the identification of that record. They ensure each record within a table can be uniquely identified by one or a combination of fields within the table. They help enforce integrity and help identify the relationship between tables.

Keys Types:

- Super Key
- Candidate Key
- Primary Key
- Secondary Key or Alternative Key
- Foreign Key

Keys Types

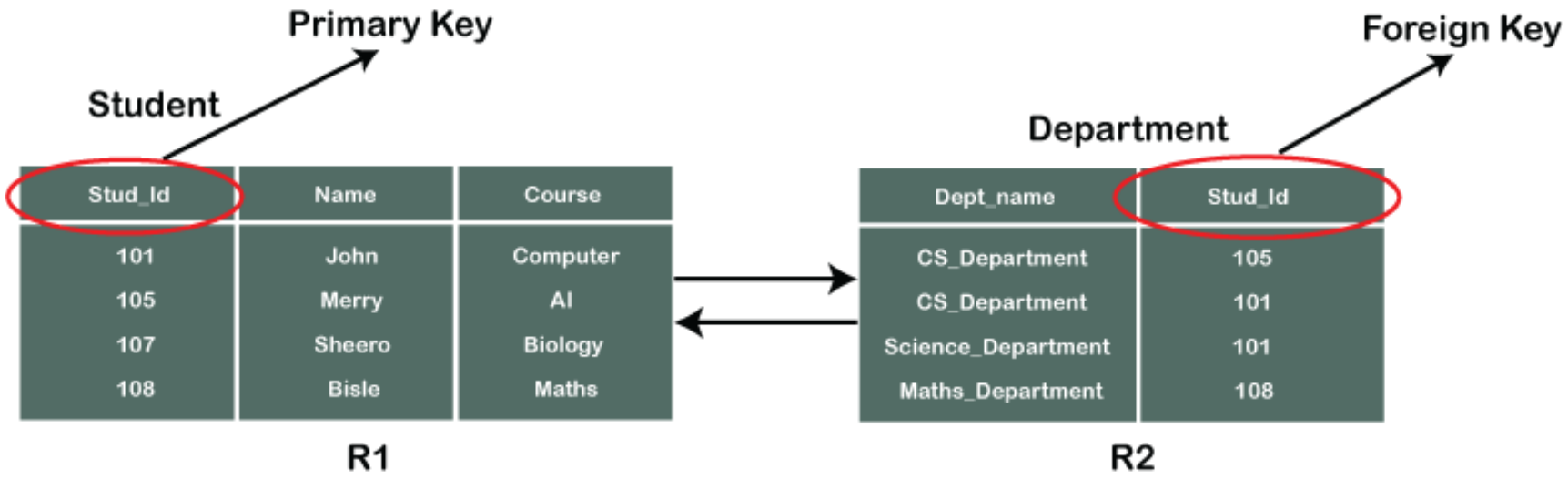
- **Super Key (SK):** any combination of fields within a table that uniquely identifies each record within that table (No two tuples will have the same value for SK). Any set of attributes that includes a key is a super key.
- **Candidate Key:** a key that contains the **least possible attributes**, and that maintains the criteria that it can uniquely identify any table row (subset of a super key).
- **Primary Key:** One candidate key from the set of all possible candidate keys is chosen to be the primary key.
- **Secondary Key or Alternative Key:** keys left after chose the PK from candidate keys.
- **Foreign Key:** a primary key from one table that appears as a field in another table, where the first table has a relationship to the second table.

Keys – Example

StudID	Stud_fname	Stud_lname	Stud_phone	Stud_email	Stud_address	Department_No

- **Super keys:** StudID, (StudID, fname), (StudID, lname), (StudID, fname, lname),(Stud_fname, Stud_lname, Stud_email),…, etc.
- **Candidate keys**: StudID, Stud_phone, Stud_email
- **Primary key**: StudID
- **Alternative Keys**: Stud_phone , Stud_email
- **Foreign Key:** Department_No

Keys – Example



PK Vs. FK

	Primary key	Foreign key
Basic	It is used to uniquely identify data in the table.	It is used to maintain relationship between tables.
NULL	PK Can not accept null values	FK can accept multiple null values
Duplicate	Only one primary key in a table	More than one foreign key in a table

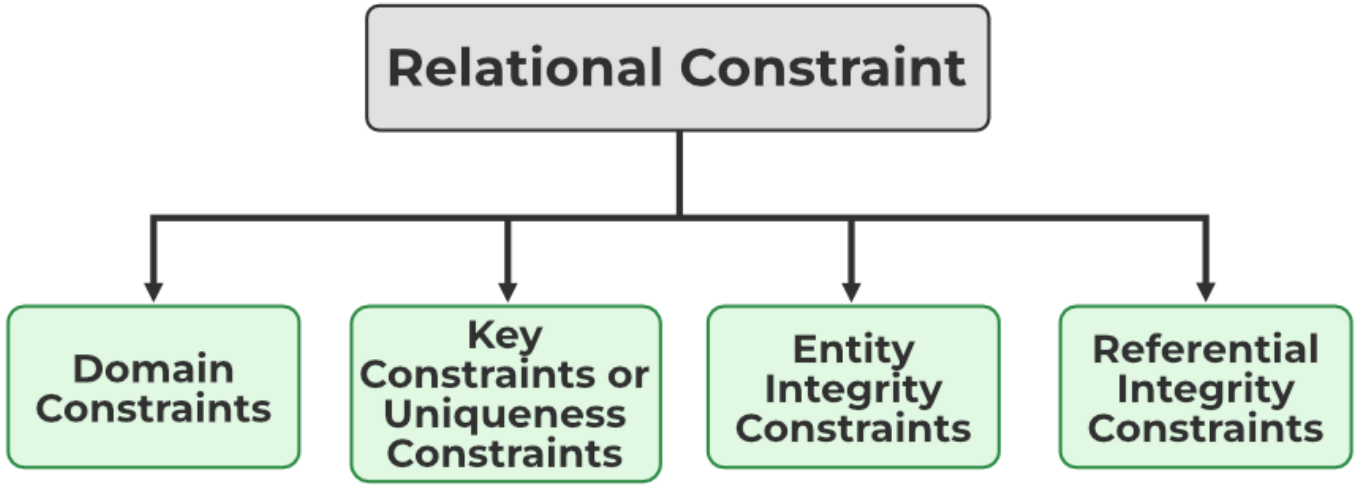
Keys Categories

- **Natural Key**:
  - a natural key is an attribute that exists in the real world or is used by the business. It can be used to uniquely identify the row.
  - An example of a natural key is a Social Security Number (for US citizens). It's usually a unique number that applies to a person and has a use for tax purposes. In Australia, they have a Tax File Number (TFN) which has a similar purpose. It's a way to uniquely identify a record, and actually has a meaning in the world outside the database.

- **Surrogate Key:**
  - A surrogate key is an attribute that is invented or made up for the sole purpose of being used as the primary key. It has no value to the business or the real world.
  - Surrogate keys are often used when there is no other way to identify a record – when there is no natural key. They are often an integer value, starting at 1 and incrementing for each new record.
  - Example: customer ID , employee ID, etc.

Constraints

Constraints: restrictions or sets of rules imposed on the database contents. It validates the quality of the database. It validates the various operations like data insertion, updating, and other processes which have to be performed without affecting the integrity of the data. So, it protects us against threats/damages to the database.



Constraints

- **NOT NULL:** makes sure that a column does not hold NULL value.
- **UNIQUE**: enforces a column to have unique values (cannot have duplicate values).
- **DEFAULT**: provides a default value to a column when there is no value provided while inserting a record into a table.
- **CHECK**: used for specifying range of values for a particular column of a table.
- **DATA TYPE**: Each table has certain set of columns, and each column allows a same type of data, based on its data type. The column does not accept values of any other data type.
- **Domain constraints**: data type + Constraints (NOT NULL / UNIQUE / CHECK / DEFAULT).
- **Referential Integrity Constraints (Mapping constraints):** foreign key constraints and mapping cardinality (relation).

References

- Elmasri, R., & Navathe, S. (2017). Fundamentals of database systems (Vol. 7). Pearson
- Eng. Lina’s slides
- Dr. Raneem’s slides.