The Relational Data Model and Relational Database Constraints

RELATIONAL MODEL (RM)

- Represents the database as a collection of relations.
- A relation is nothing but a table of values.
- Every row in the table represents a collection of related data values.
- These rows in the table denote a real-world entity or relationship.
- The table name and column names are helpful to interpret the meaning of values in each row.
- The data are represented as a set of relations.
- In the relational model, data are stored as tables.

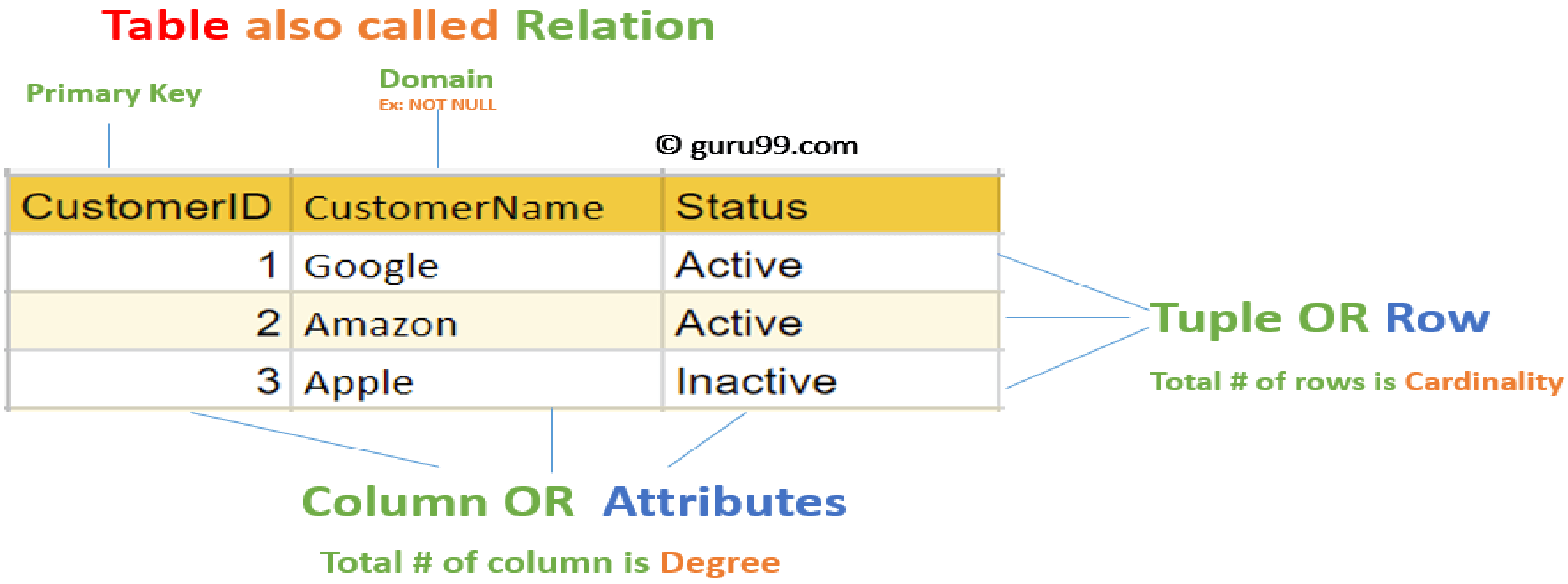

Table also called Relation

Primary Key

Domain

Ex: NOT NULL

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CustomerID	CustomerName	Status
1	Google	Active
2	Amazon	Active
3	Apple	Inactive

Tuple OR Row

Total # of rows is Cardinality

Column OR Attributes

Total # of column is Degree

Attribute: Each column in a Table. Attributes are the properties which define a relation. e.g., Student_Rollno, NAME,etc.

Tables – In the Relational model the, relations are saved in the table format. It is stored along with its entities. A table has two properties rows and columns. Rows represent records and columns represent attributes.

Tuple – It is nothing but a single row of a table, which contains a single record.

Relation Schema: A relation schema represents the name of the relation with its attributes.

Degree: The total number of attributes which in the relation is called the degree of the relation.

Cardinality: Total number of rows present in the Table.

Column: The column represents the set of values for a specific attribute.

Relation instance – Relation instance is a finite set of tuples in the RDBMS system. Relation instances never have duplicate tuples.

Relation key - Every row has one, two or multiple attributes, which is called relation key.

Attribute domain – Every attribute has some pre-defined value and scope which is known as attribute domain

Properties of Relations

- Values are atomic.
- Column values are of the same kind.
- Each row is unique.
- The sequence of columns is insignificant.
- The sequence of rows is insignificant.
- Each column must have a unique name.

Formal and informal term in relational model

Informal term	Formal term
Table	Relation
Column/fields	Attributes
All possible column values	Domain
Row	Tuple
Table definition	Schema of Relation

Advantages of using Relational model

Simplicity: A relational data model is simpler than the hierarchical and network model.

Structural Independence: The relational database is only concerned with data and not with a structure. This can improve the performance of the model.

Easy to use: The relational model is easy as tables consisting of rows and columns is quite natural and simple to understand

Query capability: It makes possible for a high-level query language like SQL to avoid complex database navigation.

Data independence: The structure of a database can be changed without having to change any application.

Scalable: Regarding a number of records, or rows, and the number of fields, a database should be enlarged to enhance its usability.

Disadvantages of using Relational model

- Few relational databases have limits on field lengths which can't be exceeded.
- Relational databases can sometimes become complex as the amount of data grows, and the relations between pieces of data become more complicated.
- Complex relational database systems may lead to isolated databases where the information cannot be shared from one system to another.

Relational Integrity Constraints

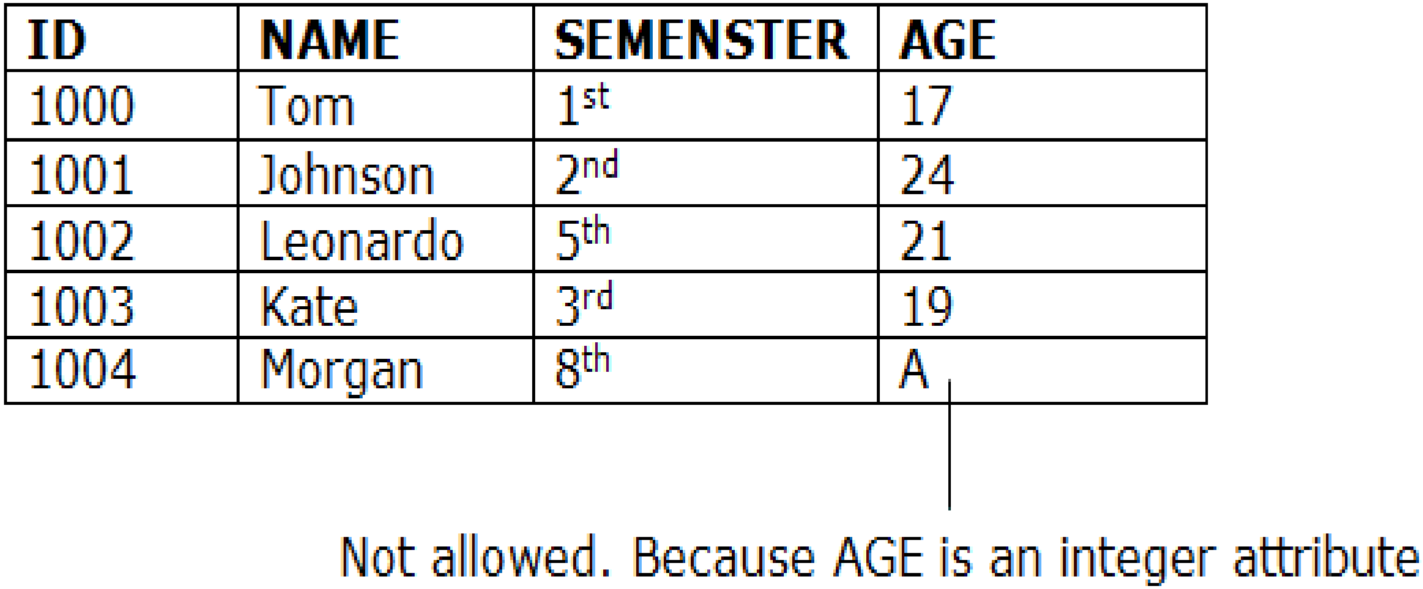
- Integrity constraints are a set of rules. It is used to maintain the quality of information.
- Integrity constraints ensure that the data insertion, updating, and other processes have to be performed in such a way that data integrity is not affected.
- Thus, integrity constraint is used to guard against accidental damage to the database.

Types of Integrity Constraint

- Domain Constraints
- Primary key constraints
- Referential constraints
- Not null constraints
- Default constraints
- Check constraints

Domain constraints

- Domain constraints can be defined as the definition of a valid set of values for an attribute.
- The data type of domain includes string, character, integer, time, date, currency, etc. The value of the attribute must be available in the corresponding domain.

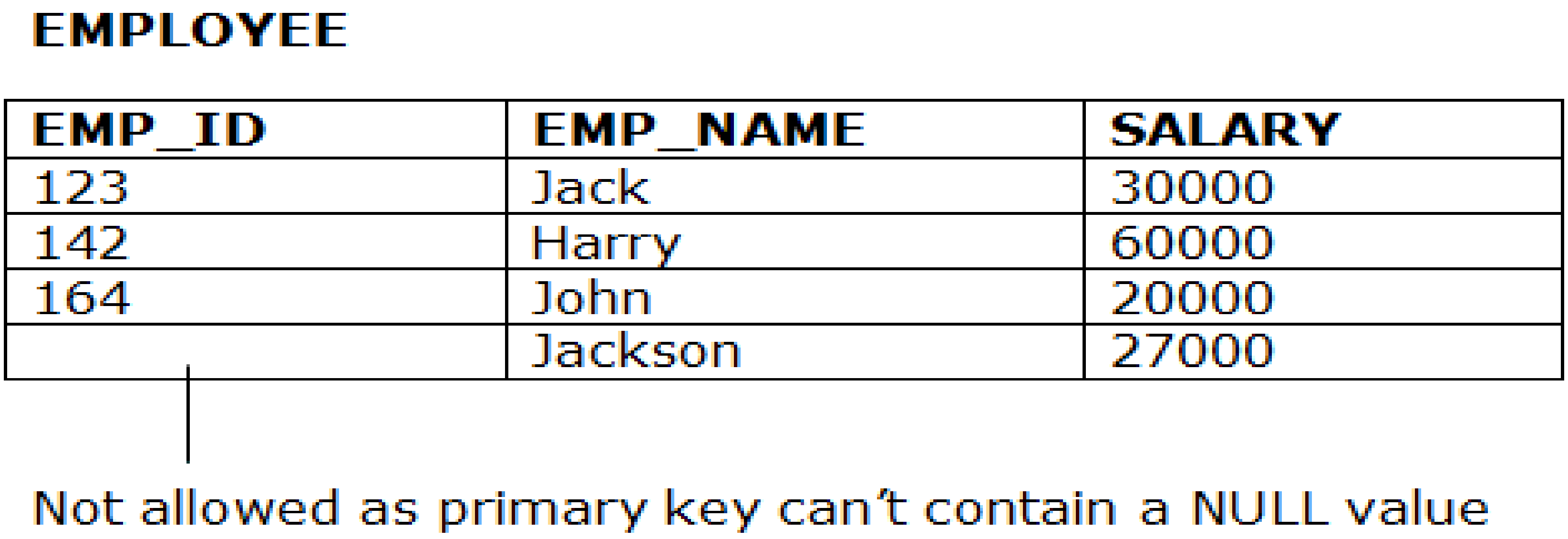


ID	NAME	SEMENSTER	AGE
1000	Tom	1st	17
1001	Johnson	2nd	24
1002	Leonardo	5th	21
1003	Kate	3rd	19
1004	Morgan	8th	A

Not allowed. Because AGE is an integer attribute

Primary Key constraints

- The Primary key (entity integrity) constraint states that primary key value can't be null.
- This is because the primary key value is used to identify individual rows in relation and if the primary key has a null value, then we can't identify those rows.
- A table can contain a null value other than the primary key field.



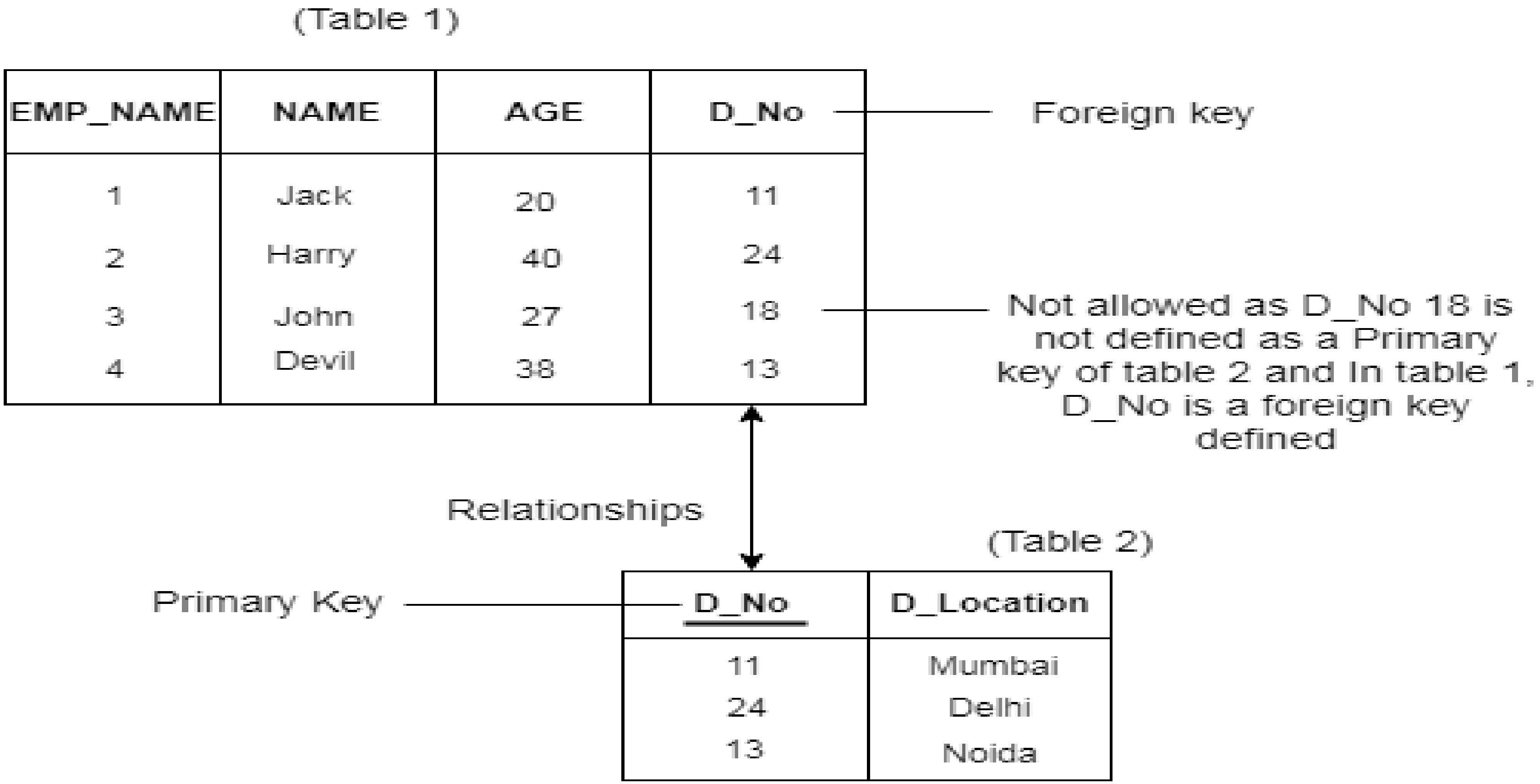
EMPLOYEE

EMP_ID	EMP_NAME	SALARY
123	Jack	30000
142	Harry	60000
164	John	20000
	Jackson	27000

Not allowed as primary key can't contain a NULL value

Referential Integrity Constraints

- A referential integrity constraint is specified between two tables.
- In the Referential integrity constraints, if a foreign key in Table 1 refers to the Primary Key of Table 2, then every value of the Foreign Key in Table 1 must be null or be available in Table 2.



(Table 1)

EMP_NAME	NAME	AGE	D_No
1	Jack	20	11
2	Harry	40	24
3	John	27	18
4	Devil	38	13

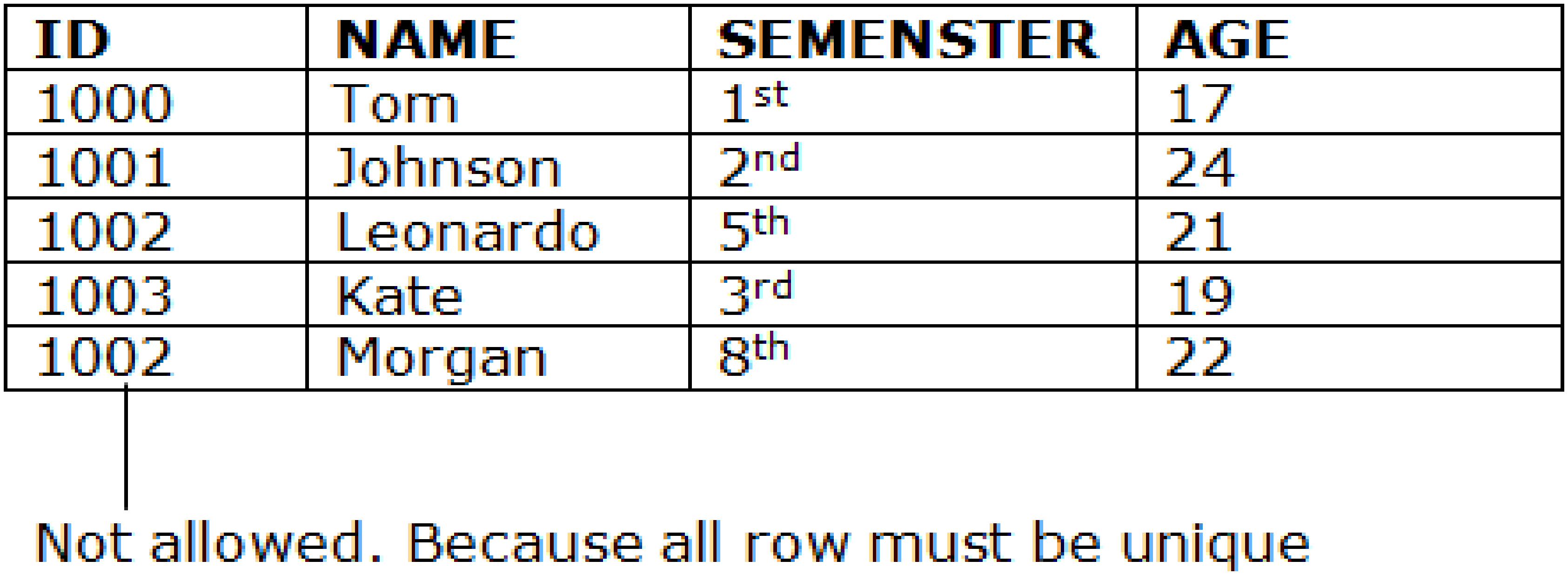
Not allowed as D_No 18 is not defined as a Primary key of table 2 and In table 1, D_No is a foreign key defined

(Table 2)

D_No	D_Location
11	Mumbai
24	Delhi
13	Noida

Unique Key constraints

➢Keys are the entity set that is used to identify an entity within its entity set uniquely.



ID	NAME	SEMENSTER	AGE
1000	Tom	1st	17
1001	Johnson	2nd	24
1002	Leonardo	5th	21
1003	Kate	3rd	19
1002	Morgan	8th	22

Not allowed. Because all row must be unique

KEYS in DBMS

- is an attribute or set of attributes which helps you to identify a row(tuple) in a relation(table).
- They allow you to find the relation between two tables.
- Keys help you uniquely identify a row in a table by a combination of one or more columns in that table.
- Key is also helpful for finding unique record or row from the table.

Types of Keys in Database Management System

- Super Key
- Primary Key
- Candidate Key
- Alternate Key
- Foreign Key

Super key

A superkey is a group of single or multiple keys which identifies rows in a table. A Super key may have additional attributes that are not needed for unique identification.

EmpSSN	EmpNum	Empname
9812345098	AB05	Shown
9876512345	AB06	Roslyn
199937890	AB07	James

In the above-given example, EmpSSN and EmpNum name are superkeys.

Primary Key

- ➢PRIMARY KEY is a column or group of columns in a table that uniquely identify every row in that table.
- ➢The Primary Key can't be a duplicate meaning the same value can't appear more than once in the table.
- ➢A table cannot have more than one primary key.

Rules for defining Primary key:

- ➢Two rows can't have the same primary key value
- ➢It must for every row to have a primary key value.
- ➢The primary key field cannot be null.
- ➢The value in a primary key column can never be modified or updated if any foreign key refers to that primary key.
- ➢In the following example, StudID is a Primary Key.

studID	Roll No	First Name	LastName	Email
1	11	Tom	Price	abc@gmail.com
2	12	Nick	Wright	xyz@gmail.com
3	13	Dana	Natan	mno@yahoo.com

Alternate key

- **ALTERNATE KEYS** is a column or group of columns in a table that uniquely identify every row in that table.
- A table can have multiple choices for a primary key but only one can be set as the primary key.
- All the keys which are not primary key are called an Alternate Key.

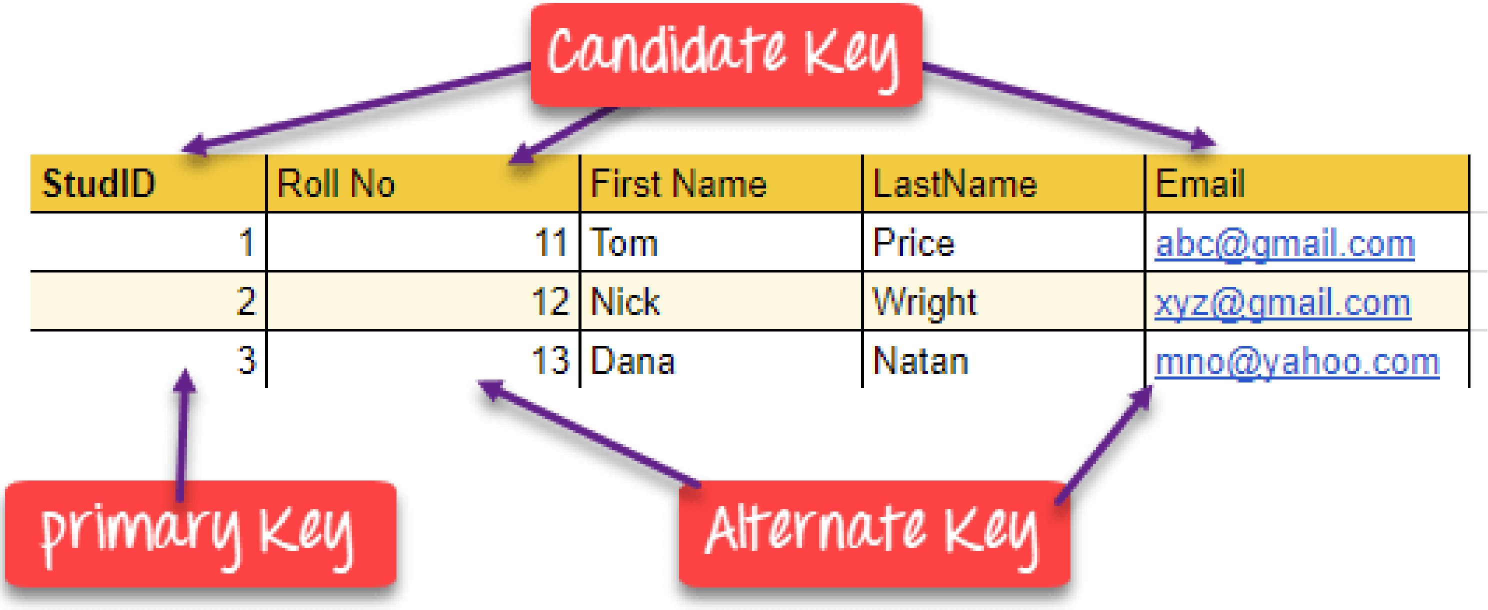
Example:

In this table, StudID, Roll No, Email are qualified to become a primary key. But since StudID is the primary key, Roll No, Email becomes the alternative key.

StudID	Roll No	First Name	LastName	Email
1	11	Tom	Price	abc@gmail.com
2	12	Nick	Wright	xyz@gmail.com
3	13	Dana	Natan	mno@yahoo.com

Candidate Key

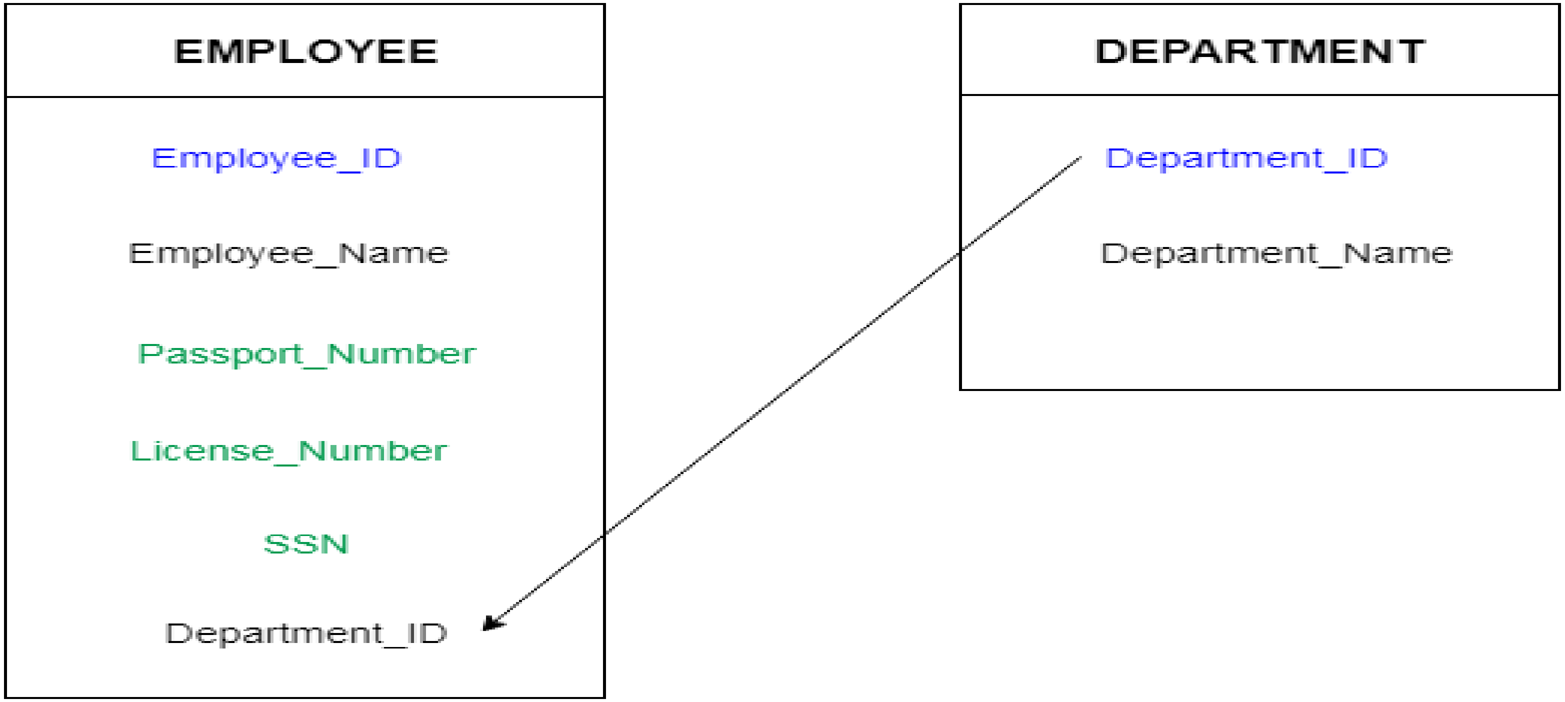
- ➢CANDIDATE KEY is a set of attributes that uniquely identify tuples in a table.
- ➢Candidate Key is a super key with no repeated attributes.
- ➢The Primary key should be selected from the candidate keys.
- ➢Every table must have at least a single candidate key.
- ➢A table can have multiple candidate keys but only a single primary key.



StudID	Roll No	First Name	LastName	Email
1	11	Tom	Price	abc@gmail.com
2	12	Nick	Wright	xyz@gmail.com
3	13	Dana	Natan	mno@yahoo.com

Foreign key

- FOREIGN KEY is a column that creates a relationship between two tables.
- The purpose of Foreign keys is to maintain data integrity and allow navigation between two different instances of an entity.
- It acts as a cross-reference between two tables as it references the primary key of another table.



EMPLOYEE

Employee_ID

Employee_Name

Passport_Number

License_Number

SSN

Department_ID

DEPARTMENT

Department_ID

Department_Name

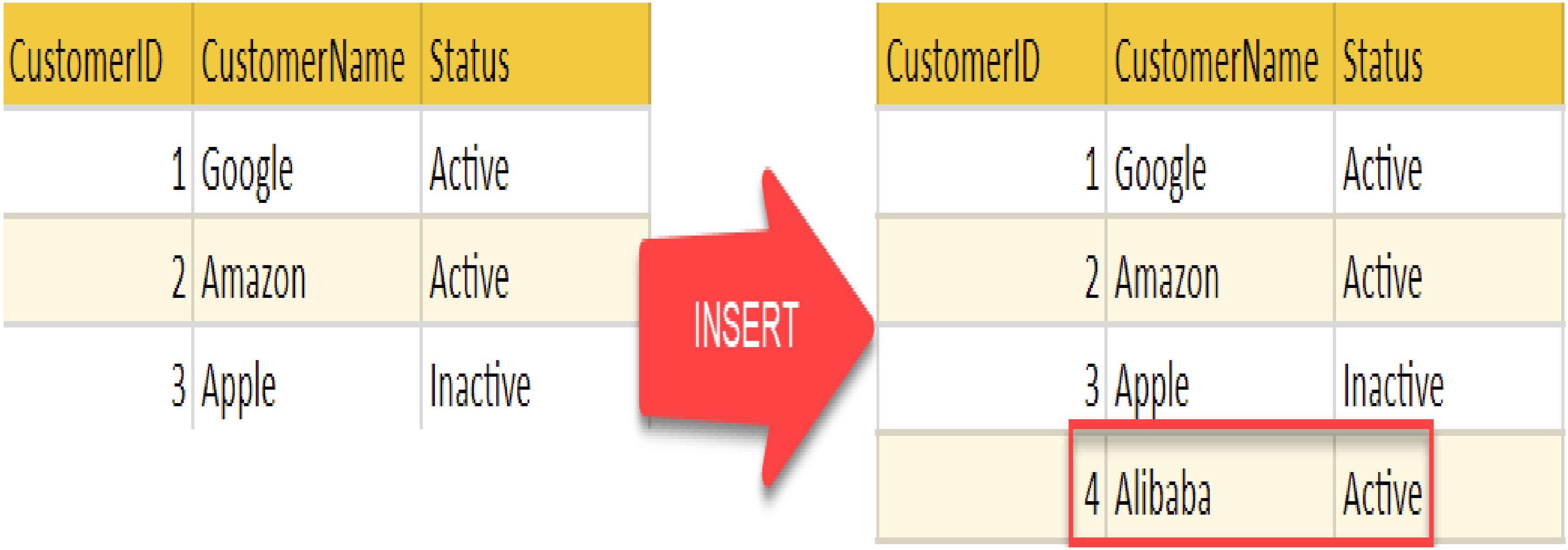
Operations in Relational Model

- Four basic operations performed on relational database model are **Insert, update, delete and select**
- Insert is used to insert data into the relation
- Delete is used to delete tuples from the table.
- Update allows you to change the values of some attributes in existing tuples.
- Select allows you to choose a specific range of data.

Whenever one of these operations are applied, integrity constraints specified on the relational database schema must never be violated.

Insert Operation

- ➢The insert operation gives values of the attribute for a new tuple which should be inserted into a relation.



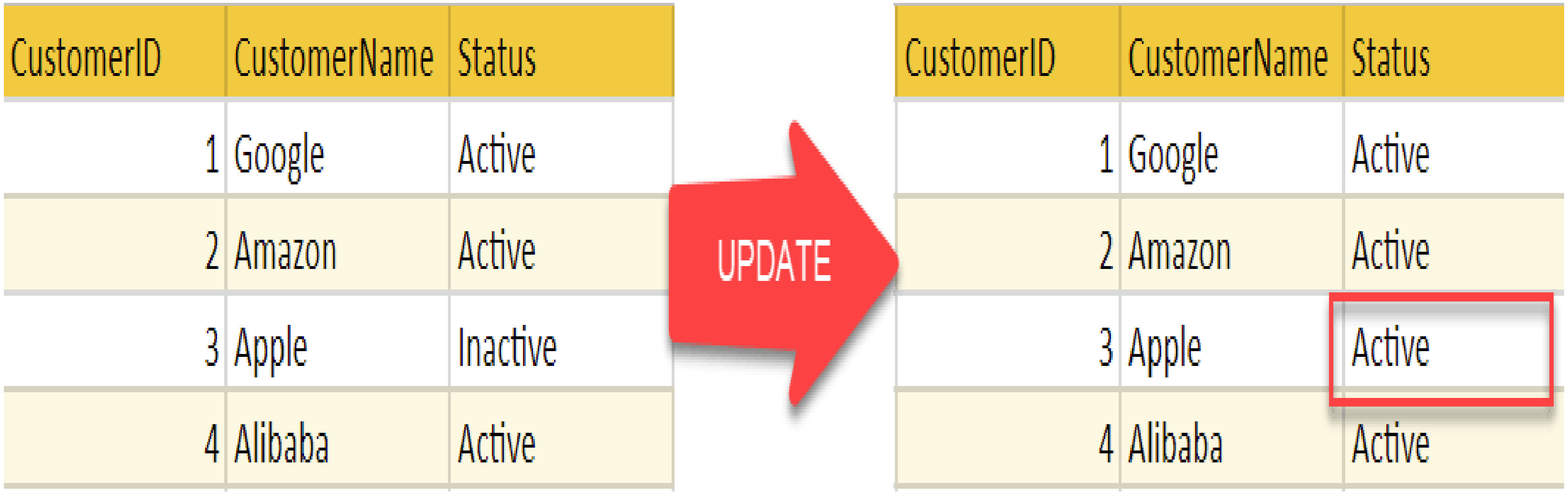
CustomerID	CustomerName	Status
1	Google	Active
2	Amazon	Active
3	Apple	Inactive

CustomerID	CustomerName	Status
1	Google	Active
2	Amazon	Active
3	Apple	Inactive
4	Alibaba	Active

Update Operation

➢Update allows you to change the values of some attributes in existing tuples.

➢You can see that in the below-given relation table CustomerName= 'Apple' is updated from Inactive to Active.

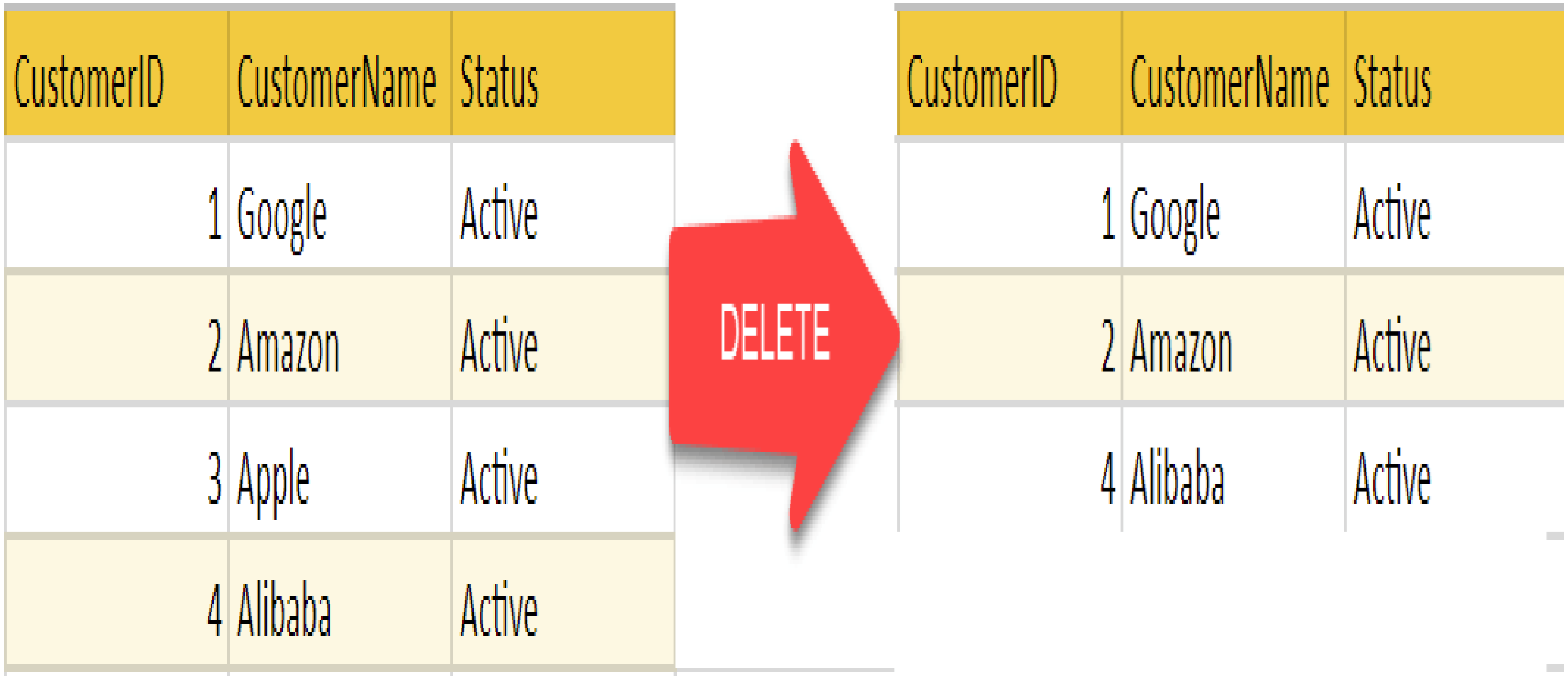


CustomerID	CustomerName	Status
1	Google	Active
2	Amazon	Active
3	Apple	Inactive
4	Alibaba	Active

CustomerID	CustomerName	Status
1	Google	Active
2	Amazon	Active
3	Apple	Active
4	Alibaba	Active

Delete Operation

- ➢Delete is used to delete tuples from the table.



CustomerID	CustomerName	Status
1	Google	Active
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3	Apple	Active
4	Alibaba	Active

CustomerID	CustomerName	Status
1	Google	Active
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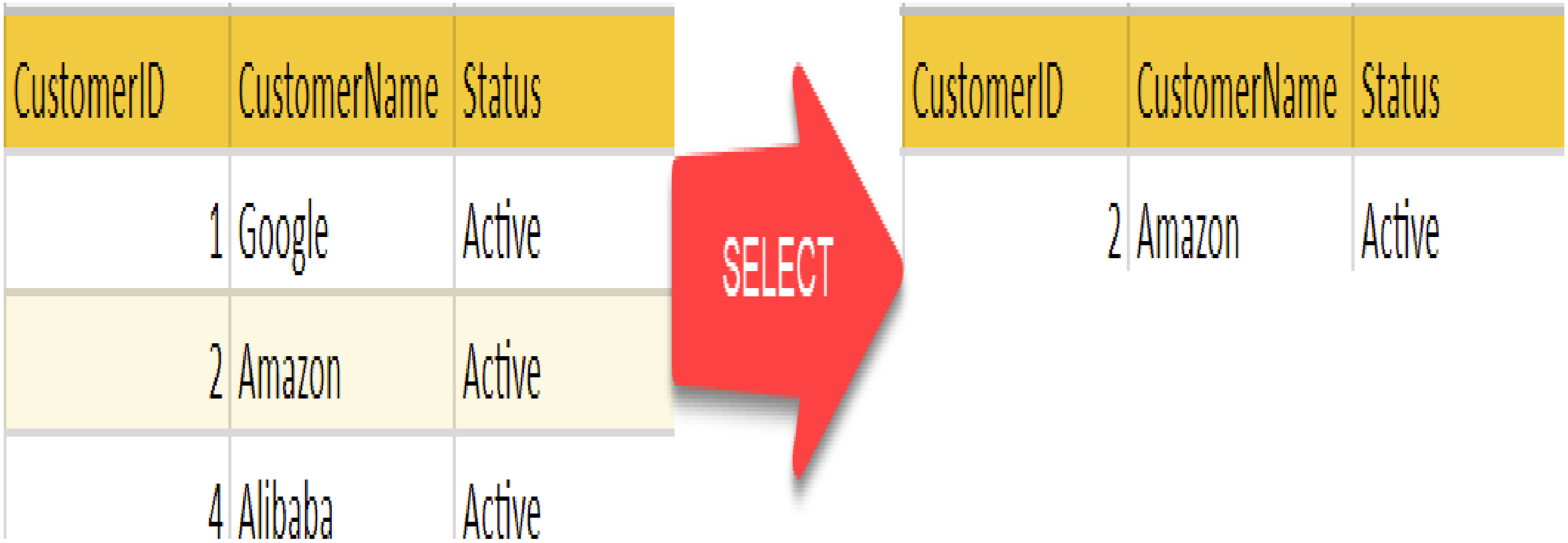
Select Operation

Select allows you to choose a specific range of data.



CustomerID	CustomerName	Status
1	Google	Active
2	Amazon	Active
4	Alibaba	Active

CustomerID	CustomerName	Status
2	Amazon	Active

Best Practices for creating a Relational Model

- ➢Data need to be represented as a collection of relations
- ➢Each relation should be depicted clearly in the table
- ➢Rows should contain data about instances of an entity
- ➢Columns must contain data about attributes of the entity
- ➢Cells of the table should hold a single value
- ➢Each column should be given a unique name
- ➢No two rows can be identical
- ➢The values of an attribute should be from the same domain

Thank You