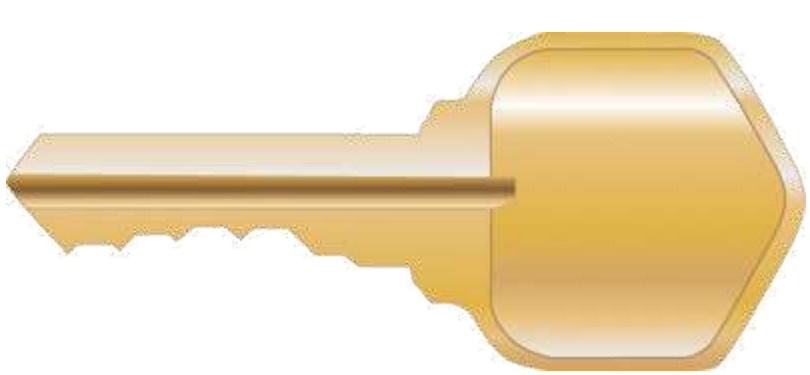

Types of Keys in Database Management System

Why we have Keys in DB?

- Keys are the entity set that is used to identify an entity within its entity set uniquely.
- A Key is an attribute or a set of attributes in a relation that identifies a tuple (record) in a relation.
- The keys are defined in a table to access or sequence the stored data quickly and smoothly.
- They are also used to create relationship between different tables.

Types of Keys in Database

1. Primary Key
2. Candidate Key
3. Alternate Key
4. Super Key
5. Composite Key
6. Foreign Key

Primary Key

Employee
EmployeeID
EmployeeName
SSN
DeptID
DOB

- Which is **Unique & Can't be have NULL Value**
- Is the column you choose to maintain uniqueness in a table at row level.
- Here in **Employee** table we can choose either **EmployeeID** or **SSN(Social Security number)**

  column for a PK.
- EmployeeID is preferable choice because SSN is a secure value.

Primary Key

- It is a candidate key that is chosen by the database designer to identify entities with in an entity set.
- Primary key is the minimal super keys. In the ER diagram primary key is represented by underlining the primary key attribute.
- Ideally a primary key is composed of only a single attribute.
- But it is possible to have a primary key composed of more than one attribute.

To define a field as primary key, following conditions had to be met:

1. No two rows can have the same primary key value
2. Every row must have a primary key value
3. The primary key field cannot be null
4. Value in a primary key column can never be modified or updated, if any foreign key refers to that primary key

Candidate Key

Employee
EmployeeID
EmployeeName
SSN
DeptID
DOB

- Are individual columns in a table that qualifies for uniqueness of each row/tuple.
- Here in **Employee** table **EmployeeID** & **SSN** are eligible for a **Primary Key** and thus are ***Candidate keys***.
- Candidate Keys are super keys for which no proper subset is a super key. **In other words candidate keys are minimal super keys**.

Alternate Key

Employee
EmployeeID
EmployeeName
SSN
DeptID
DOB

- Candidate column other the Primary column,like if **EmployeeID** is set for a PK then **SSN** would be the Alternate key.

Super Key

Employee
EmployeeID
EmployeeName
SSN
DeptID
DOB

- If you add any other Column / Attribute to a Primary Key then it become a Super Key, like **EmployeeID + EmployeeName** is a Super Key.
- Super key stands for superset of a key.
- **A Super Key is a set of one or more attributes that are taken collectively and can identify all other attributes uniquely**

Count number of Super Keys

Ex1: Let a Relation R have attributes {a1, a2, a3,…,an}. Find Super key of R.
Maximum Super keys = 2^n – 1.
If each attribute of relation is candidate key.

Ex2: Let a Relation R have attributes {a1,a2,a3} & a1 is the candidate key. Then how many super keys are possible?
Here, any superset of a1 is the super key.
Super keys are = {a1, a1 a2, a1 a3, a1 a2 a3}
Thus we see that 4 Super keys are possible in this case.
In general, if we have ‘n’ attributes with one candidate key then the number of possible superkeys are 2^(n – 1).

Count number of Super Keys

Ex-3: Let a Relation R have attributes {a1, a2, a3,…,an} and the candidate key is “a1 a2 a3” then the possible number of super keys?
Following the previous formula, we have 3 attributes instead of one. So, here the number of possible superkeys are 2^(n-3).

Ex-4: Let a Relation R have attributes {a1, a2, a3,…,an} and the candidate keys are “a1”, “a2” then the possible number of super keys?

Composite Key

Employee
EmployeeID
EmployeeName
SSN
DeptID
DOB

- If a table do have a single column that qualifies for a Candidate key, then you have to select 2 or more columns to make a row unique.
- Like if there is no EmployeeID or SSN columns, then you can make **EmployeeName + DateOfBirth** (DOB) as **Composite Primary Key**. *But still there can be a narrow chance of duplicate rows*.

Foreign Key

Employee
EmployeeID
EmployeeName
SSN
DeptID
DOB

Department
DeptID
DeptName

- Here in above tables **DeptID** of **Department** table is Primary Key where as **DeptID** of **Employee** is an **Foreign key**.
- It means it has referred to another table. This concept is also know as **Referential Integrity**.

Practical Example

Table – R1
A
B
C
D
E

- Table – R1 Let A,B,C,D,E are the attributes of this relation.
- 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.)
- Find the following:
  - **Primary Key**
  - **Candidate Key**
  - **Super Key**
  - **Composite Key**

Answers

- Primary Key: A
- Candidate Key: A & BC
- Super Key: A, BC, AE, AD & ABC
- Composite Key: BC