

Module 6 - Types of Database Keys

In a database, **keys** are special attributes (columns) that help uniquely identify rows (records) and establish relationships between tables. They ensure data integrity and efficient data retrieval.

1. Primary Key (PK)

What is it?

- A **Primary Key** is a column (or a set of columns) that **uniquely identifies each record in a table.**
- It **cannot have null values.**
- Each value in the primary key must be **unique.**

Why important?

- It uniquely distinguishes each row.
- Enforces entity integrity (no duplicates, no nulls).

Example:

Imagine a table **Students**:

StudentID	Name	Age
101	Alice	20
102	Bob	21
103	Charlie	22

- StudentID is the **primary key** because every student has a unique ID.
- No two students can have the same StudentID.
- StudentID cannot be empty or null.

2. Candidate Key

What is it?

- A **Candidate Key** is any column or combination of columns that can uniquely identify records.
- The primary key is selected from one of the candidate keys.
- A table can have **multiple candidate keys.**

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In the Students table:

StudentID	Email	Name
101	alice@example.com	Alice
102	bob@example.com	Bob
103	charlie@example.com	Charlie

- Both StudentID and Email can uniquely identify a student.
- So, StudentID and Email are **candidate keys**.
- One is chosen as the primary key (say StudentID).

**3. Alternate Key**

What is it?

- An **Alternate Key** is a candidate key that was **NOT** chosen as the primary key.
- It still uniquely identifies records but is secondary to the primary key.

**Example:**

In the above example:

- StudentID is the primary key.
- Email is the **alternate key**.

**4. Composite Key (or Compound Key)**

What is it?

- A **Composite Key** is a key made up of **two or more columns combined together** to uniquely identify a record.
- Used when a single column can't uniquely identify a record.

**Example:**

Suppose we have a table **Enrollments** which tracks courses taken by students:

StudentID	CourseID	EnrollmentDate
101	C101	2024-01-15
101	C102	2024-02-20
102	C101	2024-01-15

- Neither StudentID alone nor CourseID alone uniquely identifies a record.

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- But the combination of (StudentID, CourseID) together uniquely identifies each enrollment.
- So, (StudentID, CourseID) is a composite key.

**5. Foreign Key (FK)**

What is it?

- A Foreign Key is a column (or set of columns) in one table that refers to the primary key in another table.
- It is used to create relationships between tables.
- Helps enforce referential integrity (you can't refer to something that doesn't exist).

**Example:**

We have two tables:  
Students

StudentID	Name
101	Alice
102	Bob

Enrollments

StudentID	CourseID
101	C101
102	C102

- StudentID in Enrollments is a foreign key referencing StudentID in Students.
- This ensures only existing students can be enrolled.

**6. Super Key**

What is it?

- A Super Key is any set of one or more columns that can uniquely identify a record in a table.
- It can be a primary key, candidate key, or any superset of those.
- It may contain extra columns that aren't necessary.

**Example:**

In Students:

- StudentID alone is a super key.
- (StudentID, Name) is also a super key (because adding Name doesn't affect uniqueness).
- But (Name) alone is not a super key if names can repeat.

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Summary:

Key Type	Description	Can be Null?	Uniqueness	Example
Primary Key	Uniquely identifies records; chosen candidate key	No	Unique	StudentID
Candidate Key	Columns that can uniquely identify records	No	Unique	StudentID, Email
Alternate Key	Candidate key not chosen as primary key	No	Unique	Email
Composite Key	Multiple columns combined for unique ID	No	Unique	(StudentID, CourseID)
Foreign Key	Refers to primary key in another table	Can be null	May repeat	StudentID in Enrollments
Super Key	Any combination uniquely identifying records	No	Unique	StudentID, (StudentID, Name)

Assignment

Ques 1: In a table Students(StudentID, Email, Name), if both StudentID and Email can uniquely identify students, but StudentID is chosen as the primary key, then what is Email?

- A) Super Key
- B) Alternate Key
- C) Foreign Key
- D) Composite Key

Ques 2: In a school database:

Table 1: Students(StudentID, Name)

Table 2: Results(StudentID, Marks)

If StudentID in Results points to StudentID in Students, what kind of key is it?

- A) Primary Key
- B) Alternate Key
- C) Foreign Key
- D) Super Key

Ques 3: Fill in the Blanks

1. A \_\_\_\_\_ key is a column that uniquely identifies each row and cannot have null values.

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2. A \_\_\_\_\_ key is a candidate key that was not selected as the primary key.
3. A \_\_\_\_\_ key is used to link one table to another.
4. When two or more columns are combined to form a key, it is called a \_\_\_\_\_ key.
5. A \_\_\_\_\_ key can contain extra columns but still uniquely identifies rows.

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