**SQL Key Constraints**

**Key constraints** are used to **uniquely identify rows** in a table or **enforce data integrity**. They define relationships between tables.

**1. PRIMARY KEY**

* **Uniquely identifies each row** in a table.
* Cannot contain **NULL values**.
* Only **one primary key per table** (can be composite—multiple columns).

**Example:**

CREATE TABLE Students (

StudentID INT PRIMARY KEY,

Name VARCHAR(50),

DeptID INT

);

✅ Here, StudentID uniquely identifies each student.

**Composite Primary Key Example:**

CREATE TABLE Enrollment (

StudentID INT,

CourseID INT,

PRIMARY KEY (StudentID, CourseID)

);

* Here, combination of StudentID and CourseID must be unique.

**2. FOREIGN KEY**

* Establishes a **link between two tables**.
* Ensures **referential integrity**: values in the foreign key column must exist in the primary key of another table.
* Can accept **NULL** unless specified otherwise.

**Example:**

CREATE TABLE Department (

DeptID INT PRIMARY KEY,

DeptName VARCHAR(50)

);

CREATE TABLE Students (

StudentID INT PRIMARY KEY,

Name VARCHAR(50),

DeptID INT,

FOREIGN KEY (DeptID) REFERENCES Department(DeptID)

);

* Students.DeptID must exist in Department.DeptID.

**3. UNIQUE**

* Ensures all values in a column are **distinct**.
* Can be multiple unique constraints per table.
* Can accept **NULL** (usually one NULL allowed, depending on RDBMS).

**Example:**

CREATE TABLE Employees (

EmployeeID INT PRIMARY KEY,

Email VARCHAR(100) UNIQUE

);

* No two employees can have the same email.

**4. NOT NULL**

* Ensures a column **cannot contain NULL values**.
* Used when a value is **mandatory**.

**Example:**

CREATE TABLE Students (

StudentID INT PRIMARY KEY,

Name VARCHAR(50) NOT NULL

);

* Every student **must have a Name**.

**5. CHECK**

* Ensures that column values **satisfy a specific condition**.
* Used for **data validation**.

**Example:**

CREATE TABLE Employees (

EmployeeID INT PRIMARY KEY,

Name VARCHAR(50),

Age INT CHECK (Age >= 18)

);

* Age must be 18 or older.

**Another Example:**

Gender CHAR(1) CHECK (Gender IN ('M','F'))

* Only 'M' or 'F' allowed.

**6. DEFAULT**

* Provides a **default value** for a column if no value is supplied.

**Example:**

CREATE TABLE Orders (

OrderID INT PRIMARY KEY,

Status VARCHAR(20) DEFAULT 'Pending'

);

* If no status is given, it will automatically be 'Pending'.

**Quick Reference Table**

| **Constraint** | **Purpose** | **Example** |
| --- | --- | --- |
| PRIMARY KEY | Unique identifier, no NULL | StudentID INT PRIMARY KEY |
| FOREIGN KEY | Link to another table, referential integrity | FOREIGN KEY (DeptID) REFERENCES Department |
| UNIQUE | Ensure column values are unique | Email VARCHAR(100) UNIQUE |
| NOT NULL | Column cannot be NULL | Name VARCHAR(50) NOT NULL |
| CHECK | Enforce a condition | Age INT CHECK (Age>=18) |
| DEFAULT | Default value if none provided | Status VARCHAR(20) DEFAULT 'Pending' |