SQL

by

Kishan
Dubey

Database

Database is collection of data in a format that can be easily accessed (Digital)

A software application used to manage our DB is called DBMS (Database Management System)

Types of Databases

Relational

Data stored in tables

MySQL
Microsoft SQL Server
ORACLE
PostgreSQL

Non-relational(NoSQL)

data not stored in tables

** We use SQL to work with relational DBMS

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What is SQL?

Structured Query Language

SQL is a programming language used to interact with relational databases.

It is used to perform **CRUD** operations :

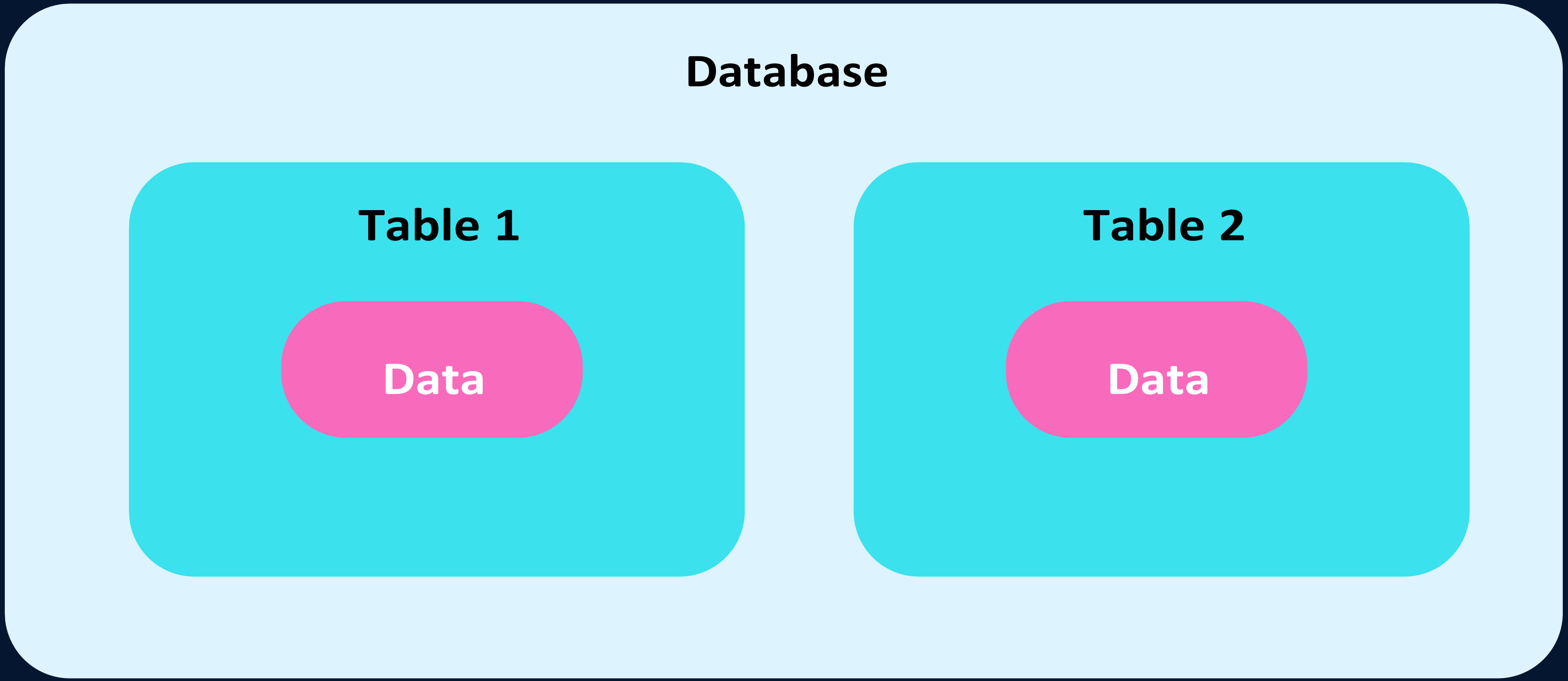
Create

Read

Update

Delete

Database Structure



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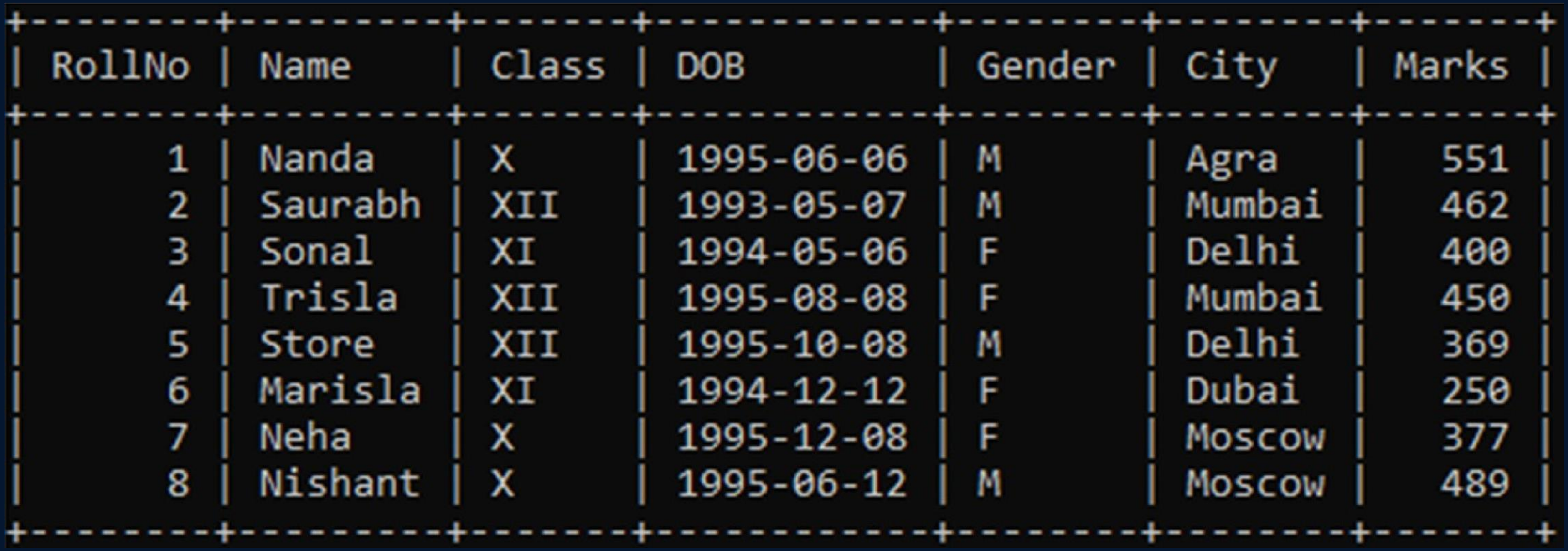
What is a table?

Student table



```
+--------+---------+-------+------------+--------+--------+-------+
| RollNo | Name    | Class | DOB        | Gender | City   | Marks |
+--------+---------+-------+------------+--------+--------+-------+
|      1 | Nanda   | X     | 1995-06-06 | M      | Agra   |   551 |
|      2 | Saurabh | XII   | 1993-05-07 | M      | Mumbai |   462 |
|      3 | Sonal   | XI    | 1994-05-06 | F      | Delhi  |   400 |
|      4 | Trisla  | XII   | 1995-08-08 | F      | Mumbai |   450 |
|      5 | Store   | XII   | 1995-10-08 | M      | Delhi  |   369 |
|      6 | Marisla | XI    | 1994-12-12 | F      | Dubai  |   250 |
|      7 | Neha    | X     | 1995-12-08 | F      | Moscow |   377 |
|      8 | Nishant | X     | 1995-06-12 | M      | Moscow |   489 |
+--------+---------+-------+------------+--------+--------+-------+
```

Creating our First Database

Our first SQL Query

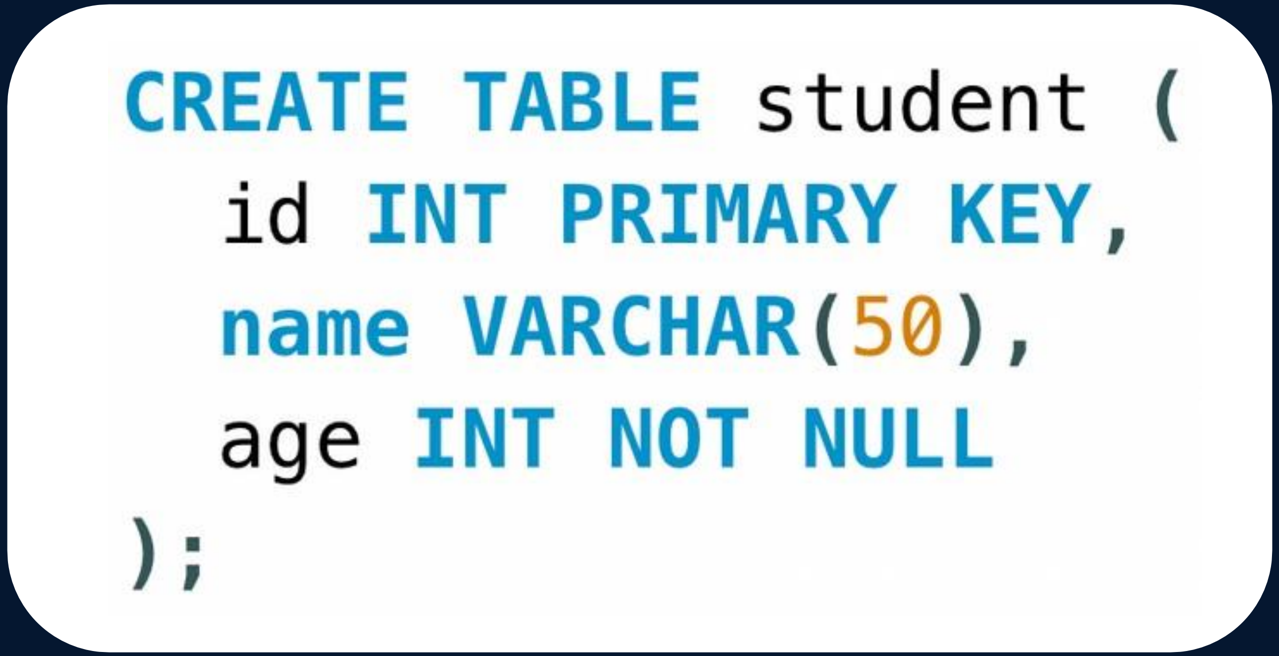
```
CREATE DATABASE db_name;
```

```
DROP DATABASE db_name;
```

Creating our First Table

```
USE db_name;

CREATE TABLE table_name (
    column_name1 datatype constraint,
    column_name2 datatype constraint,
    column_name2 datatype constraint
);
```



```
CREATE TABLE student (
  id INT PRIMARY KEY,
  name VARCHAR(50),
  age INT NOT NULL
);
```

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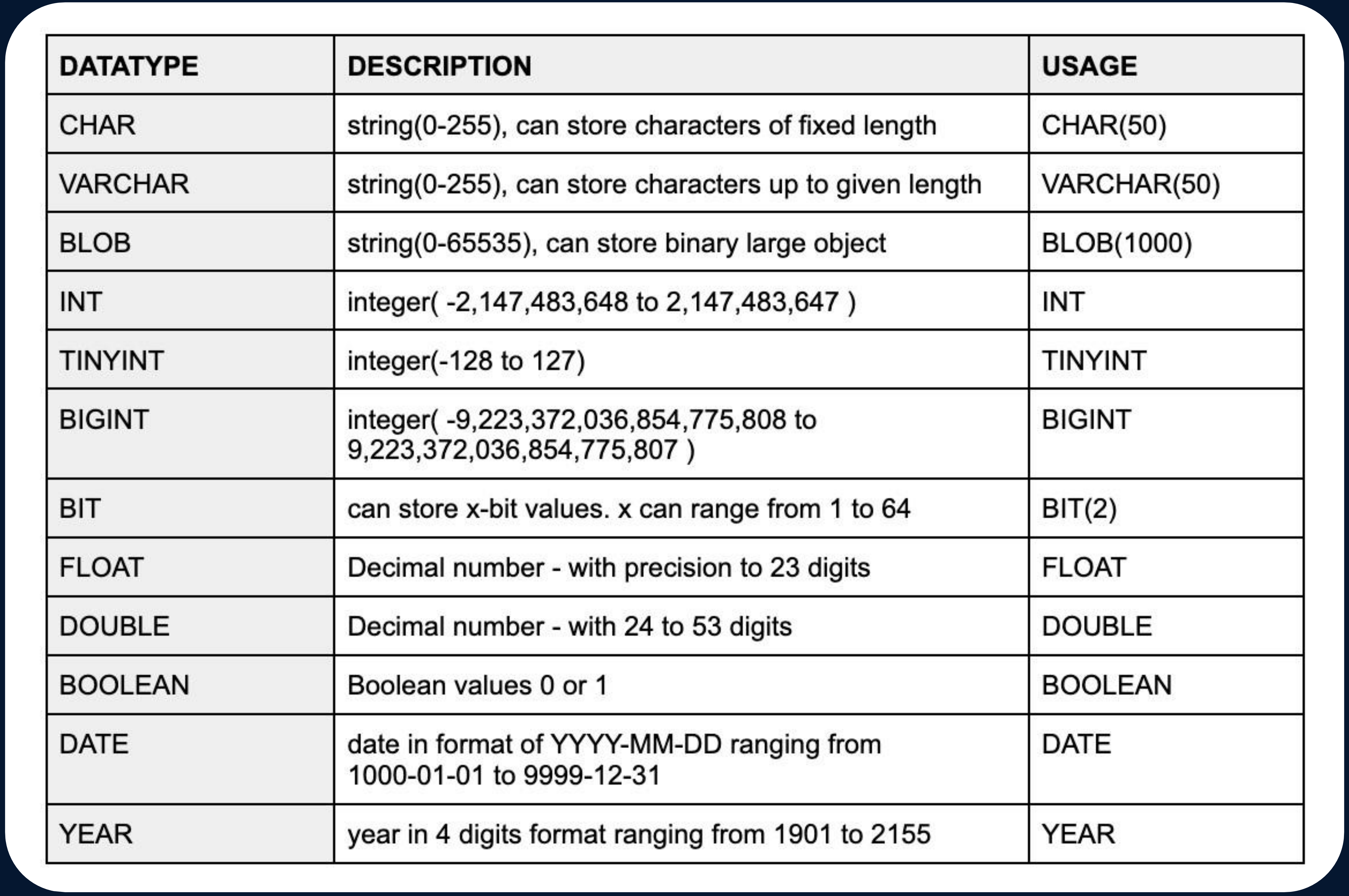
SQL Datatypes

They define thetype of valuesthat can be stored in a column



DATATYPE	DESCRIPTION	USAGE
CHAR	string(0-255), can store characters of fixed length	CHAR(50)
VARCHAR	string(0-255), can store characters up to given length	VARCHAR(50)
BLOB	string(0-65535), can store binary large object	BLOB(1000)
INT	integer(-2,147,483,648 to 2,147,483,647)	INT
TINYINT	integer(-128 to 127)	TINYINT
BIGINT	integer(-9,223,372,036,854,775,808 to 9,223,372,036,854,775,807)	BIGINT
BIT	can store x-bit values. x can range from 1 to 64	BIT(2)
FLOAT	Decimal number - with precision to 23 digits	FLOAT
DOUBLE	Decimal number - with 24 to 53 digits	DOUBLE
BOOLEAN	Boolean values 0 or 1	BOOLEAN
DATE	date in format of YYYY-MM-DD ranging from 1000-01-01 to 9999-12-31	DATE
YEAR	year in 4 digits format ranging from 1901 to 2155	YEAR

SQL Datatypes

Signed & Unsigned

TINYINT **UNSIGNED** (0 to 255)

TINYINT (-128 to 127)

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Types of SQL Commands

DDL (Data Definition Language) : create, alter, rename, truncate & drop

DQL (Data Query Language) : select

DML (Data Manipulation Language) : select, insert, update & delete

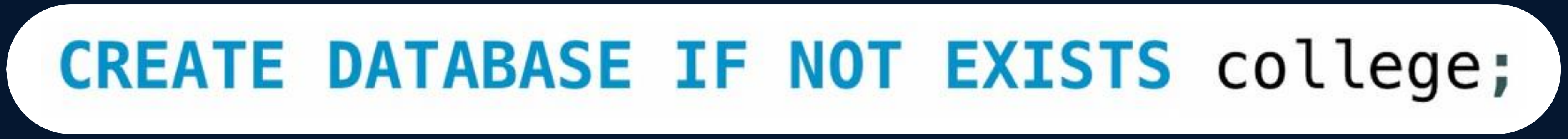
DCL (Data Control Language) : grant & revoke permission to users

TCL (Transaction Control Language) : start transaction, commit, rollback etc.

Database related Queries

CREATE DATABASE *db_name;*

CREATE DATABASEIF NOT EXISTS*db_name;*



```
CREATE DATABASE IF NOT EXISTS college;
```

DROP DATABASE *db_name;*

DROP DATABASEIF EXISTS *db_name;*

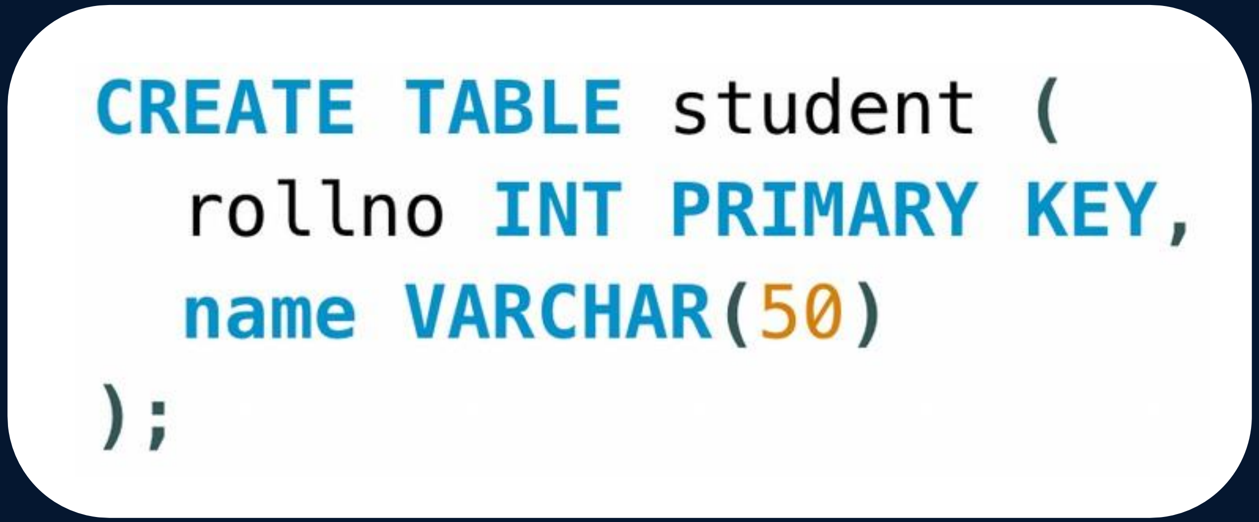
SHOW DATABASES*;*

SHOW TABLES*;*

Table related Queries

Create

```
CREATE TABLE table_name (
    column_name1 datatype constraint,
    column_name2 datatype constraint,
);
```



```
CREATE TABLE student (
  rollno INT PRIMARY KEY,
  name VARCHAR(50)
);
```

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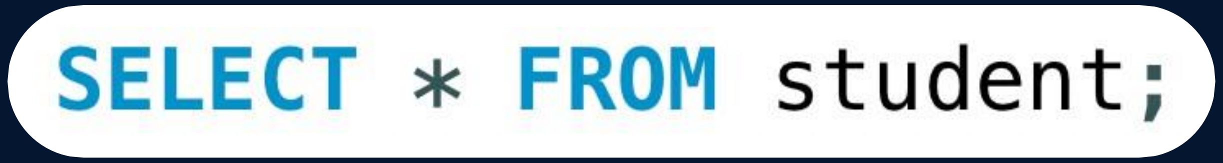
Table related Queries

Select & View ALL columns

SELECT * FROM *table_name;*

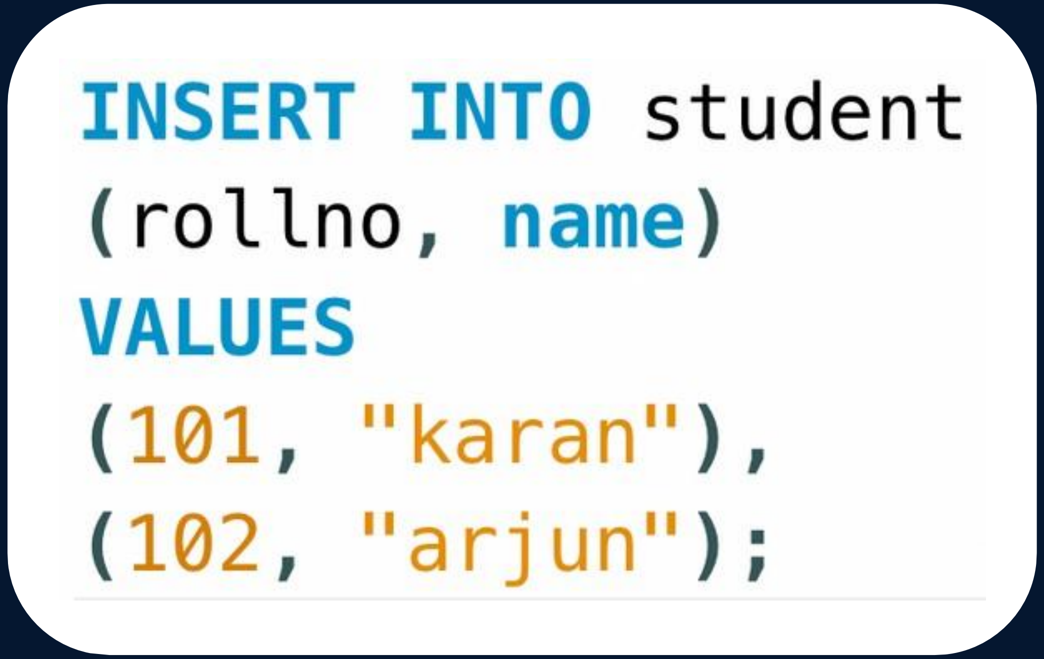


```
SELECT * FROM student;
```

Table related Queries

Insert

INSERT INTO *table_name*
(colname1, colname2);
VALUES
(col1_v1, col2_v1),
(col1_v2, col2_v2);



```
INSERT INTO student
(rollno, name)
VALUES
(101, "karan"),
(102, "arjun");
```

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Keys

Primary Key

It is a column (or set of columns) in a table that uniquely identifies each row. (a unique id)

There is only 1 PK & it should be NOT null.

Foreign Key

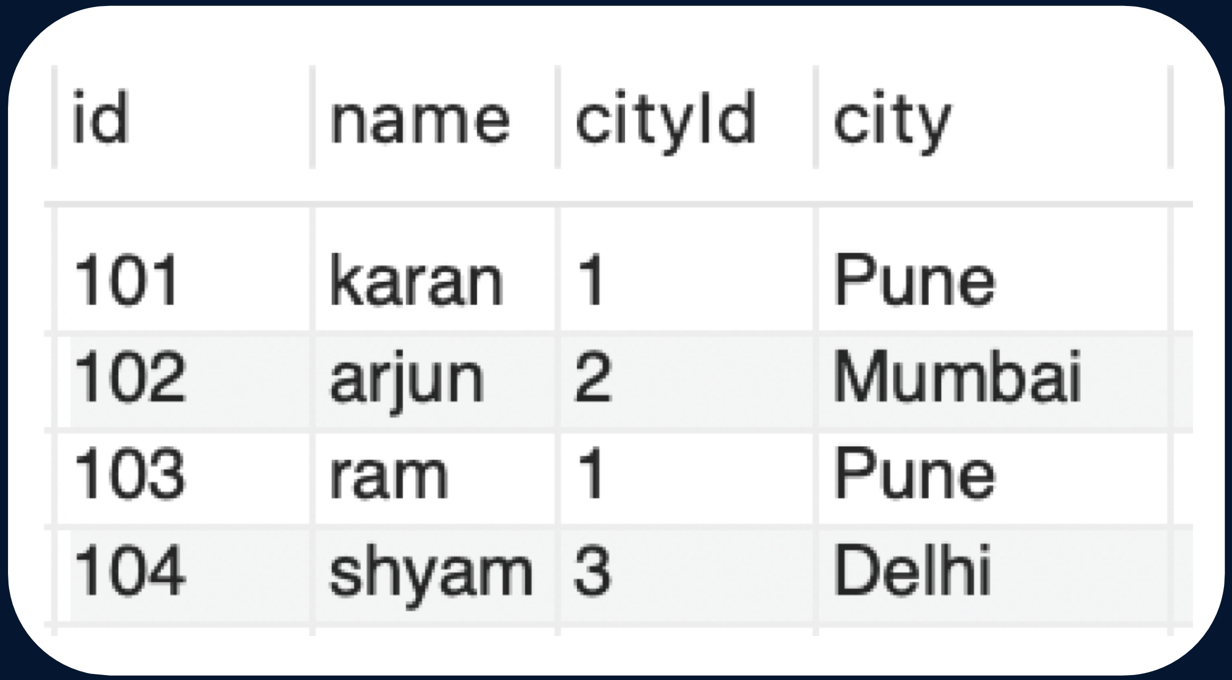
A foreign key is a column (or set of columns) in a table that refers to the primary key in another table.

There can be multiple FKs.

FKs can have duplicate & null values.

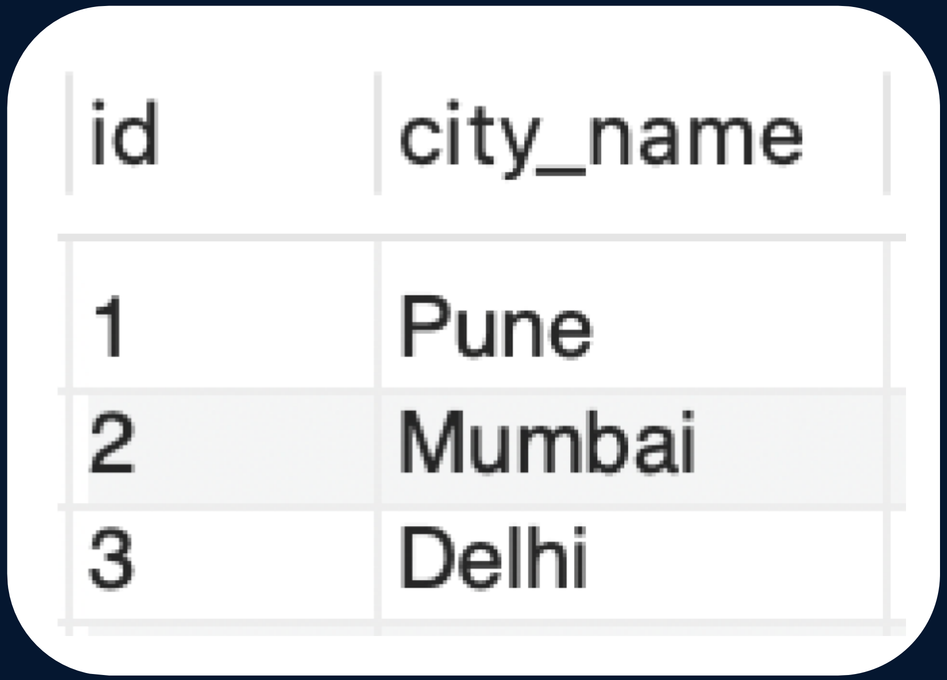
Keys

table1 - Student



id	name	cityId	city
101	karan	1	Pune
102	arjun	2	Mumbai
103	ram	1	Pune
104	shyam	3	Delhi

table2 - City

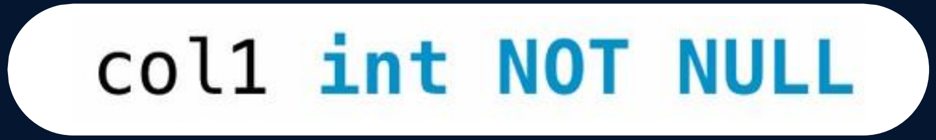


id	city_name
1	Pune
2	Mumbai
3	Delhi

Constraints

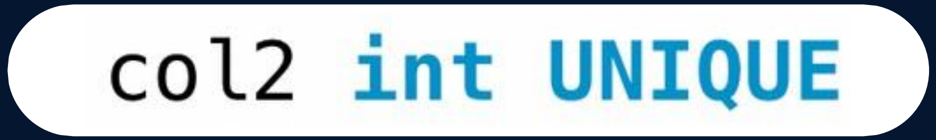
SQL constraints are used to specify rules for data in a table.

NOT NULL columns cannot have a null value



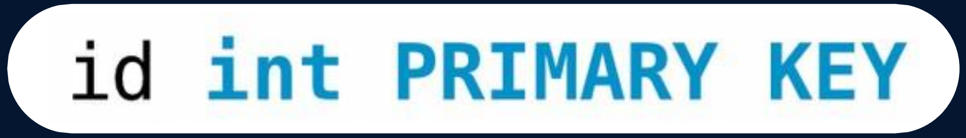
```
col1 int NOT NULL
```

UNIQUE all values in column are different

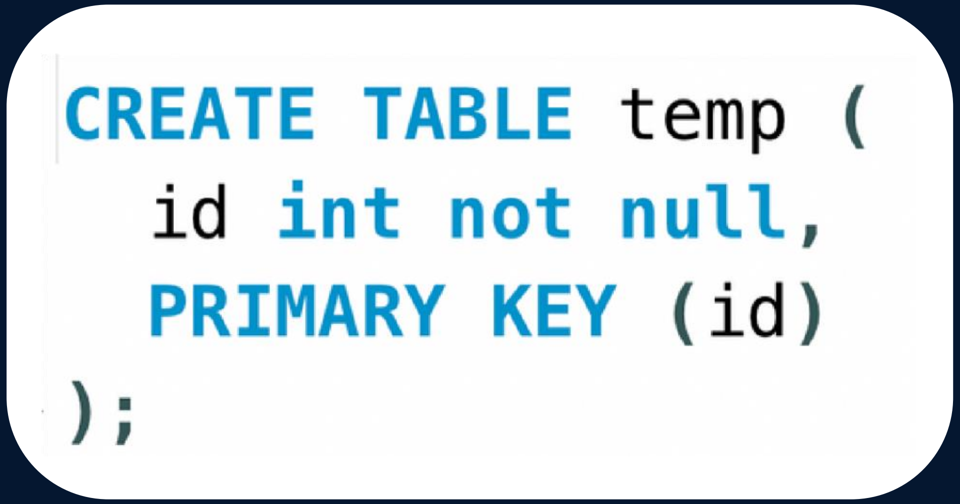


```
col2 int UNIQUE
```

PRIMARY KEY makes a column unique & not null but used only for one



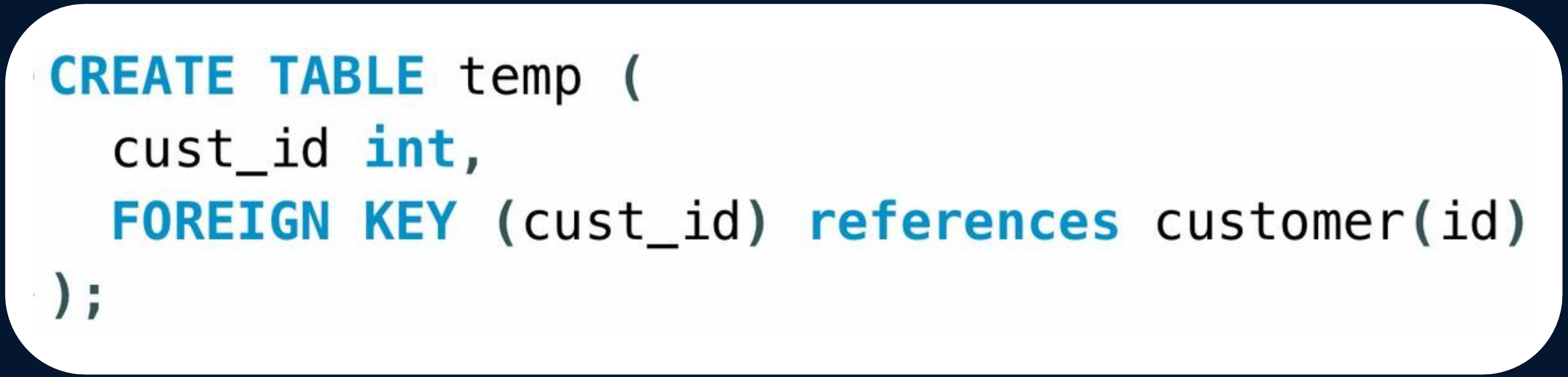
```
id int PRIMARY KEY
```



```
CREATE TABLE temp (
  id int not null,
  PRIMARY KEY (id)
);
```

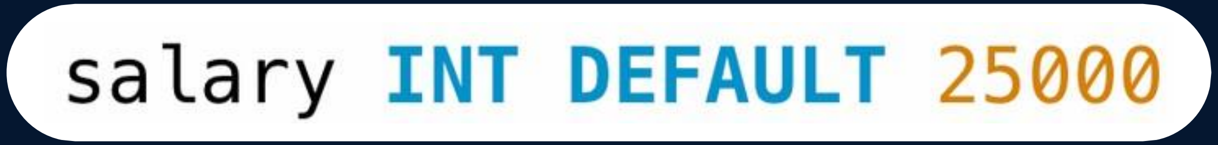
Constraints

FOREIGN KEY prevent actions that would destroy links between tables



```
CREATE TABLE temp (
  cust_id int,
  FOREIGN KEY (cust_id) references customer(id)
);
```

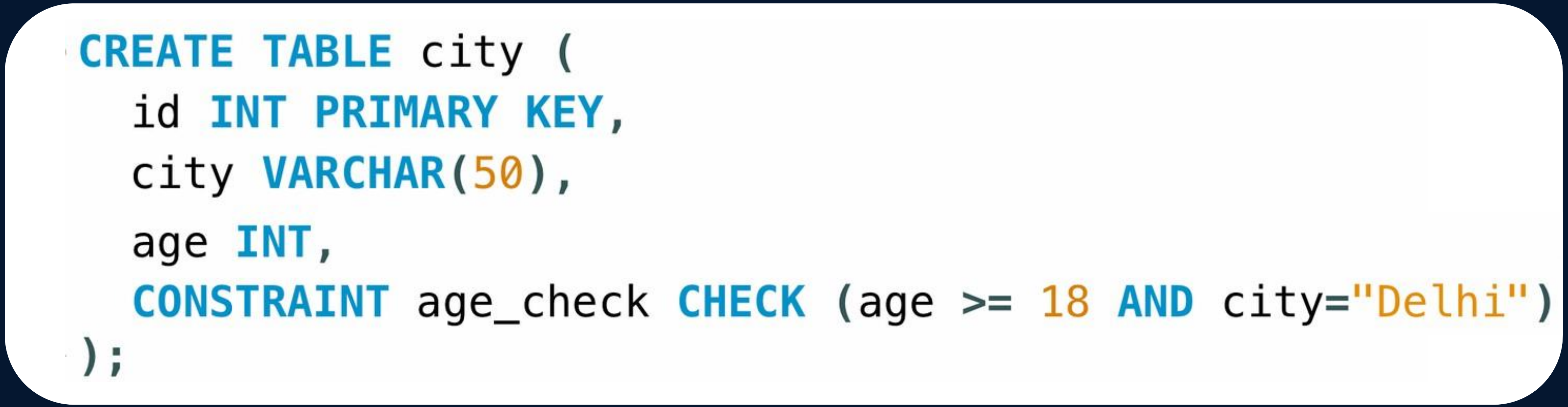
DEFAULT sets the default value of a column



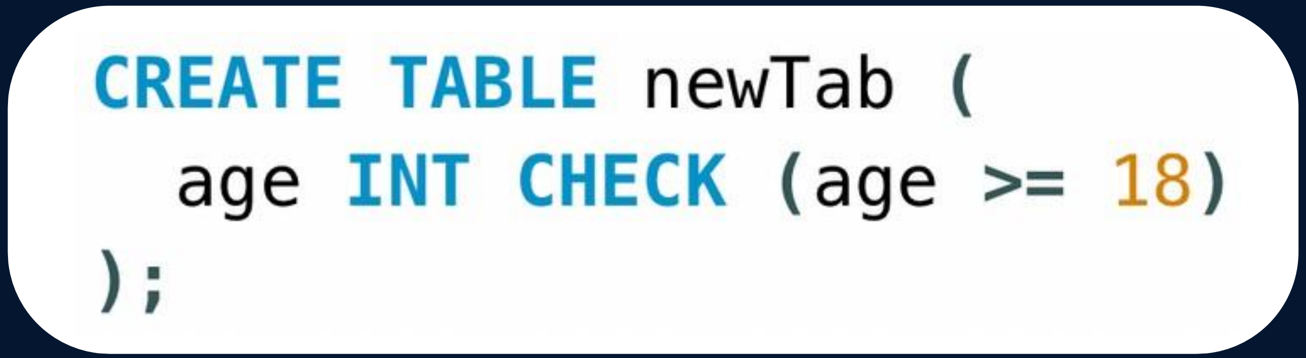
```
salary INT DEFAULT 25000
```

Constraints

CHECK it can limit the values allowed in a column

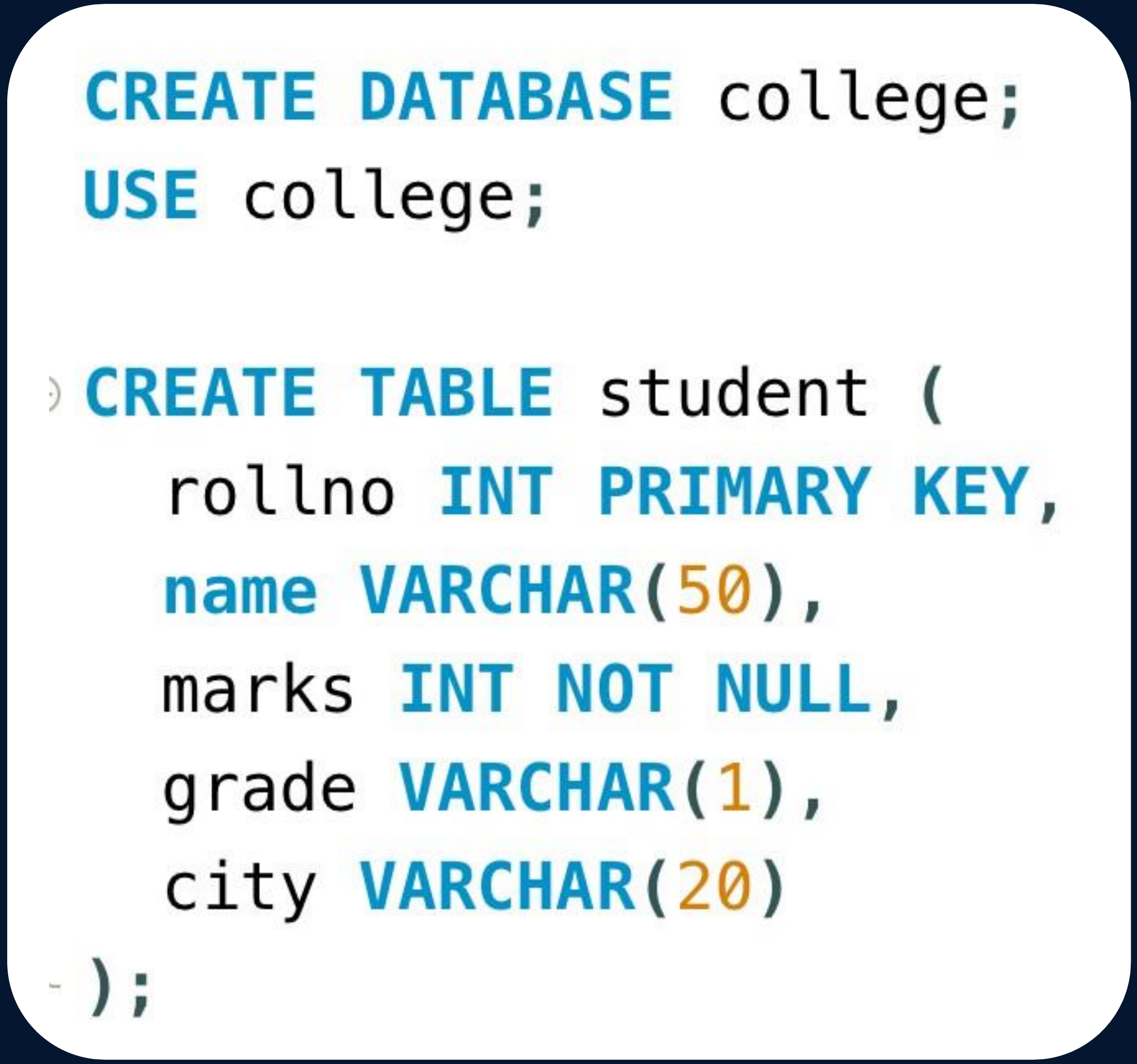


```
CREATE TABLE city (
  id INT PRIMARY KEY,
  city VARCHAR(50),
  age INT,
  CONSTRAINT age_check CHECK (age >= 18 AND city="Delhi")
);
```



```
CREATE TABLE newTab (
  age INT CHECK (age >= 18)
);
```

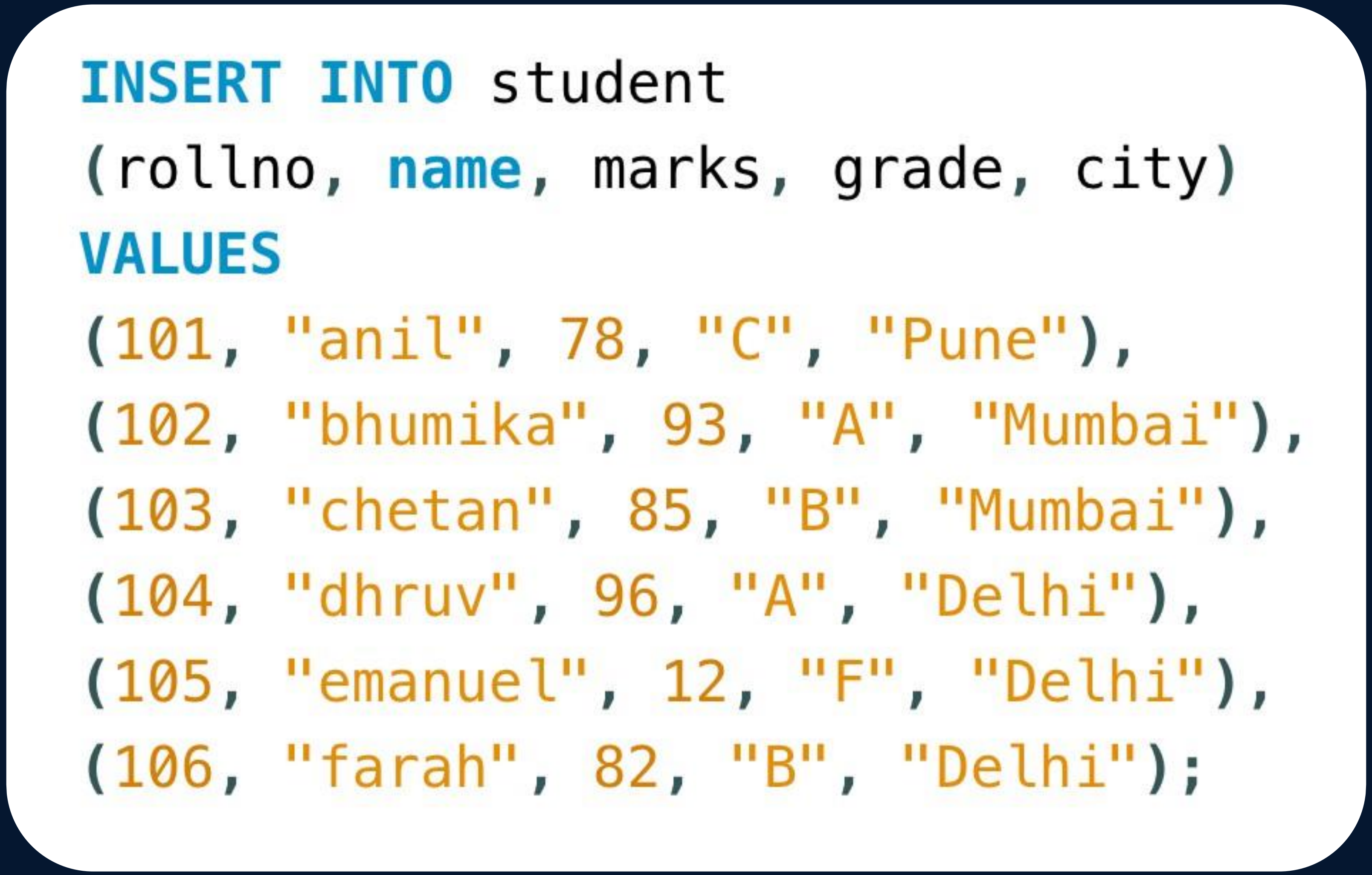
Create this sample table



```sql
CREATE DATABASE college;
USE college;

CREATE TABLE student (
  rollno INT PRIMARY KEY,
  name VARCHAR(50),
  marks INT NOT NULL,
  grade VARCHAR(1),
  city VARCHAR(20)
);
```

Insert this data



```sql
INSERT INTO student
(rollno, name, marks, grade, city)
VALUES
(101, "anil", 78, "C", "Pune"),
(102, "bhumika", 93, "A", "Mumbai"),
(103, "chetan", 85, "B", "Mumbai"),
(104, "dhruv", 96, "A", "Delhi"),
(105, "emanuel", 12, "F", "Delhi"),
(106, "farah", 82, "B", "Delhi");
```

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Select in Detail

used to select any data from the database

Basic Syntax

```
SELECT  col1, col2 FROM table_name;
```

To Select ALL

```
SELECT  * FROM table_name;
```

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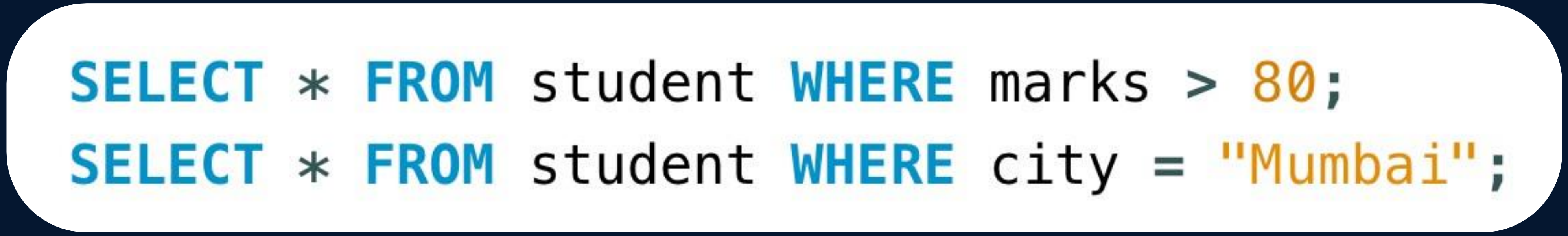
Where Clause

To define some conditions

SELECT *col1, col2* **FROM** *table_name*
WHERE *conditions;*



```sql
SELECT * FROM student WHERE marks > 80;
SELECT * FROM student WHERE city = "Mumbai";
```

Where Clause

Using Operators in WHERE

Arithmetic Operators :+(addition) , -(subtraction), *(multiplication), /(division), %(modu)lus

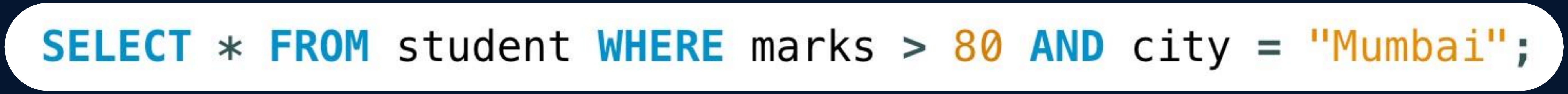
Comparison Operators := (equal to), != (not equal to), > , >=, <,<=

Logical Operators :AND, OR , NOT, IN, BETWEEN, ALL, LIKE, ANY

Bitwise Operators :& (Bitwise AND), | (Bitwise OR)

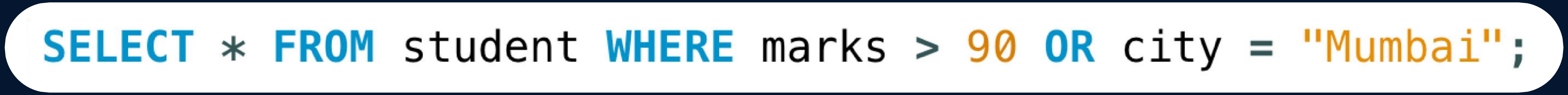
Operators

AND (to check for both conditions to be true)



```sql
SELECT * FROM student WHERE marks > 80 AND city = "Mumbai";
```

OR (to check for one of the conditions to be true)



```sql
SELECT * FROM student WHERE marks > 90 OR city = "Mumbai";
```

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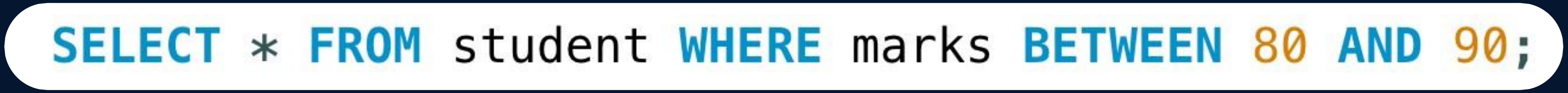
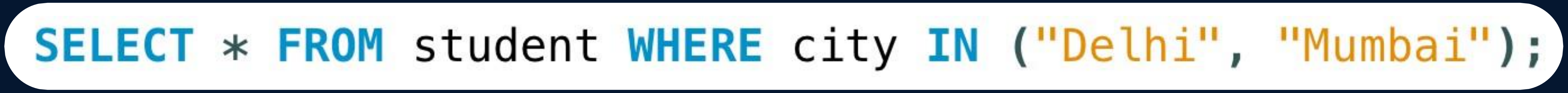
Operators

Between (selects for a given range)



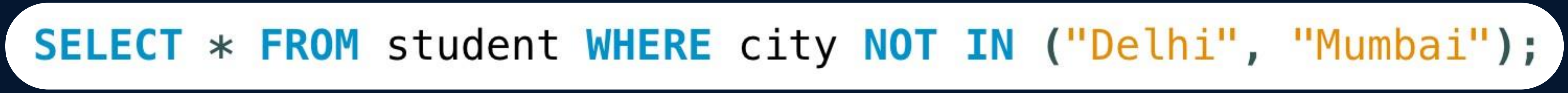
```sql
SELECT * FROM student WHERE marks BETWEEN 80 AND 90;
```

In (matches any value in the list)



```sql
SELECT * FROM student WHERE city IN ("Delhi", "Mumbai");
```

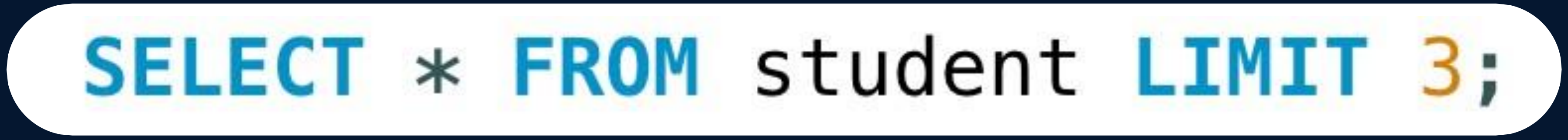
NOT (to negate the given condition)



```sql
SELECT * FROM student WHERE city NOT IN ("Delhi", "Mumbai");
```

Limit Clause

Sets an upper limit on number of (tuples)rows to be returned

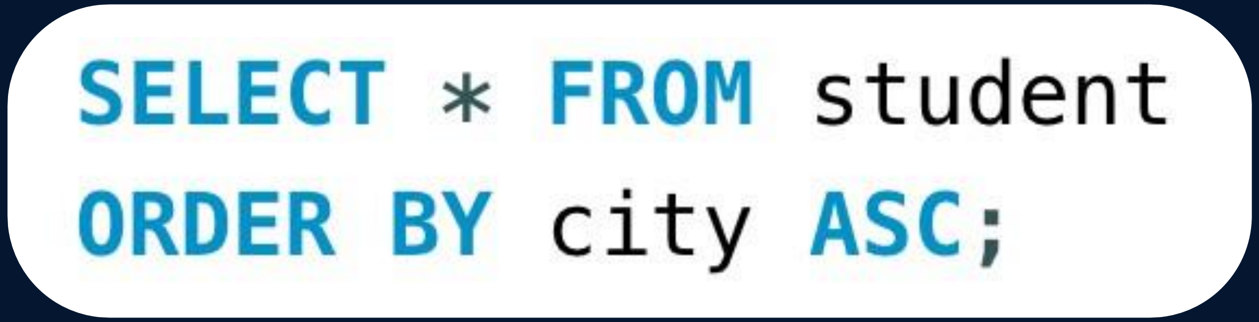


```
SELECT * FROM student LIMIT 3;
```

```
SELECT  col1, col2 FROM table_name
LIMIT number;
```

Order By Clause

To sort in ascending (ASC) or descending order (DESC)



```
SELECT * FROM student
ORDER BY city ASC;
```

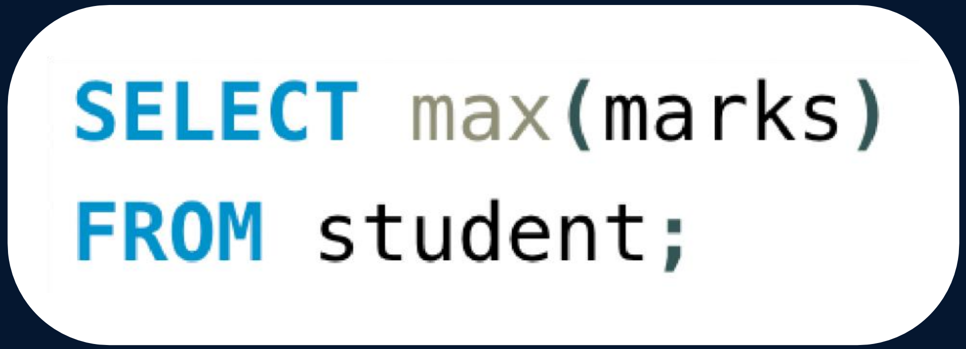
SELECT *col1, col2* **FROM** *table_name*
ORDER BY*col_name(s)* **ASC***;*

Aggregate Functions

Aggregare functions perform a calculation on a set of values, and return a single value.

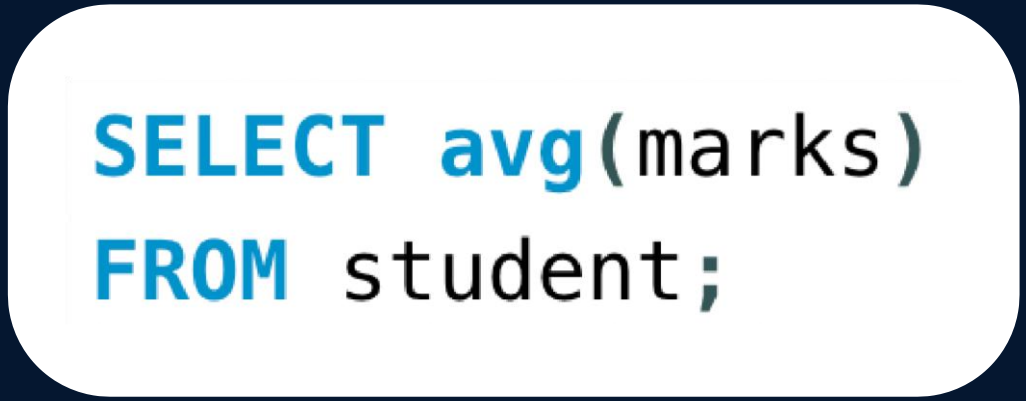
- COUNT( )
- MAX( )
- MIN( )
- SUM( )
- AVG( )

Get Maximum Marks



```
SELECT max(marks)
FROM student;
```

Get Average marks



```
SELECT avg(marks)
FROM student;
```

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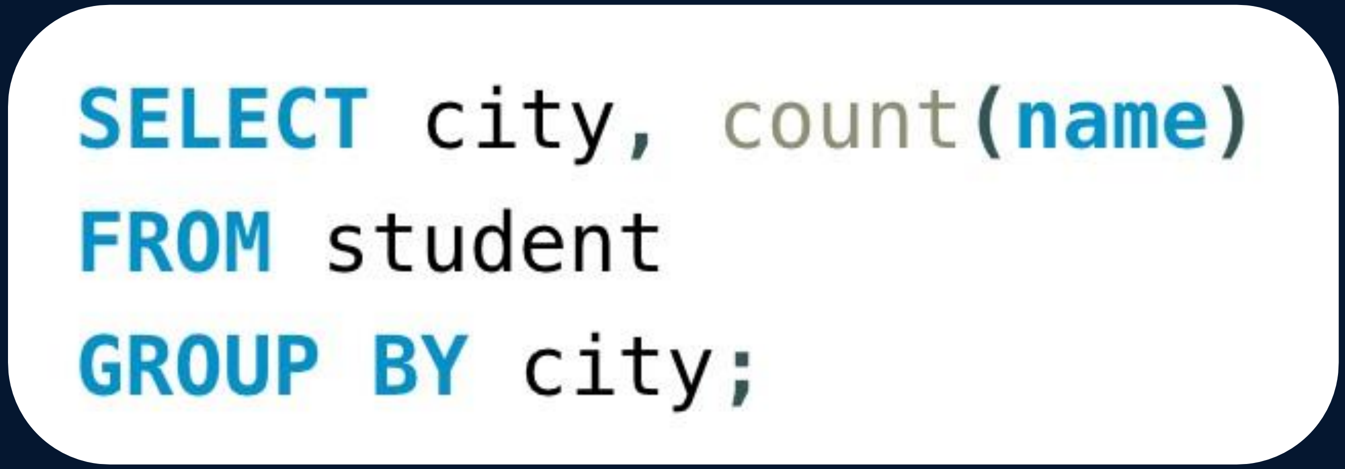
Group ByClause

Groups rows that have the same values into summary rows.
It collects data from multiple records and groups the result by one or more column.

*Generally we use group by with some _aggregation function_.

Count number of students in each city



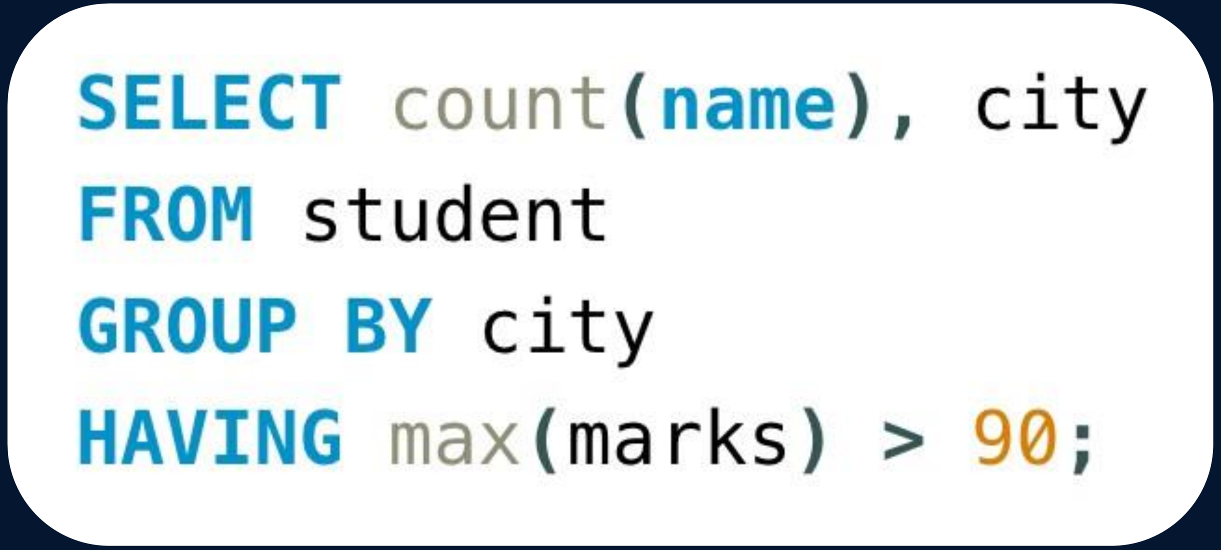
```
SELECT city, count(name)
FROM student
GROUP BY city;
```

Having Clause

Similar to Where i.e. applies some condition on rows.

Used when we want to apply anycondition after grouping

Count number of students in each city where max marks cross 90.



```
SELECT count(name), city
FROM student
GROUP BY city
HAVING max(marks) > 90;
```

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General Order

```
SELECT  column(s)
FROM table_name
WHERE condition
GROUP BYcolumn(s)
HAVING condition
ORDER BYcolumn(s) ASC;
```

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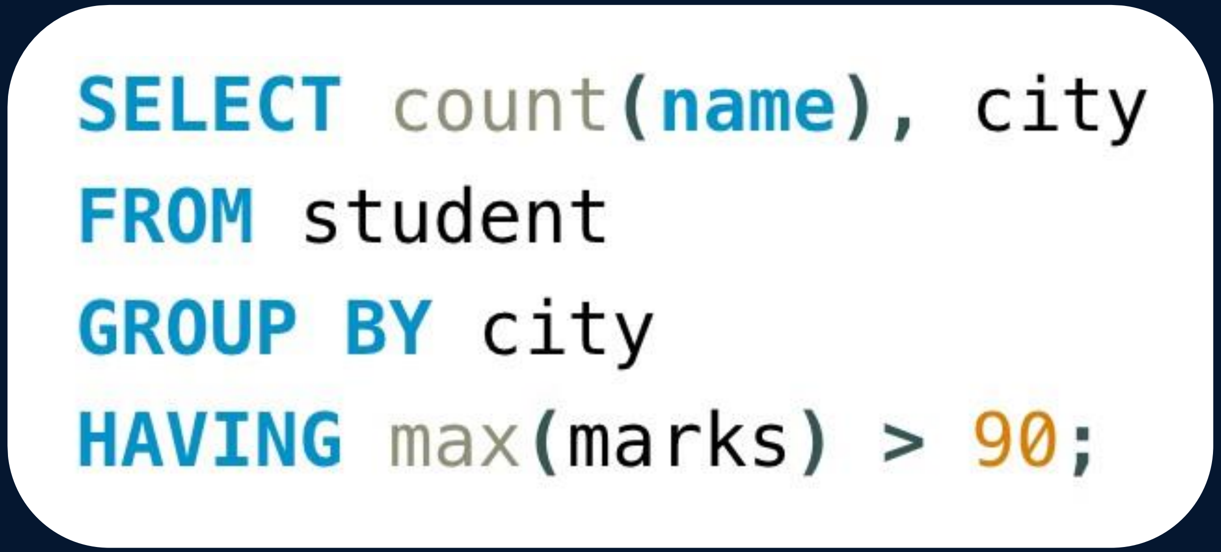
Having Clause

Similar to Where i.e. applies some condition on rows.

Used when we want to apply anycondition after grouping

Count number of students in each city where max marks cross 90.

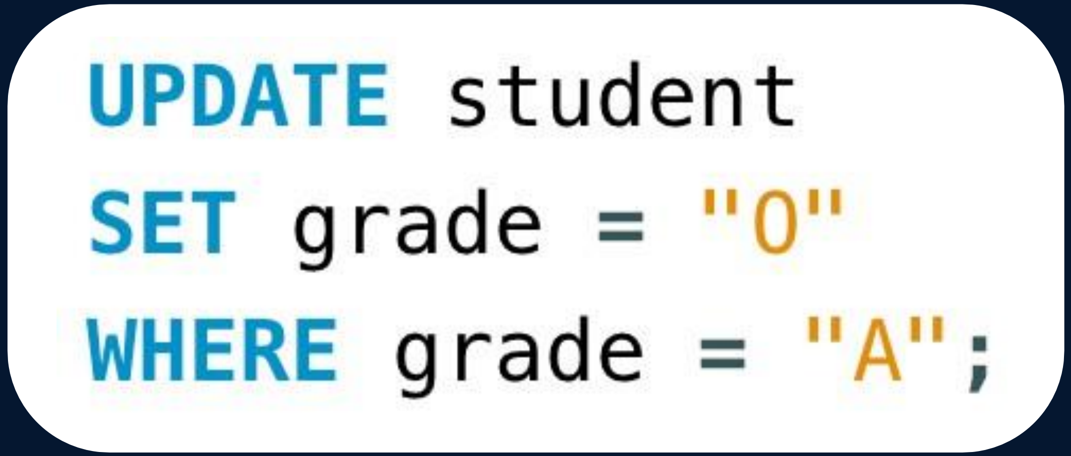


```
SELECT count(name), city
FROM student
GROUP BY city
HAVING max(marks) > 90;
```

Table related Queries

Update (to update existing rows)

UPDATE *table_name*
SET *col1 = val1, col2 = val2*
WHERE *condition;*

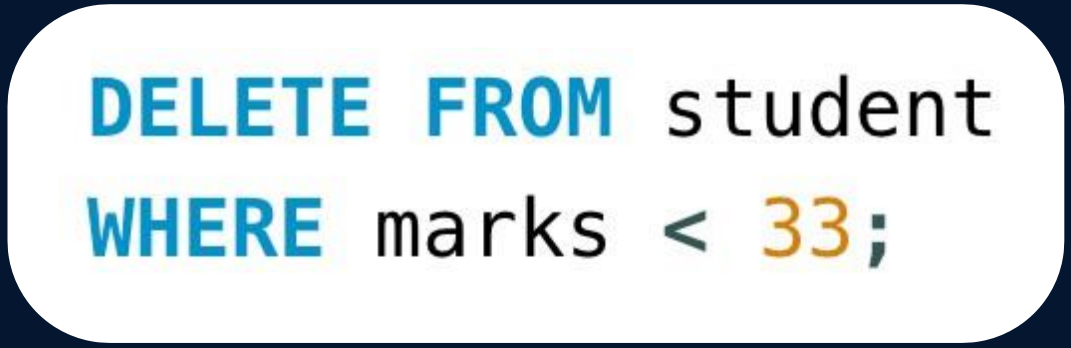


```
UPDATE student
SET grade = "O"
WHERE grade = "A";
```

Table related Queries

Delete (to delete existing rows)

DELETE FROM *table_name*
WHERE *condition;*



```sql
DELETE FROM student
WHERE marks < 33;
```

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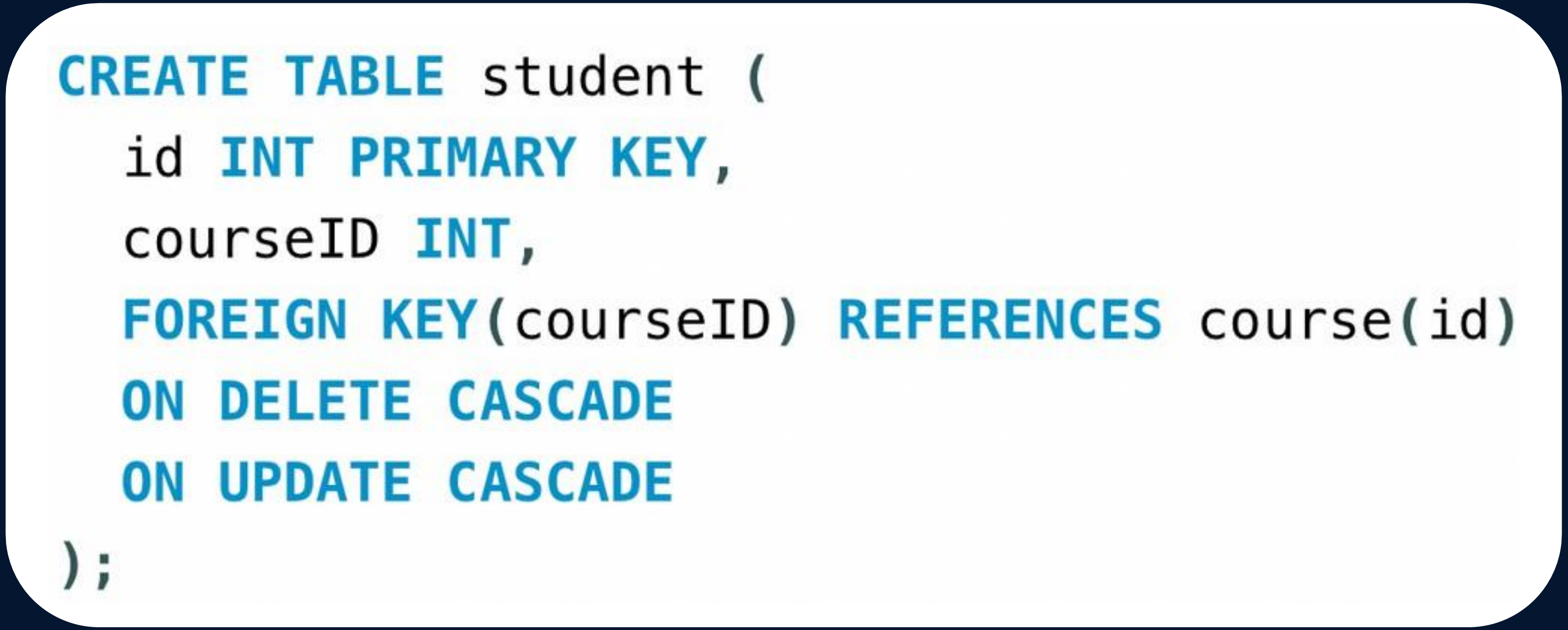
Cascading for FK

On Delete Cascade

When we create a foreign key using this option, it deletes the referencing rows in the child table when the referenced row is deleted in the parent table which has a primary key.

On Update Cascade

When we create a foreign key using UPDATE CASCADE the referencing rows are updated in the child table when the referenced row is updated in the parent table which has a primary key.



```sql
CREATE TABLE student (
  id INT PRIMARY KEY,
  courseID INT,
  FOREIGN KEY(courseID) REFERENCES course(id)
  ON DELETE CASCADE
  ON UPDATE CASCADE
);
```

Table related Queries

Alter (to change the schema)

ADD Column

```
ALTER TABLEtable_name
ADD COLUMNcolumn_name datatype constraint;
```

DROP Column

```
ALTER TABLEtable_name
DROP COLUMNcolumn_name;
```

RENAME Table

```
ALTER TABLEtable_name
RENAME TOnew_table_name;
```

Table related Queries

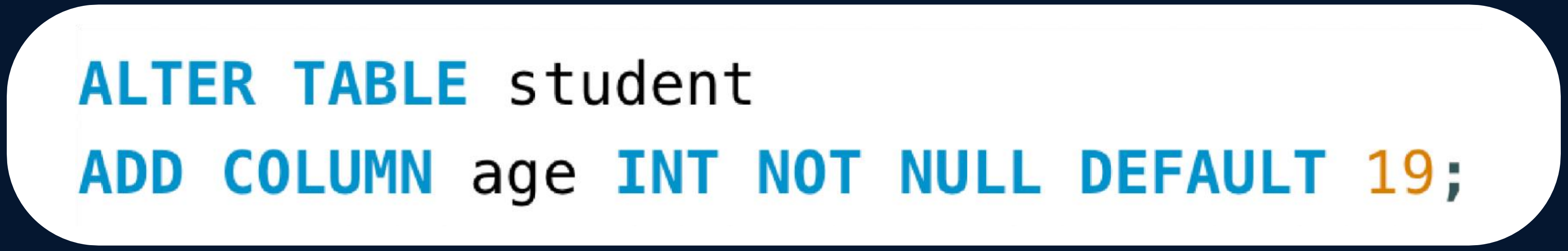
CHANGE Column (rename)

```
ALTER TABLEtable_name
CHANGE COLUMNold_name new_name new_datatype new_constraint;
```

MODIFY Column (modify datatype/ constraint)

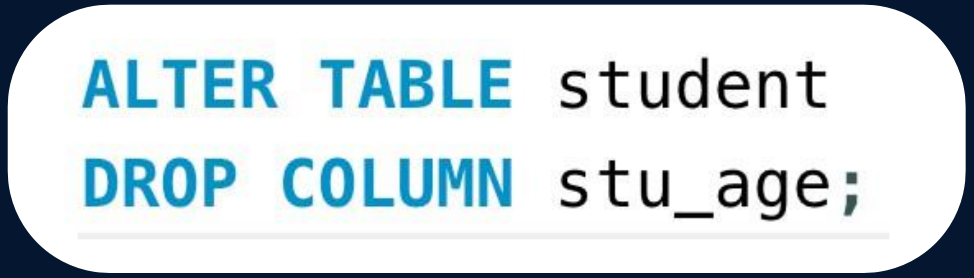
```
ALTER TABLEtable_name
MODIFY col_name new_datatypenew_constraint;
```

ADD Column



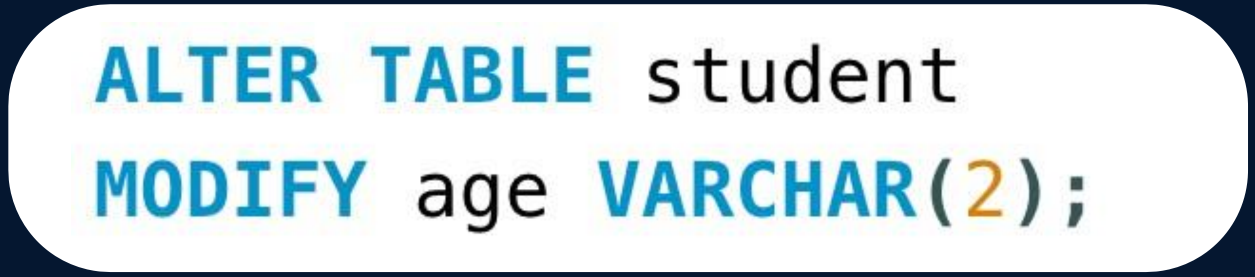
```
ALTER TABLE student
ADD COLUMN age INT NOT NULL DEFAULT 19;
```

DROP Column



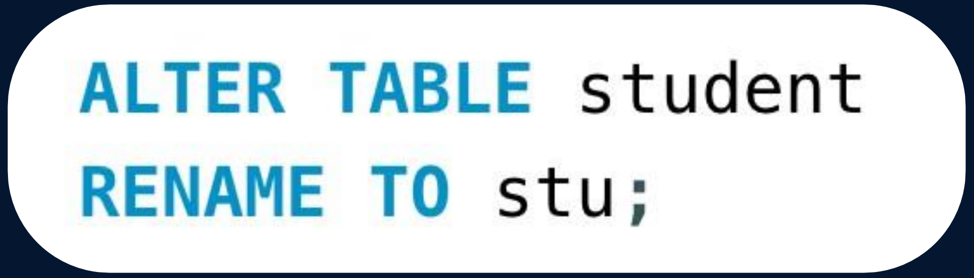
```
ALTER TABLE student
DROP COLUMN stu_age;
```

MODIFY Column



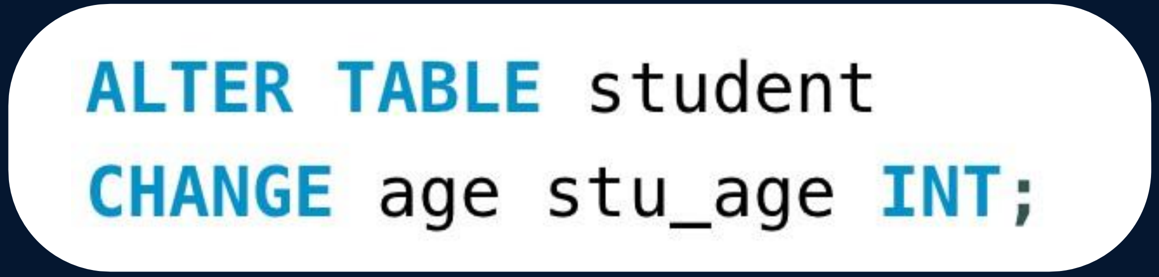
```
ALTER TABLE student
MODIFY age VARCHAR(2);
```

RENAME Table



```
ALTER TABLE student
RENAME TO stu;
```

CHANGE Column (rename)



```
ALTER TABLE student
CHANGE age stu_age INT;
```

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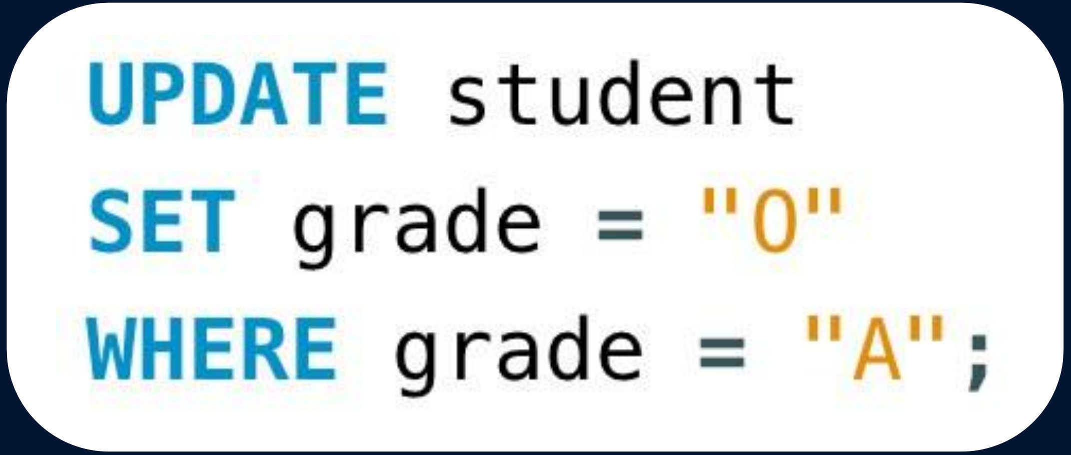
Table related Queries

Truncate (to delete table's data)

TRUNCATE TABLE*table_name ;*



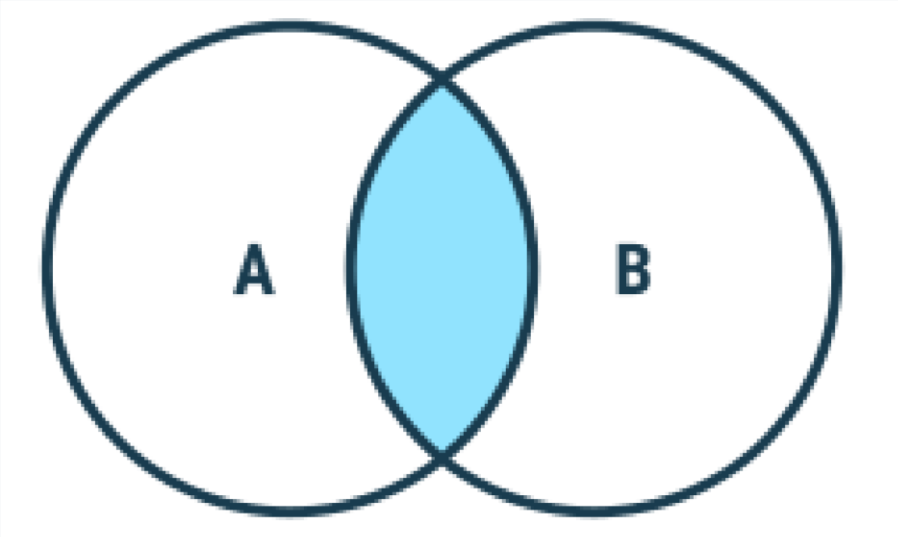
```
UPDATE student
SET grade = "O"
WHERE grade = "A";
```

Joins in SQL

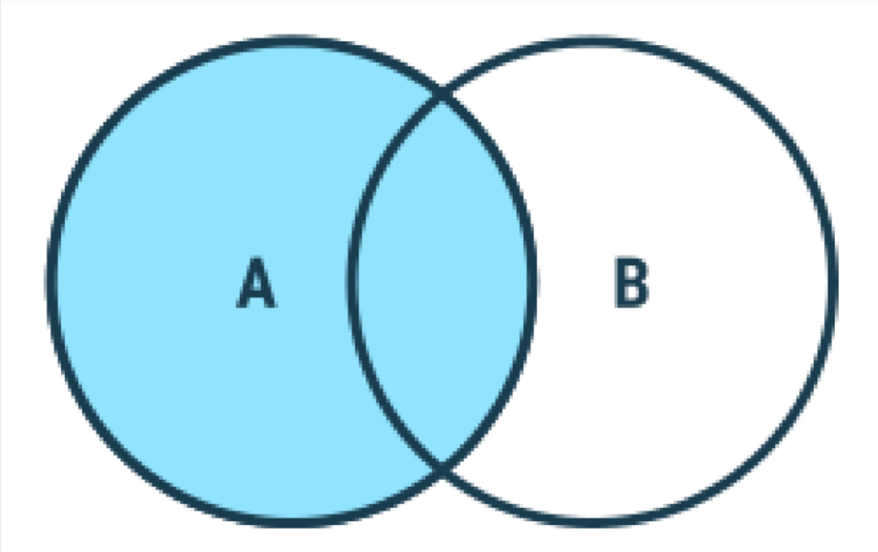
Join is used to combine rows from two or more tables, based on a related column between them.

Kishan

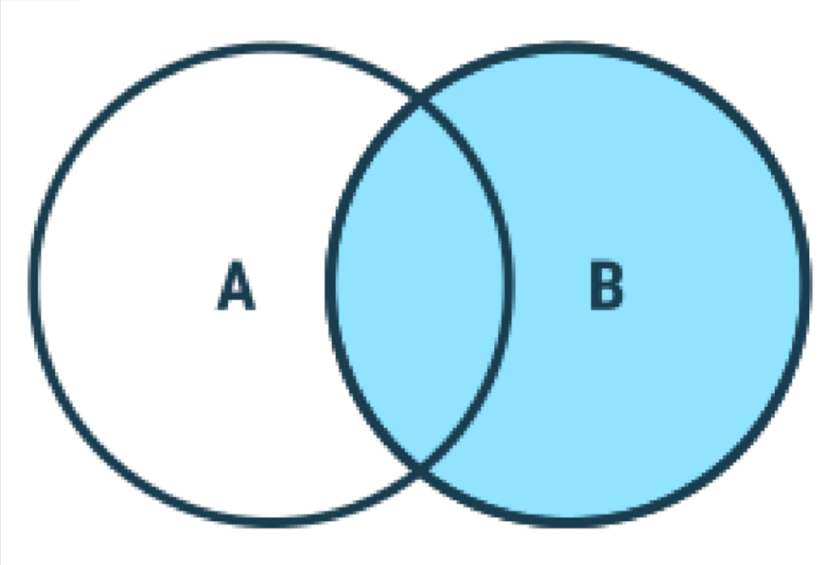
Types of Joins



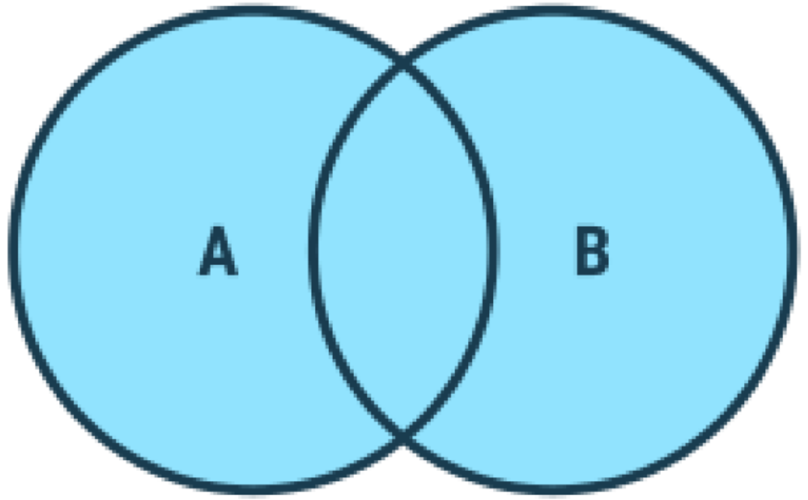
Inner Join



Left Join



Right Join



Full Join

Outer Joins

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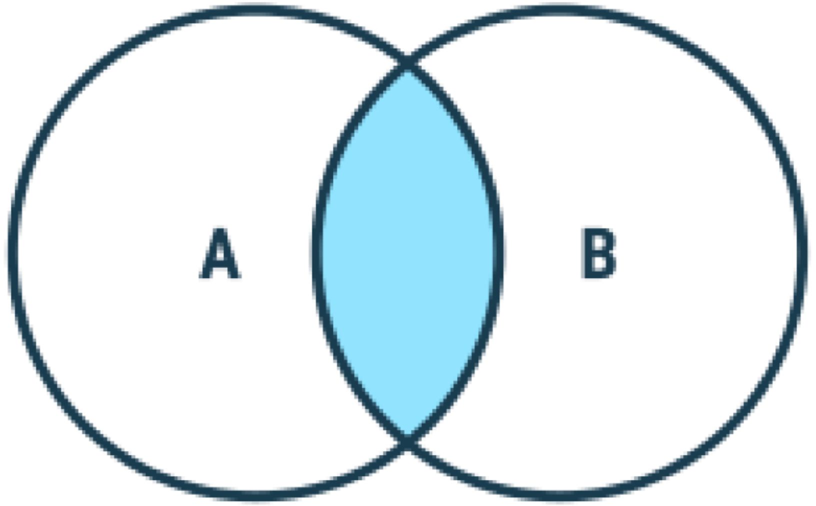
Inner Join

Returns records that have matching values in both tables



Syntax

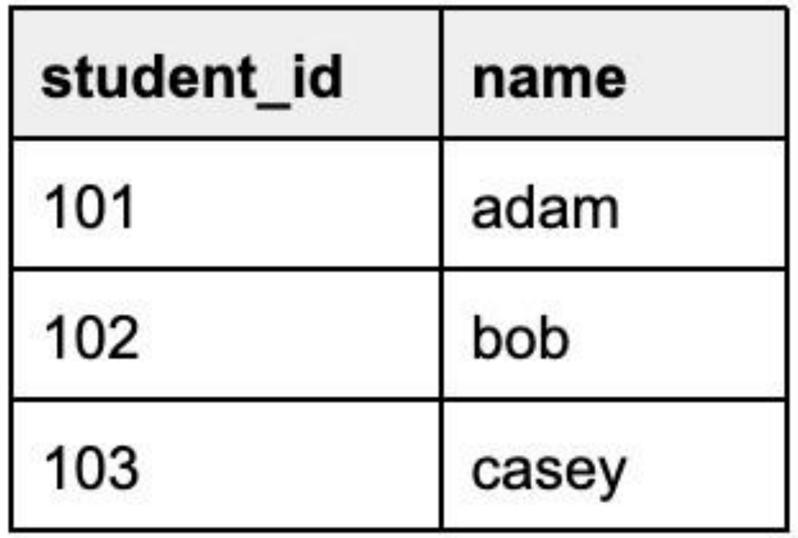
```
SELECT column(s)
FROM tableA
INNER JOIN tableB
O N tableA.col_name = tableB.col_name;
```

Kishan

Inner Join

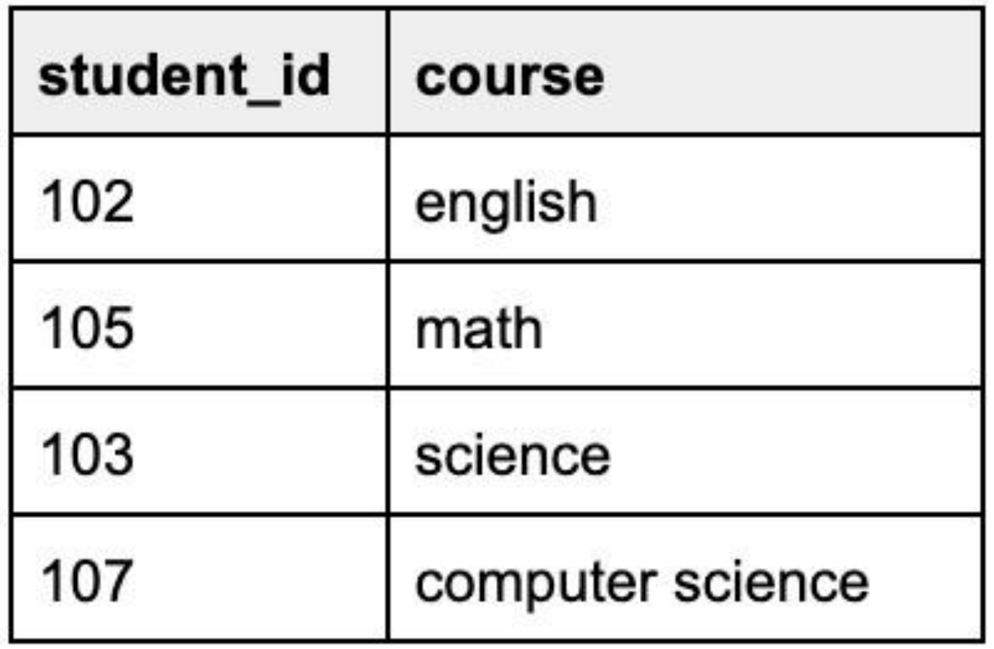
Example

student



student_id	name
101	adam
102	bob
103	casey

course

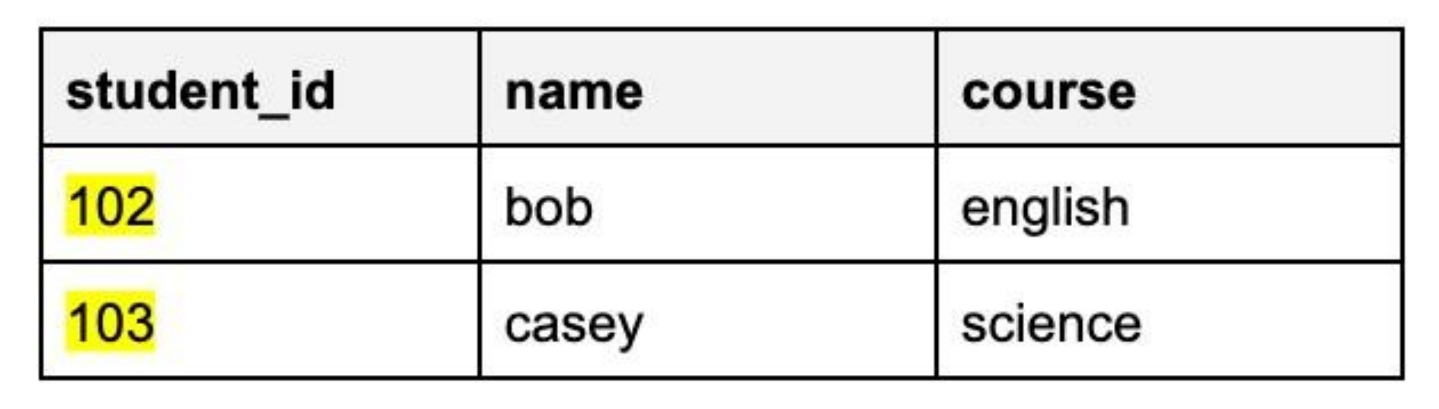


student_id	course
102	english
105	math
103	science
107	computer science

```
SELECT *

FROM student


 INNER JOIN course
    O N student.student_id = course.student_id;
```



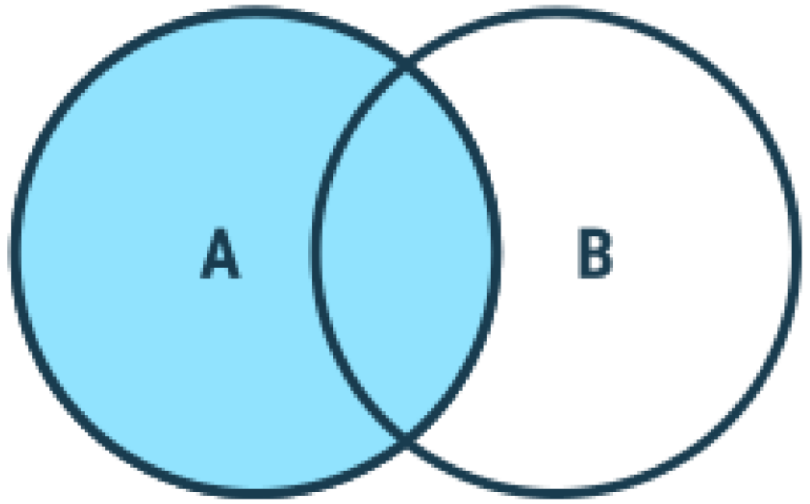
student_id	name	course
102	bob	english
103	casey	science

Result

Kishan

Left Join

Returns all records from the left table, and the matched records from the right table



Syntax

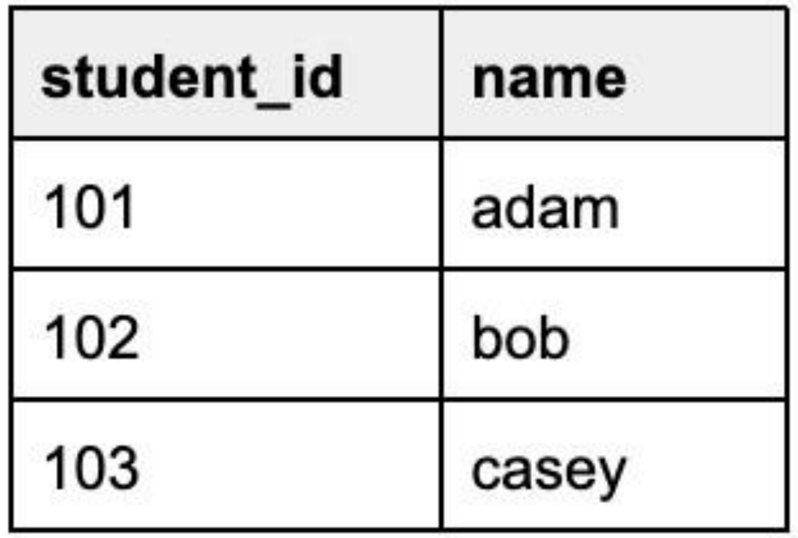
```
SELECT column(s)
FROM tableA
LEFT JOIN tableB
O N tableA.col_name = tableB.col_name;
```

Kishan

Left Join

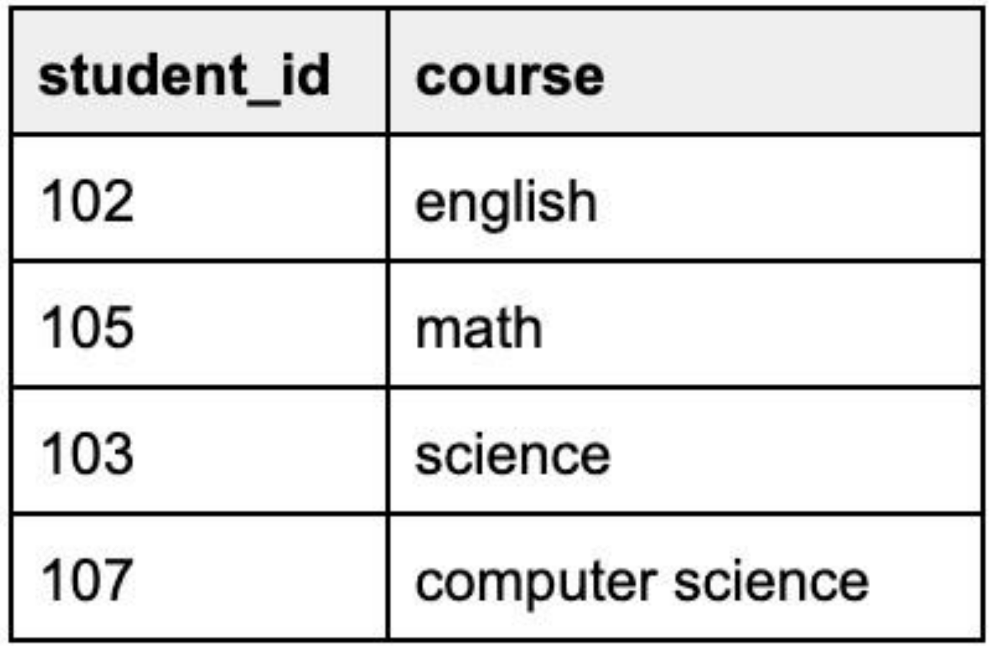
Example

student



student_id	name
101	adam
102	bob
103	casey

course

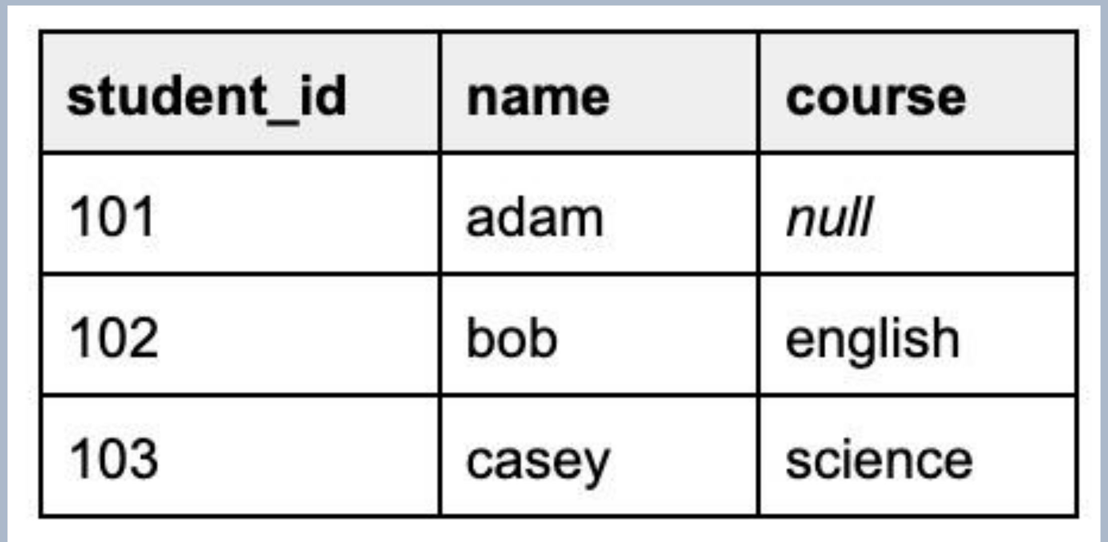


student_id	course
102	english
105	math
103	science
107	computer science

```
SELECT FROM student *   as s

    LEFT JOIN course as c
     O N s.student_id = c.student_id;
```

Result

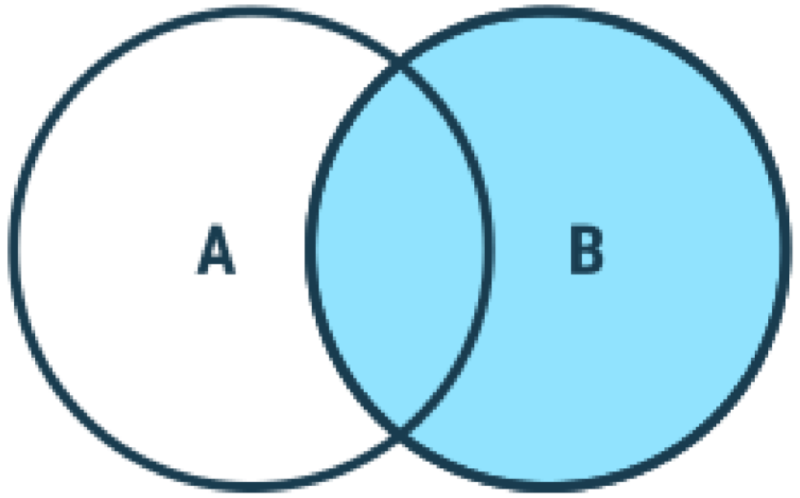


student_id	name	course
101	adam	*null*
102	bob	english
103	casey	science

Kishan

Right Join

Returns all records from the right table, and the matched records from the left table



Syntax

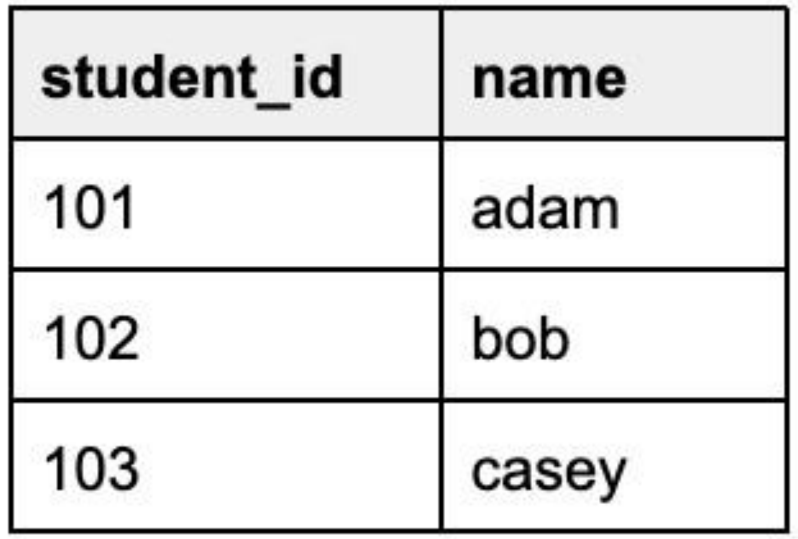
```
SELECT column(s)
FROM tableA
RIGHT JOIN tableB
```

ON *tableA.col_name = tableB.col_name;*

Right Join

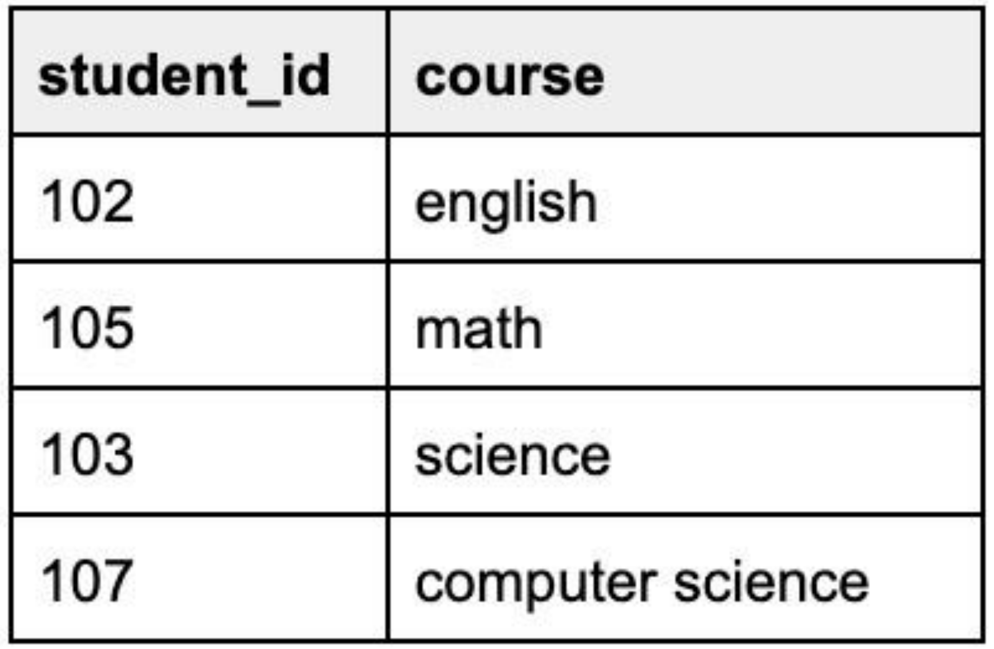
Example

student



student_id	name
101	adam
102	bob
103	casey

course

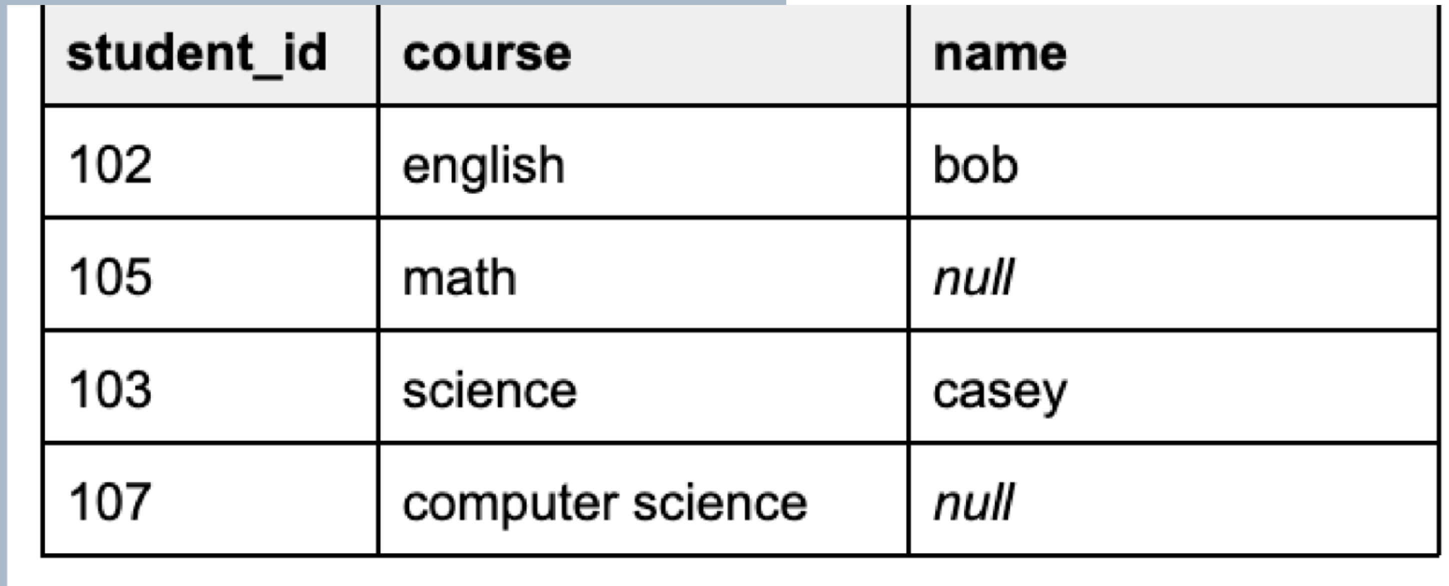


student_id	course
102	english
105	math
103	science
107	computer science

Kishan

```
SELECT *
FROM student as s
RIGHT JOIN course as c
ON s.student_id = c.student_id;
```

Result

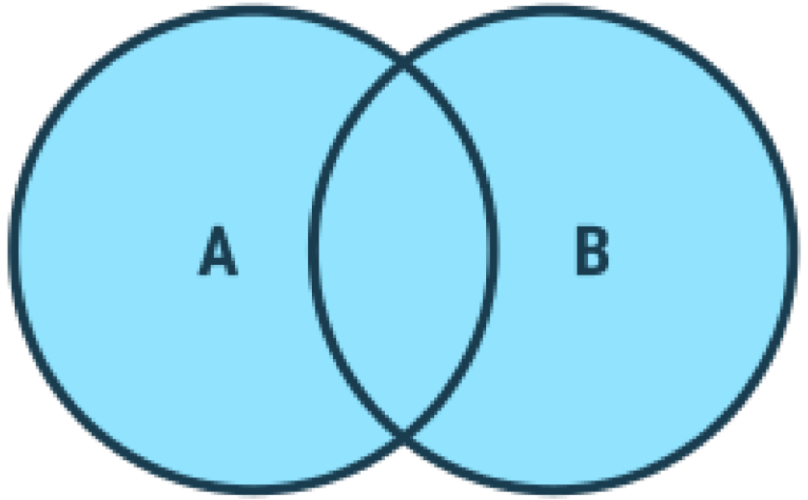


student_id	course	name
102	english	bob
105	math	*null*
103	science	casey
107	computer science	*null*

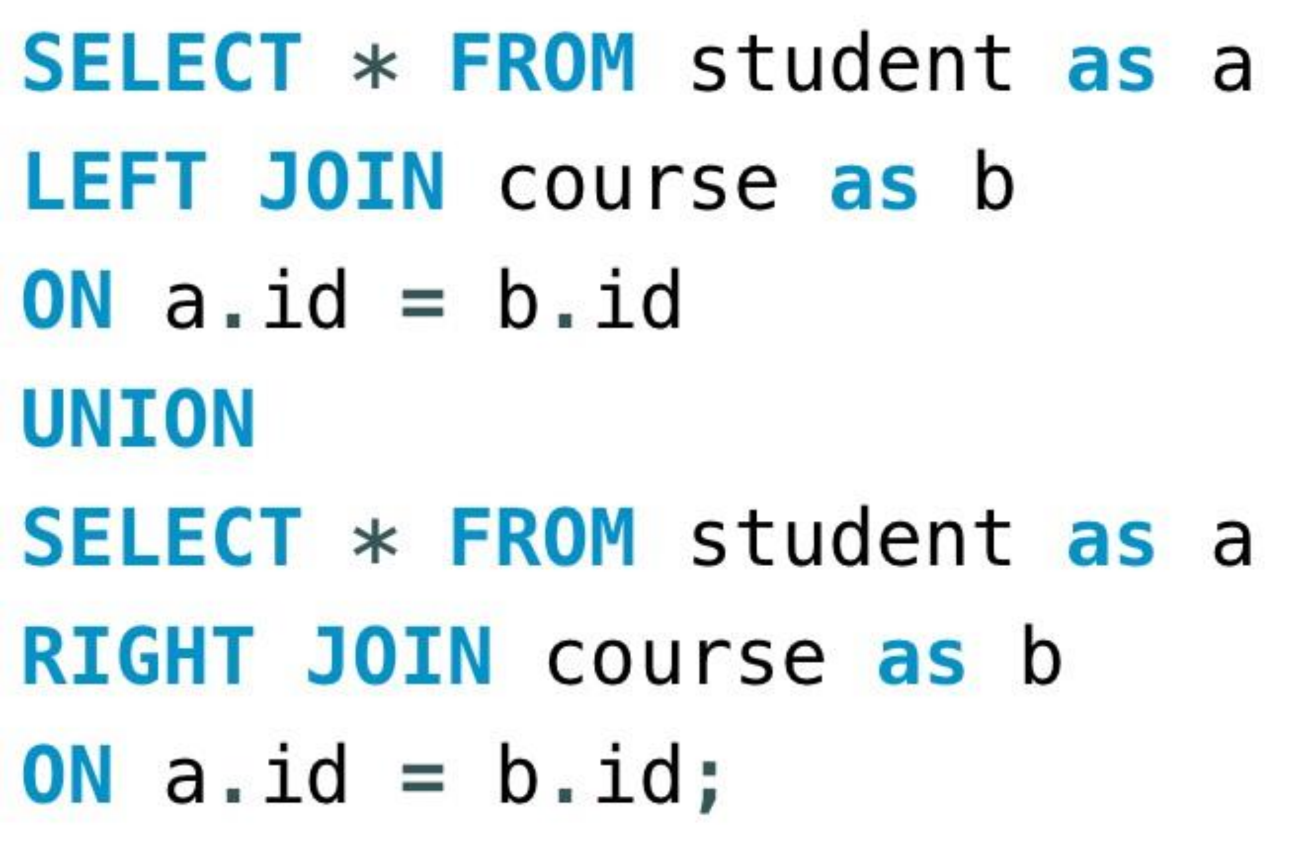
Kishan

__________ Full Join

Returns all records when there is a match in either left or right table



Syntax in MySQL



```
SELECT * FROM student as a
LEFT JOIN course as b
ON a.id = b.id
UNION
SELECT * FROM student as a
RIGHT JOIN course as b
ON a.id = b.id;
```

LEFT JOIN

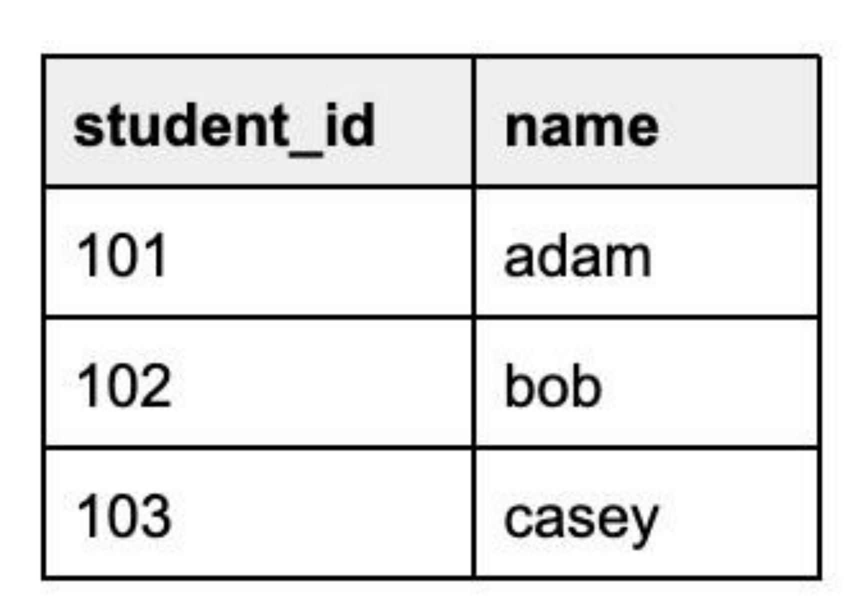
UNION

RIGHT JOIN

Kishan

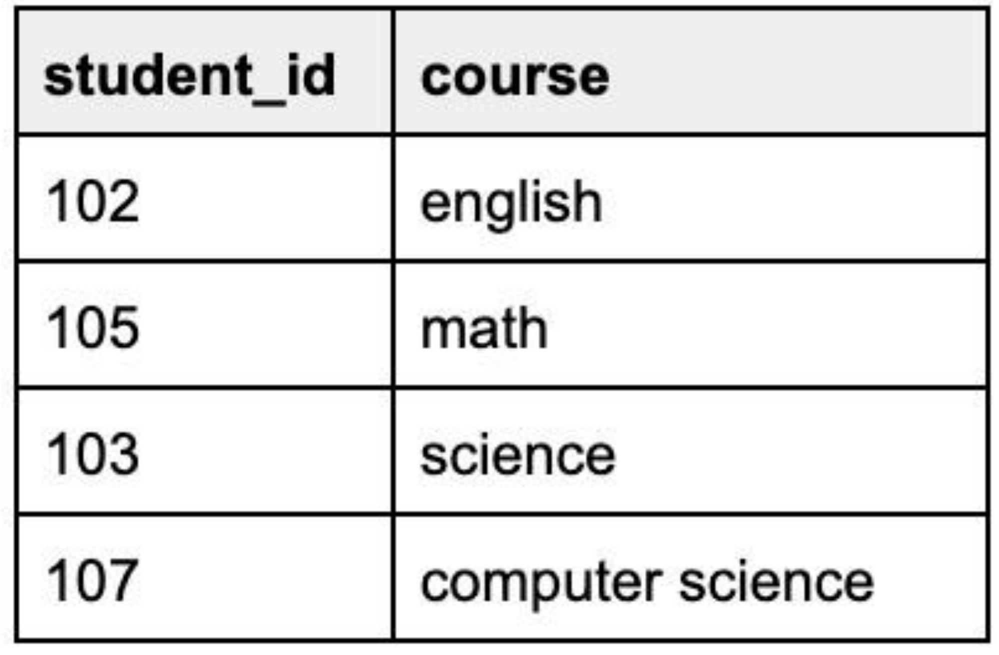
Full Join

***Example** student*



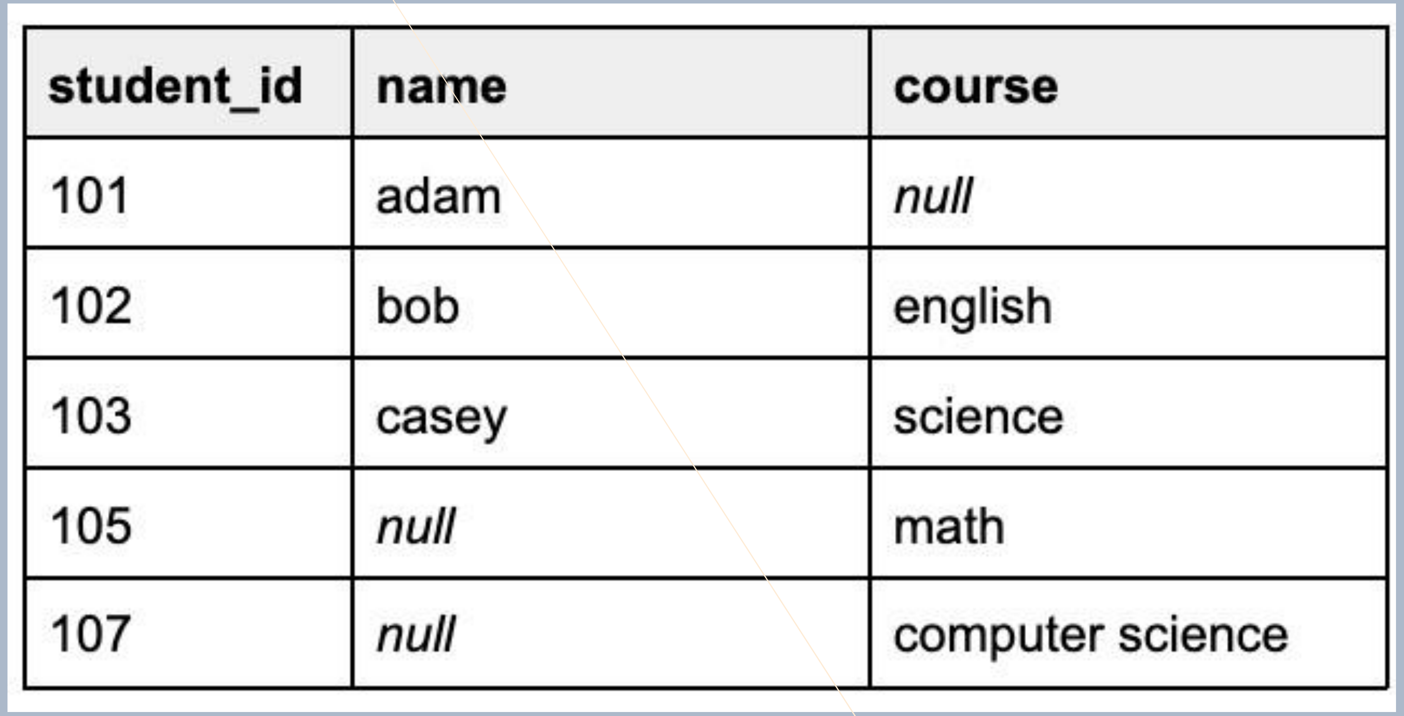
student_id	name
101	adam
102	bob
103	casey

course



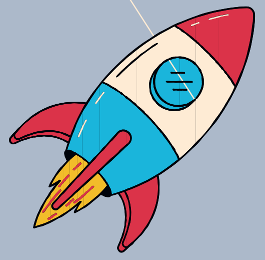
student_id	course
102	english
105	math
103	science
107	computer science

Result

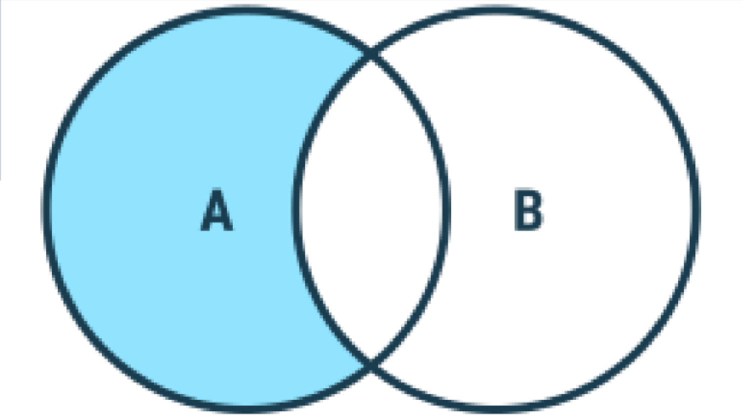


student_id	name	course
101	adam	*null*
102	bob	english
103	casey	science
105	*null*	math
107	*null*	computer science

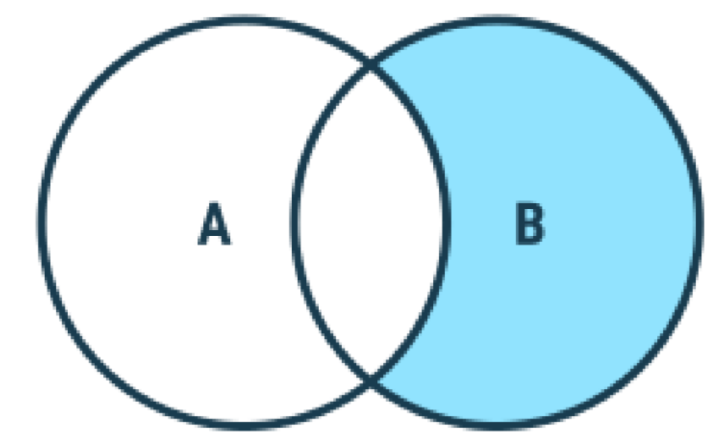
Think & Ans



Qs: Write SQL commands to display the right exclusive join :



Left Exclusive Join



Right Exclusive Join

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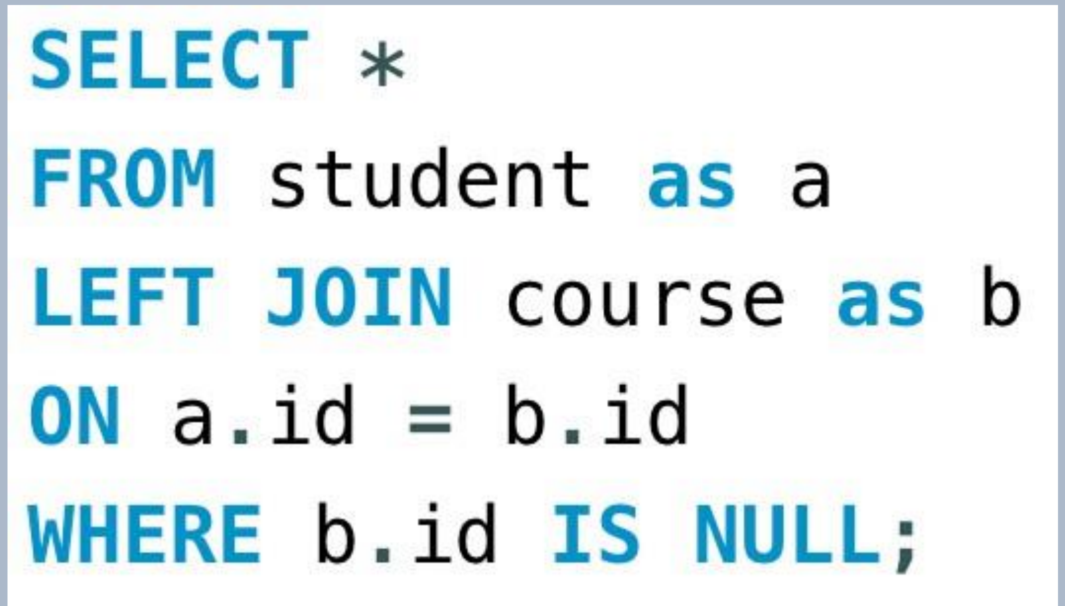

```sql
SELECT *
FROM student as a
LEFT JOIN course as b
ON a.id = b.id
WHERE b.id IS NULL;
```

Self Join

It is a regular join but the table is joined with itself.

Syntax

SELECT *column(s)*
FROM ***table as a***
JOIN ***table as b***

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O N *a.col_name = b.col_name;*

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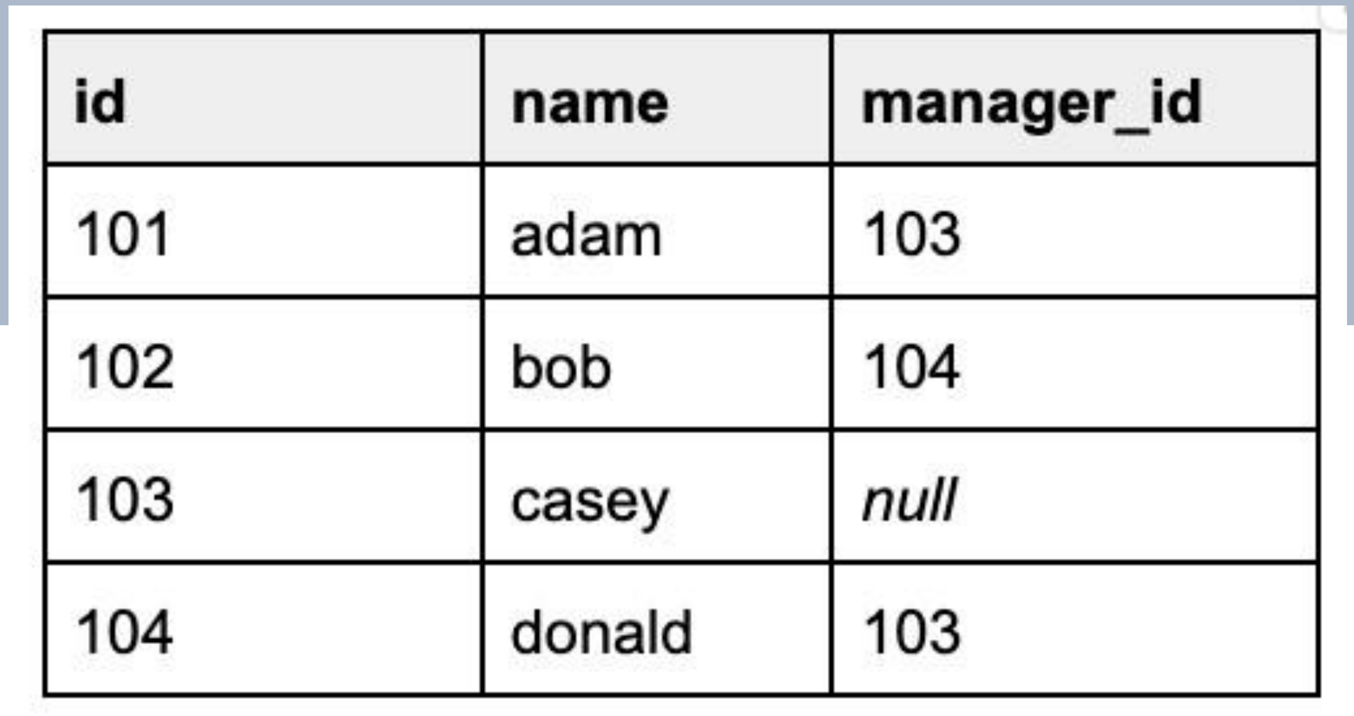
__________ Self Join

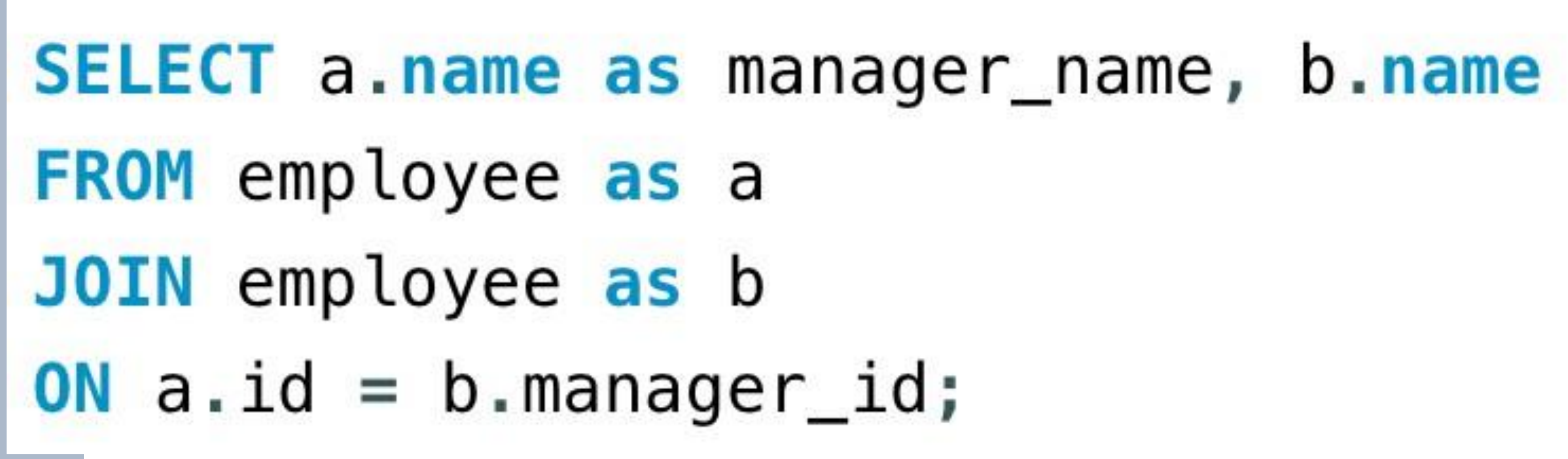
Example



id	name	manager_id
101	adam	103
102	bob	104
103	casey	*null*
104	donald	103

Employee

Result



```sql
SELECT a.name as manager_name, b.name
FROM employee as a
JOIN employee as b
ON a.id = b.manager_id;
```

Union

It is used to combine the result-set of two or more SELECT statements.
Gives UNIQUE records.

To use it :

- every SELECT should have same no. of columns
- columns must have similar data types
- columns in every SELECT should be in same order

Syntax

```
SELECT column(s) FROM tableA


UNION

SELECT column(s) FROM tableB
```

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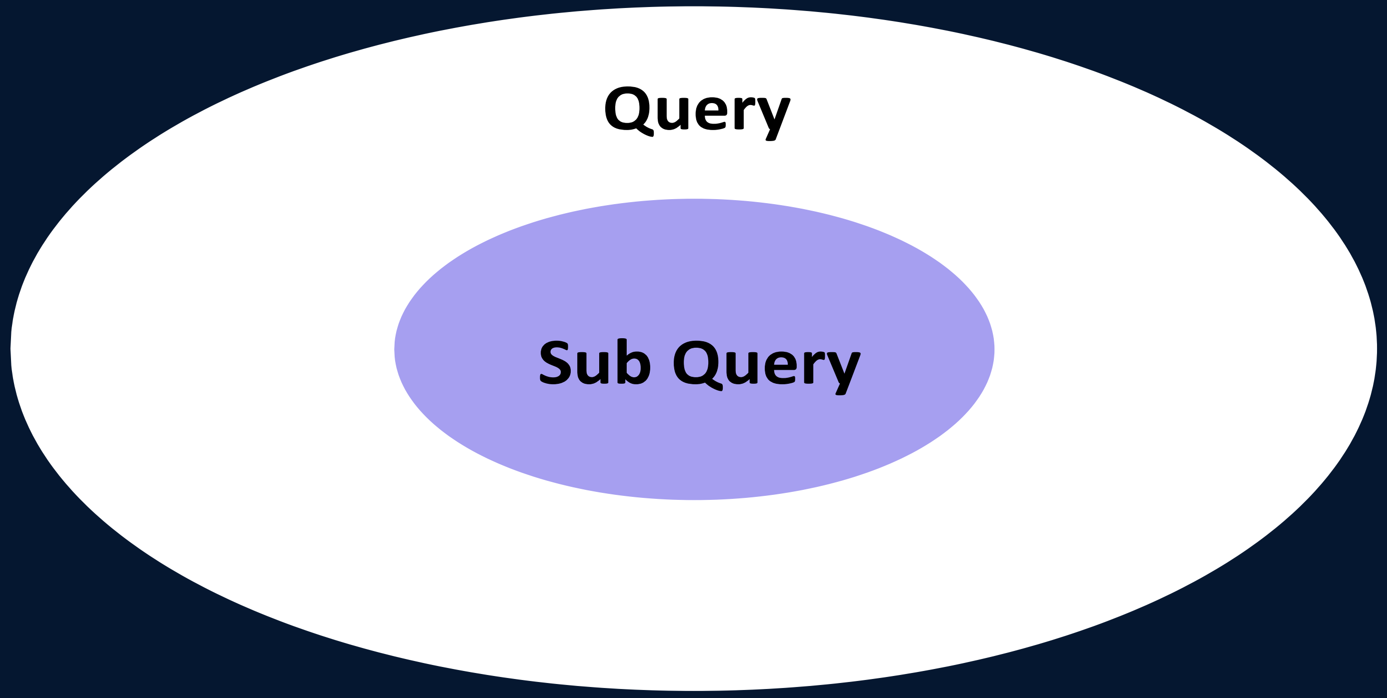
SQL Sub Queries

A Subquery or Inner query or a Nested query is a query within another SQL query.

It involves 2 select statements.

Syntax

```
SELECT column(s)
FROM table_name
WHERE col_name operator
( subquery );
```



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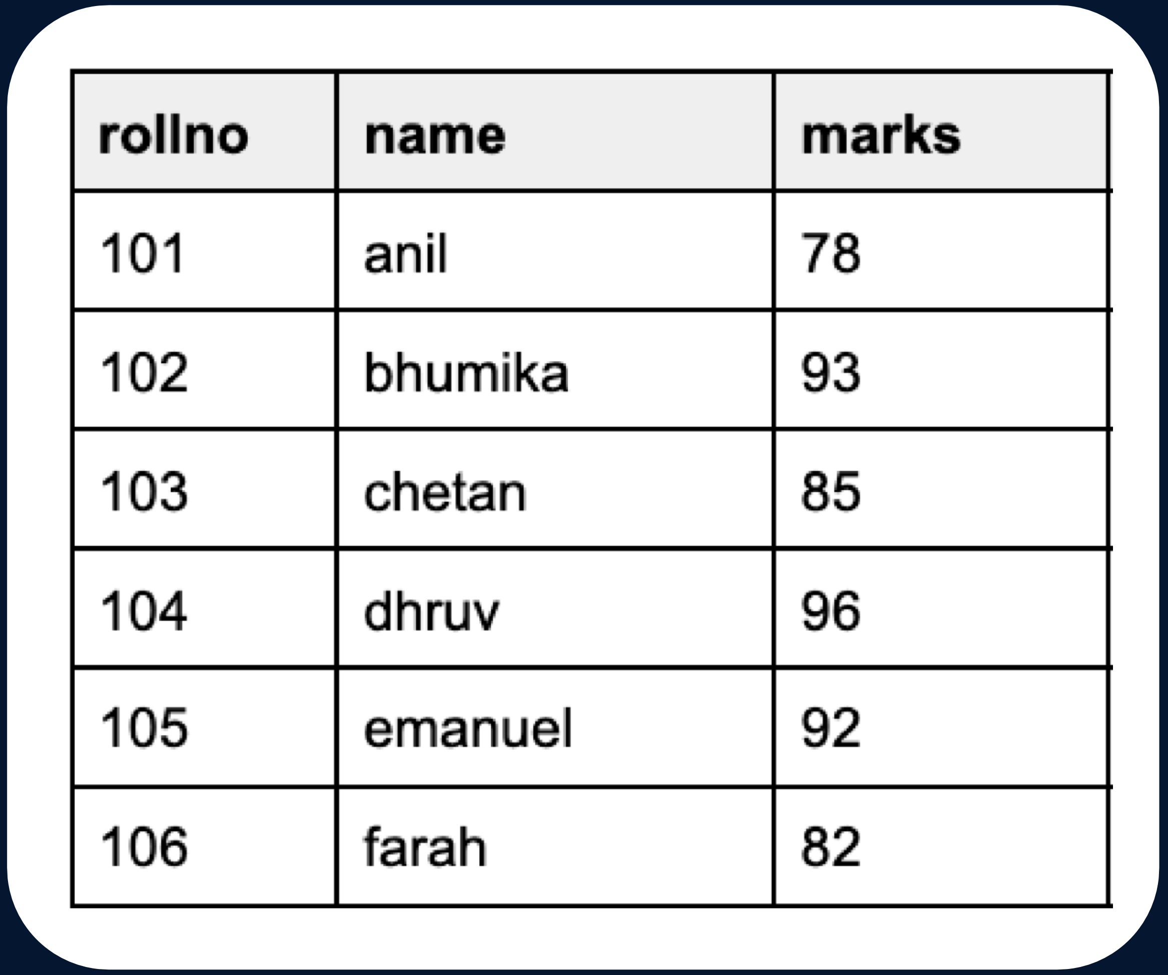
SQL Sub Queries

Example

Get names of all students who scored more than class average.

Step 1. Find the avg of class

Step 2. Find the names of students with marks > avg



rollno	name	marks
101	anil	78
102	bhumika	93
103	chetan	85
104	dhruv	96
105	emanuel	92
106	farah	82

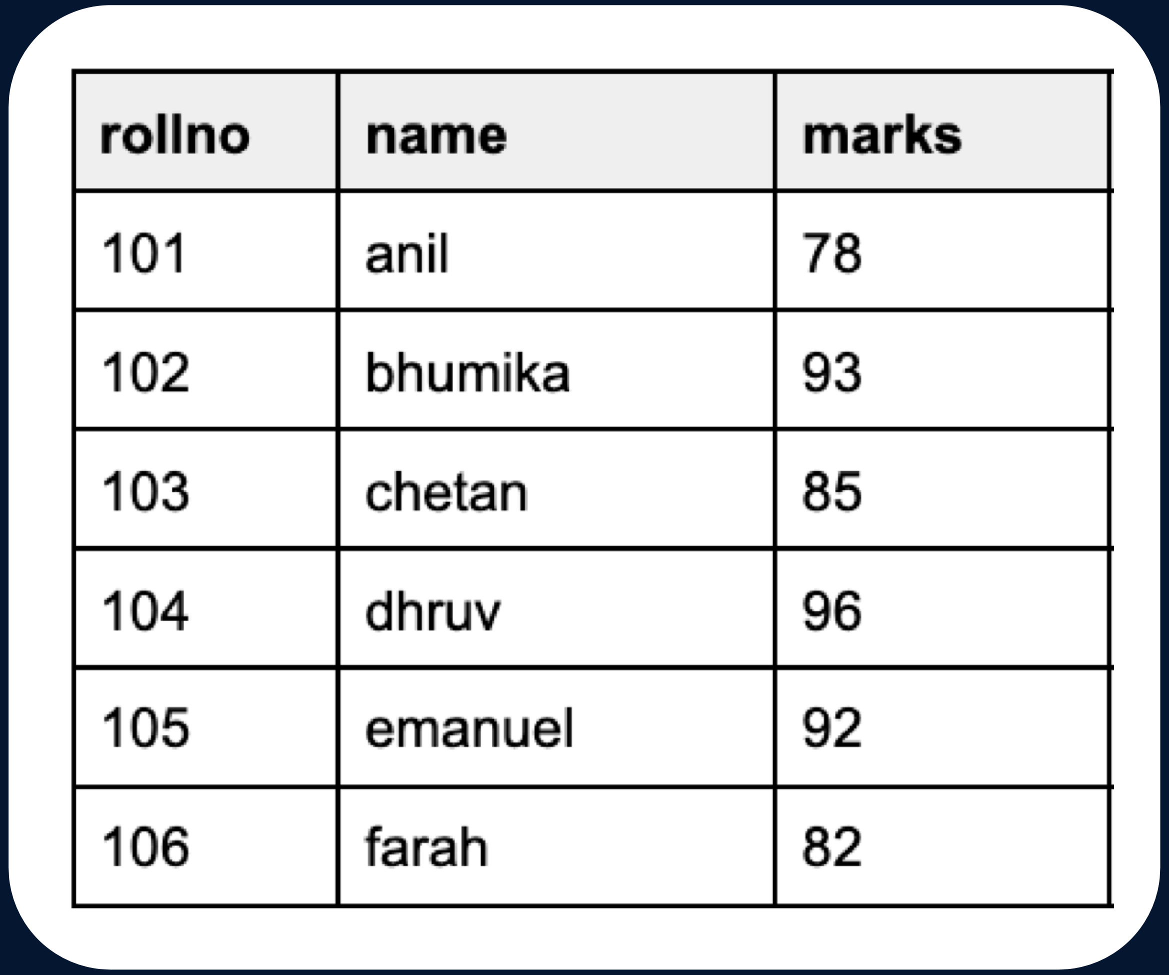
SQL Sub Queries

Example

Find the names of all students with even roll numbers.

Step 1. Find the even roll numbers

Step 2. Find the names of students with even roll no



rollno	name	marks
101	anil	78
102	bhumika	93
103	chetan	85
104	dhruv	96
105	emanuel	92
106	farah	82

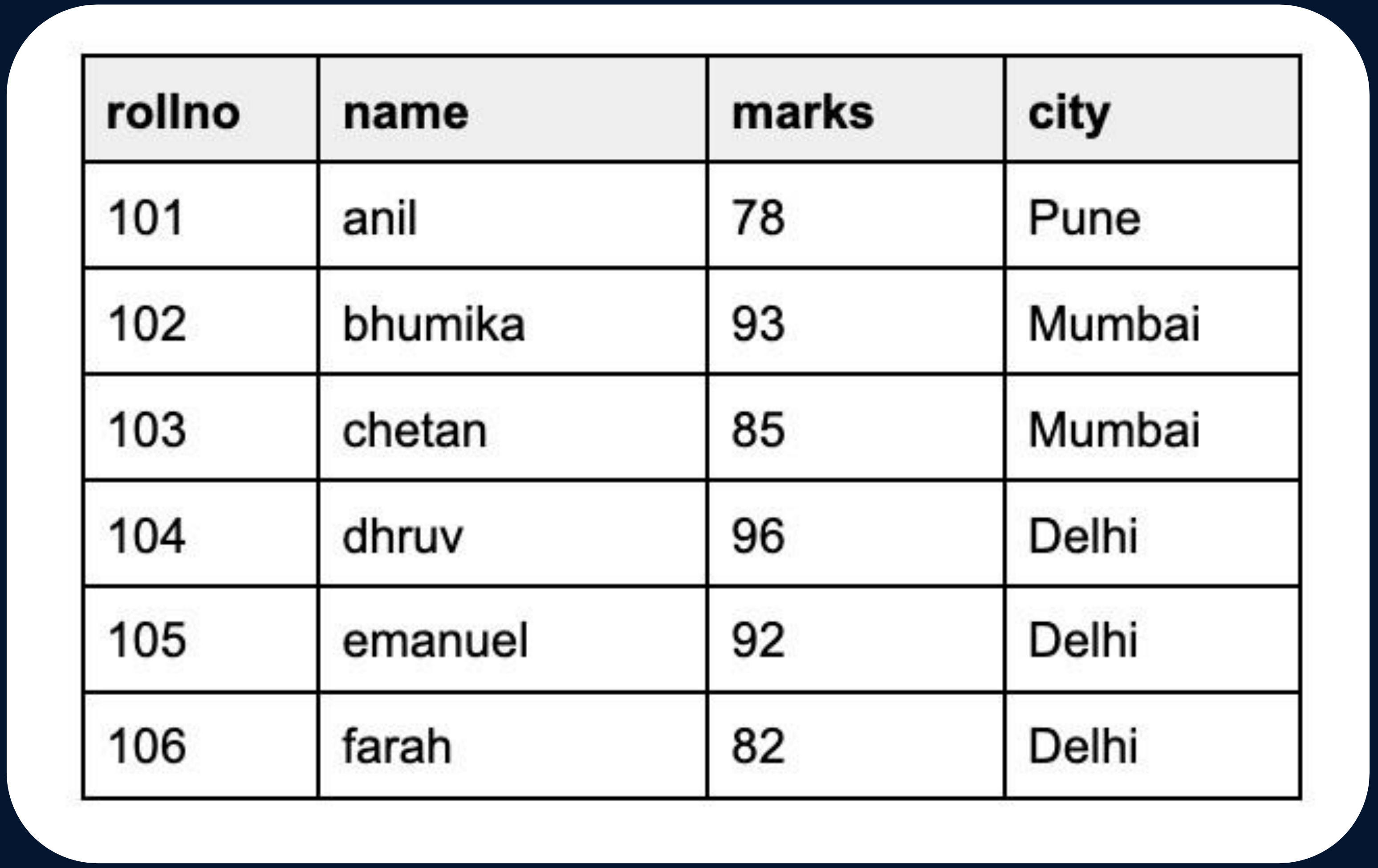
SQL Sub Queries

Example withFROM

Find the max marks from the students of Delhi

Step 1. Find the students of Mumbai

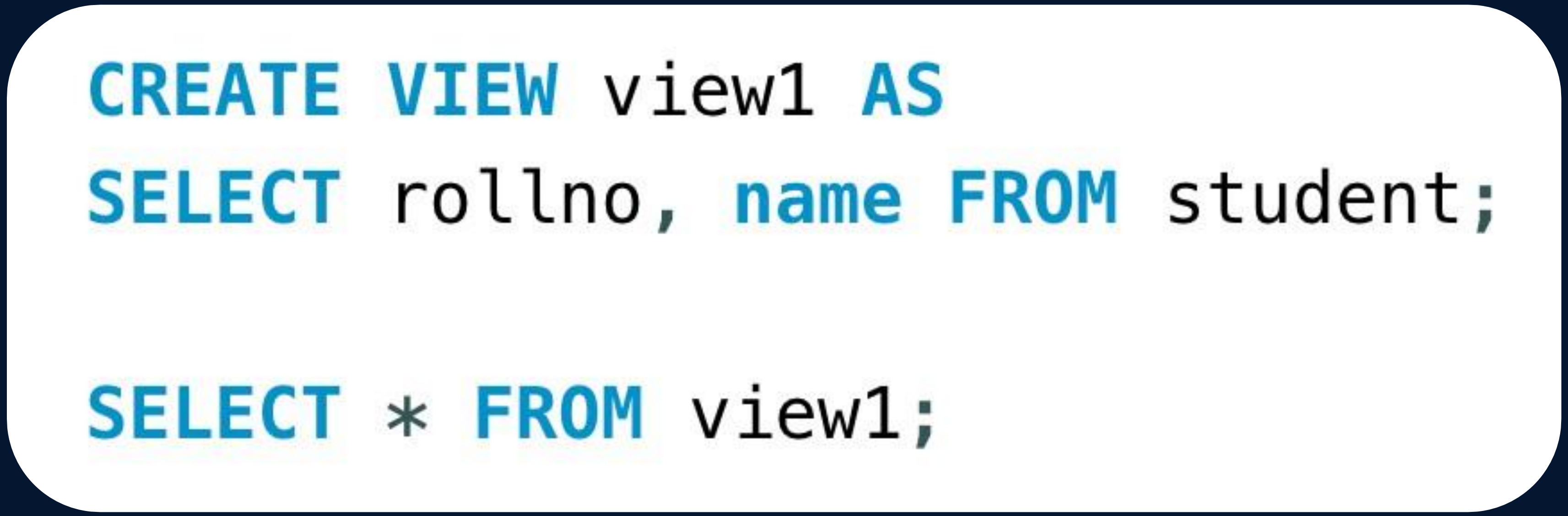
Step 2. Find their max marks using the sublist in step 1



rollno	name	marks	city
101	anil	78	Pune
102	bhumika	93	Mumbai
103	chetan	85	Mumbai
104	dhruv	96	Delhi
105	emanuel	92	Delhi
106	farah	82	Delhi

MySQL Views

A view is a virtual table based on the result-set of an SQL statement.



```
CREATE VIEW view1 AS
SELECT rollno, name FROM student;

SELECT * FROM view1;
```

***A view always shows up-to-date data. The database engine recreates the view, every time a user queries it.**

Kishan