

# SQL

# 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



## Non-relational (NoSQL)

data not stored in tables



\*\* We use SQL to work with relational DBMS

# What is SQL?



## Structured Query Language

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

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

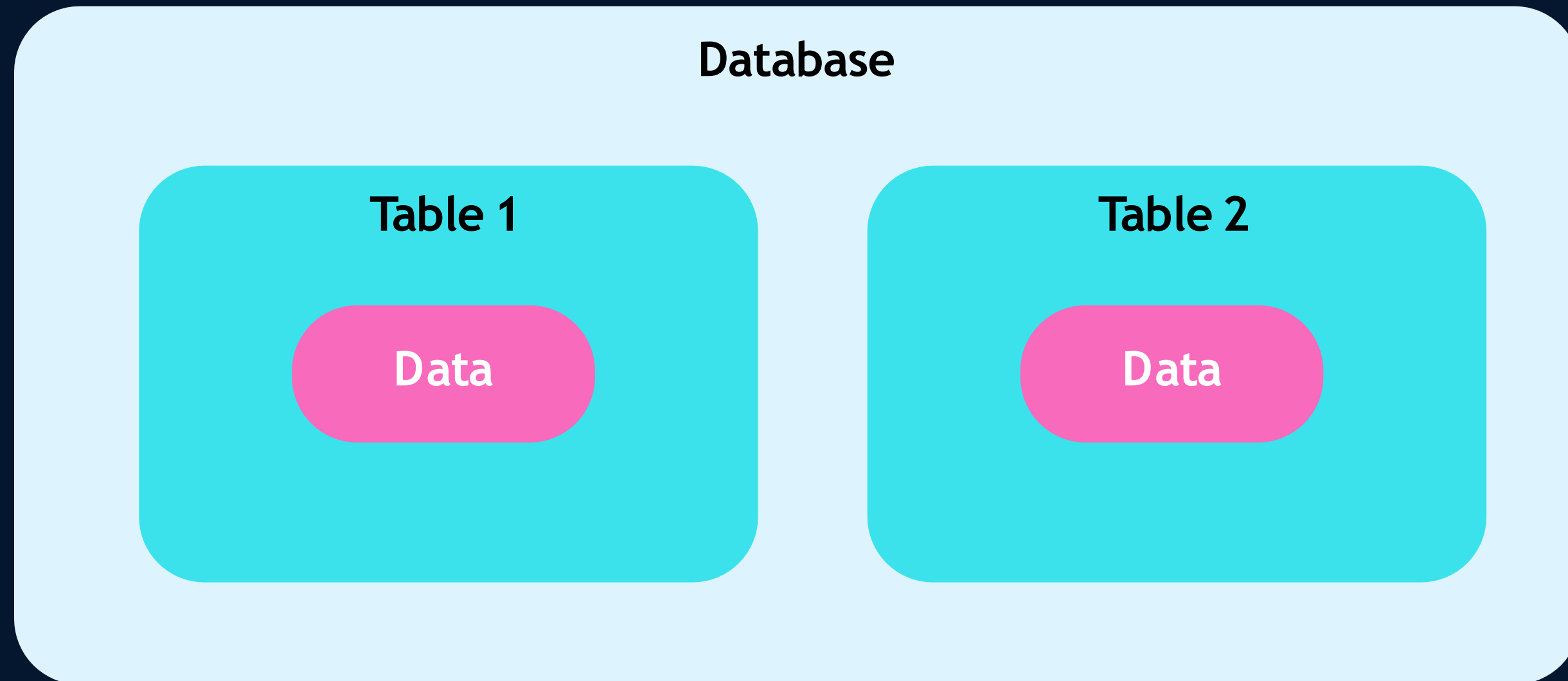
Create

Read

Update

Delete

# Database Structure



# 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  
);
```



# SQL Datatypes

They define the **type of values** that 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)

# 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 DATABASE **IF NOT EXISTS** *db\_name*;

**CREATE DATABASE IF NOT EXISTS** college;

DROP DATABASE *db\_name*;

DROP DATABASE **IF 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)  
);
```

# 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");
```

# 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*

```
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*

```
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");
```

# 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;
```

# Where Clause

To define some conditions

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

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



# Where Clause

## Using Operators in WHERE

**Arithmetic Operators :** +(addition) , -(subtraction), \*(multiplication), /(division), %(modulus)

**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)

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

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

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

# Operators

**Between** (selects for a given range)

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

**In** (matches any value in the list)

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

**NOT** (to negate the given condition)

```
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

Aggregate 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;
```

## Group By Clause

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 any **condition 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;
```

## General Order

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



## Table related Queries

Update (to update existing rows)

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

```
UPDATE student  
SET grade = "0"  
WHERE grade = "A";
```

## Table related Queries

Delete (to delete existing rows)

DELETE FROM *table\_name*  
WHERE *condition*;

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

# 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.

```
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 TABLE *table\_name*

ADD COLUMN *column\_name datatype constraint;*

## DROP Column

ALTER TABLE *table\_name*

DROP COLUMN *column\_name;*

## RENAME Table

ALTER TABLE *table\_name*

RENAME TO *new\_table\_name;*

## Table related Queries

**CHANGE** Column (rename)

**ALTER TABLE** *table\_name*

**CHANGE COLUMN** *old\_name new\_name new\_datatype new\_constraint;*

**MODIFY** Column (modify datatype/ constraint)

**ALTER TABLE** *table\_name*

**MODIFY** *col\_name new\_datatype new\_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;
```

## Table related Queries

Truncate (to delete table's data)

```
TRUNCATE TABLE table_name ;
```

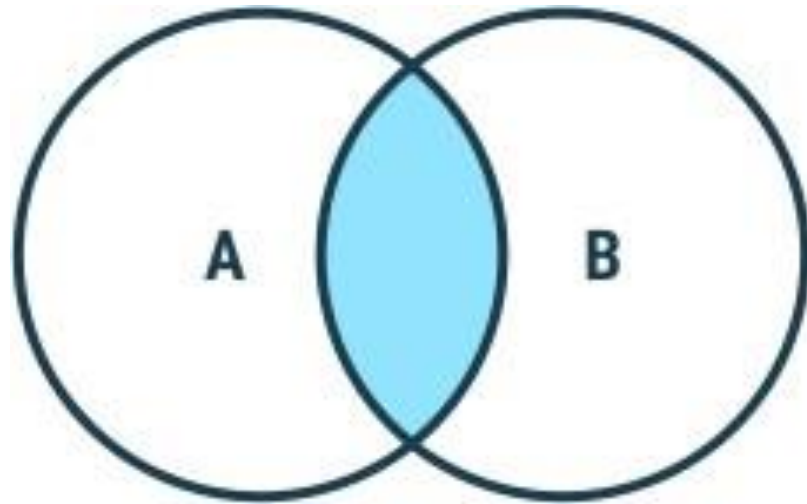
```
UPDATE student  
SET grade = "0"  
WHERE grade = "A";
```

## Joins in SQL

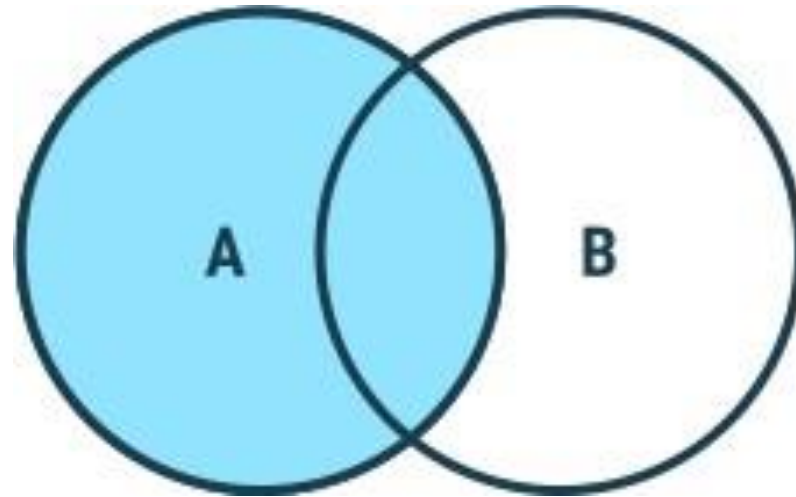
Join is used to combine rows from two or more tables, based on a related column between them.



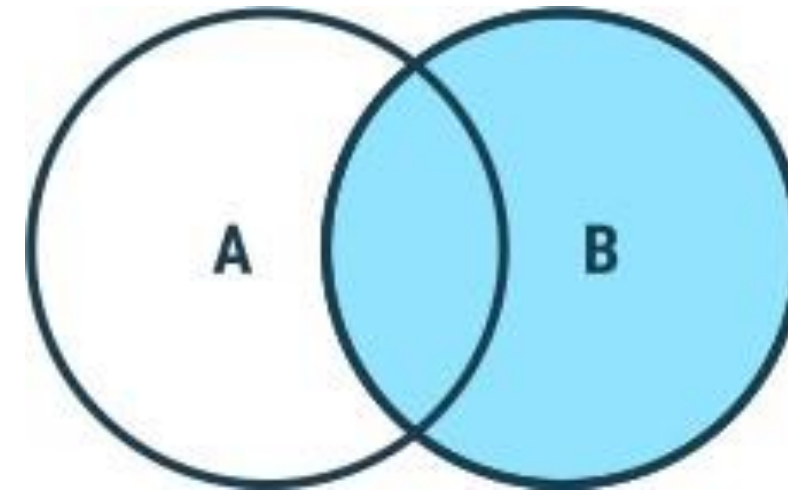
## Types of Joins (Venn Diagrams)



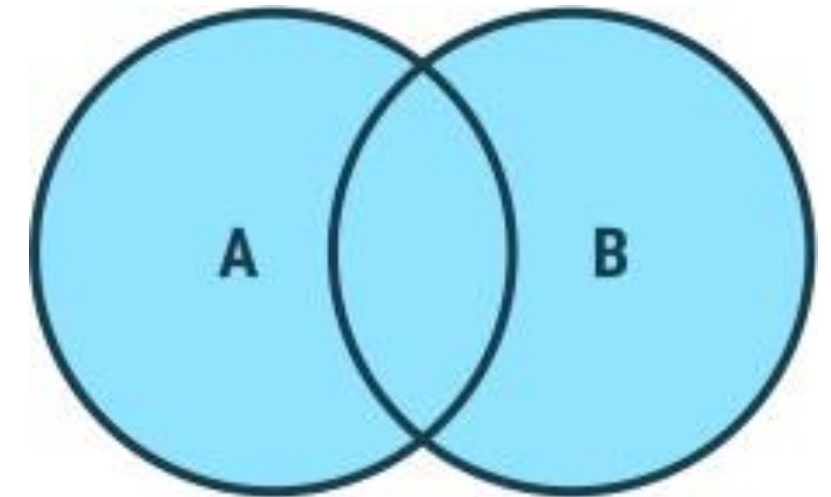
Inner Join



Left Join



Right Join



Full Join



Outer Joins

## Inner Join

Returns records that have matching values in both tables

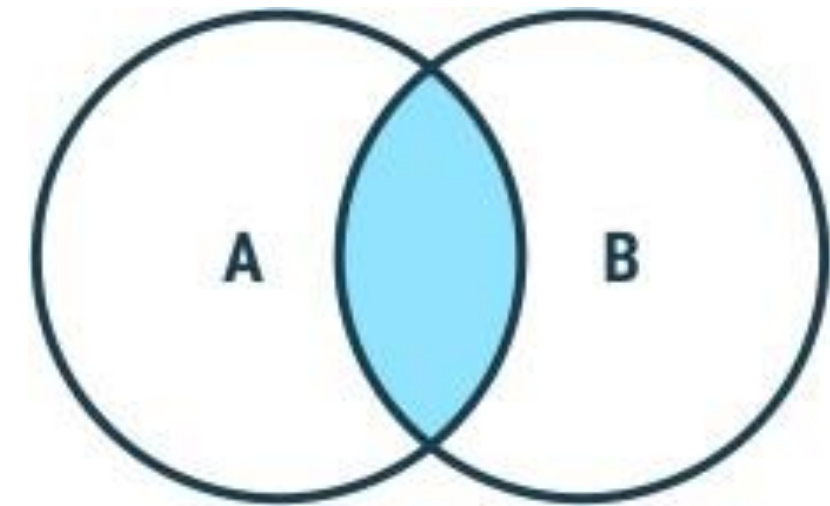
### *Syntax*

**SELECT** *column(s)*

**FROM** *tableA*

**INNER JOIN** *tableB*

**ON** *tableA.col\_name = tableB.col\_name;*



# 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  
ON student.student_id = course.student_id;
```

## Result

student_id	name	course
102	bob	english
103	casey	science

## Left Join

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

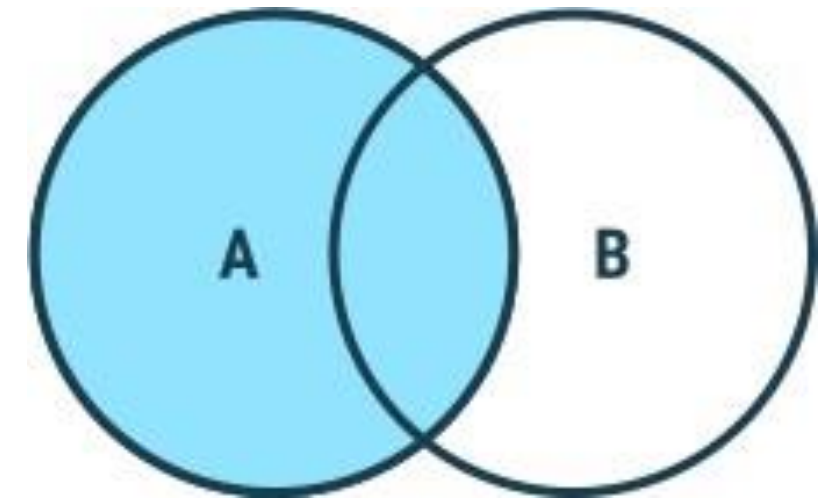
### *Syntax*

**SELECT** *column(s)*

**FROM** *tableA*

**LEFT JOIN** *tableB*

**ON** *tableA.col\_name = tableB.col\_name;*



# 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  
ON s.student_id = c.student_id;
```

## Result

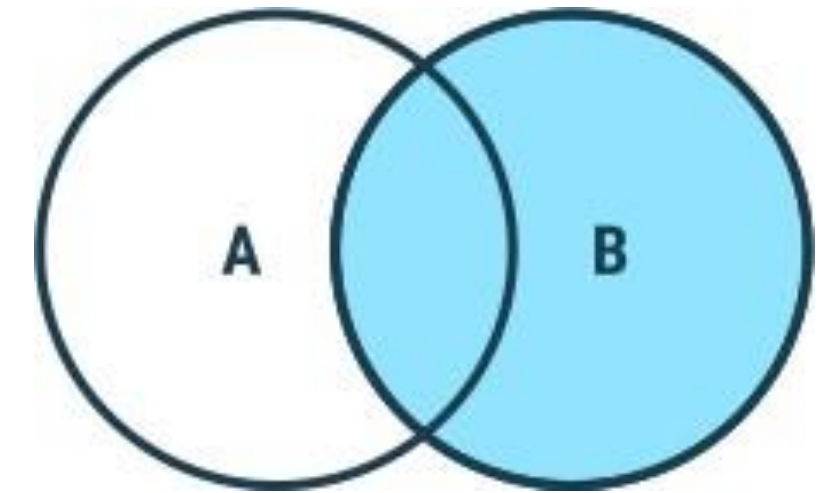
student_id	name	course
101	adam	<i>null</i>
102	bob	english
103	casey	science

## 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

```
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

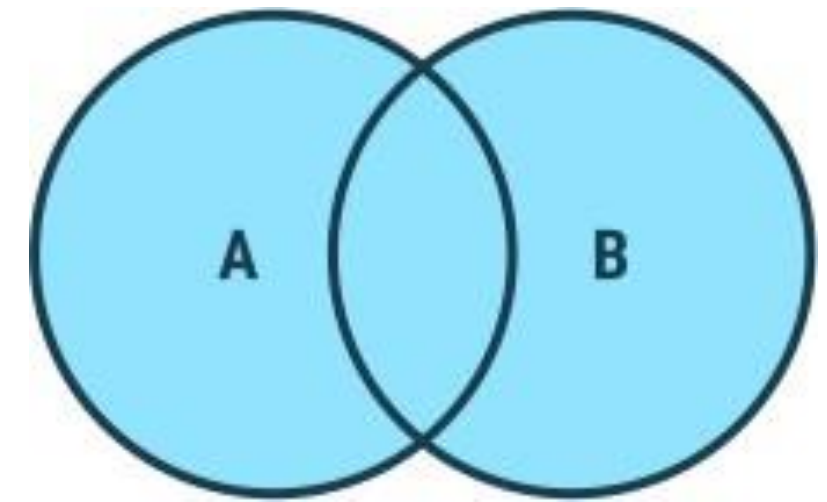
## Full Join

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*





# Full Join

## *Example*

*student*

student_id	name
101	adam
102	bob
103	casey

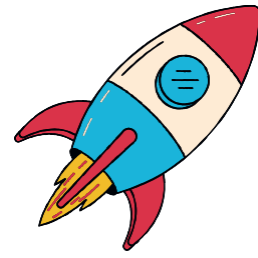
*course*

student_id	course
102	english
105	math
103	science
107	computer science

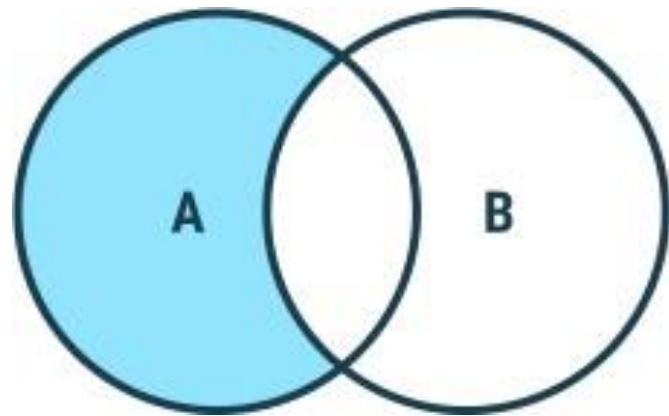
## *Result*

student_id	name	course
101	adam	<i>null</i>
102	bob	english
103	casey	science
105	<i>null</i>	math
107	<i>null</i>	computer science

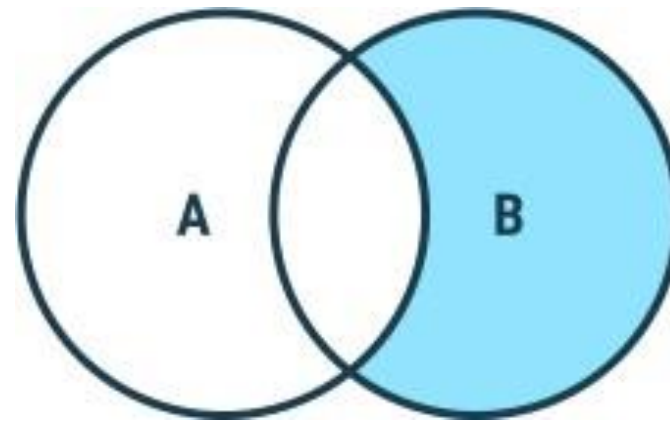
# Think & Ans



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



Left Exclusive Join



Right Exclusive Join

```
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*

**ON** *a.col\_name = b.col\_name;*

# Self Join

## *Example*

### *Employee*

id	name	manager_id
101	adam	103
102	bob	104
103	casey	<i>null</i>
104	donald	103

## *Result*

```
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*

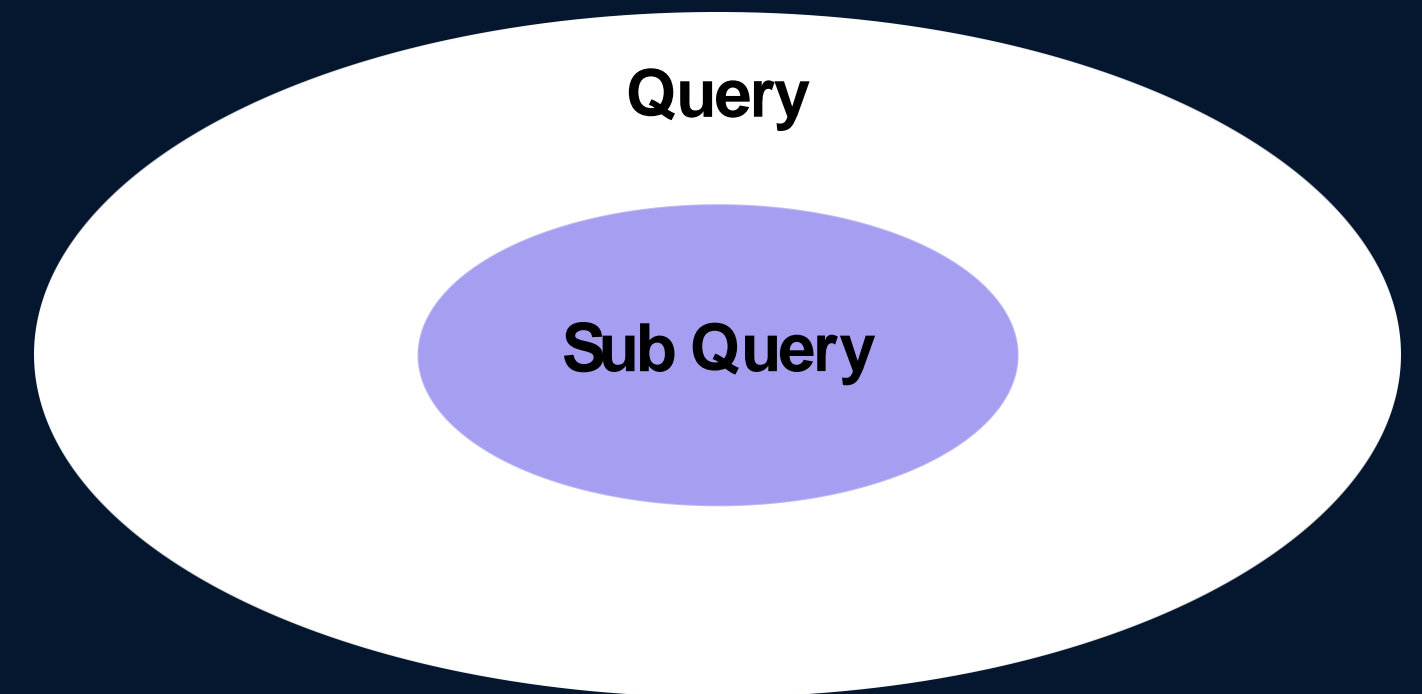
# SQL Sub Queries

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 );
```



## 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 with FROM*

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.