DATA AND
ARTIFICIAL INTELLIGENCE

Subqueries, Operators, and Derived Tables in SQL

simplilearn

Learning Objectives

By the end of this lesson, you will be able to:

- Identify the different join operations performed on tables
- List the various type of set operations and their usage
- Create and view subqueries with different methods
- Use derived tables for complex operations
- Verify subquery output with EXISTS operator

Use Case: Project and Team Management

Use Case: Project and Team Management

Problem Statement: You work as a junior analyst at your organization. You must help the HR department create employee information, project details, and project assignment tables in one of the databases so that managers from all departments can monitor the status and progress of ongoing projects.

Objective: Build the appropriate database and table structures for storing the required manager-specific data.

Download the **EMP_RECORDS.csv**, **PROJ_RECORDS.csv**, and **PROJ_ASSIGN.csv** files from the course resources section.

Use Case: Project and Team Management

Step 1: Create a database named **PROJ_DB** with the **CREATE DATABASE** statement.

SQL Query

```
CREATE DATABASE IF NOT EXISTS PROJ_DB;
```

Use Case: Project and Team Management

Step 2: Set **PROJ_DB** as the default database in MySQL with the **USE** statement.

SQL Query

```
USE PROJ_DB;
```

Use Case: Project and Team Management

Step 3: Set **INNODB** as the default storage engine for **PROJ_DB** database in MySQL with the **SET** statement.

SQL Query

```
SET default_storage_engine = INNODB;
```

Use Case: Project and Team Management

The managers have provided a detailed description of the required employee table given below.

Column Name	Value Type
EMP_ID	A unique ID assigned to each employee while joining the organization
MANAGER_ID	EMP_ID of the reporting manager for the project
FIRST_NAME	First name of the employee
LAST_NAME	Last name of the employee
GENDER	Gender of the employee abbreviated as M (male), F (female), and O (others)
EXP	Overall work experience of the employee
ROLE	Employee job designation
CONTINENT	Location of the branch
COUNTRY	Country of the branch
DEPT	Department of the employee

Use Case: Project and Team Management

Step 4: Create the required **EMP_RECORDS** table in the **PROJ_DB** database with the **CREATE TABLE** statement as given below.

SQL Query

```
CREATE TABLE IF NOT EXISTS PROJ_DB.EMP_RECORDS (
    EMP_ID VARCHAR(4) NOT NULL PRIMARY KEY,
    FIRST_NAME VARCHAR(100) NOT NULL,
    LAST_NAME VARCHAR(100),
    GENDER VARCHAR(1) NOT NULL,
    ROLE VARCHAR(100) NOT NULL,
    DEPT VARCHAR(100) NOT NULL,
    EXP INTEGER NOT NULL CHECK (EXP >= 0),
    COUNTRY VARCHAR(80) NOT NULL,
    CONTINENT VARCHAR(50) NOT NULL,
    MANAGER_ID VARCHAR(100),
    CONSTRAINT empid_check CHECK ( SUBSTR(EMP_ID,1,1) = 'E'),
    CONSTRAINT gender_check CHECK(GENDER in ('M', 'F', 'O'))
)  ENGINE=INNODB;
```

Use Case: Project and Team Management

Step 5: Analyze the structure of the **EMP_RECORDS** table with the **DESCRIBE** statement.

SQL Query

```
DESCRIBE PROJ_DB.EMP_RECORDS;
```

Output:

	Field	Type	Null	Key	Default	Extra
▶	EMP_ID	varchar(4)	NO	PRI	NULL	
	FIRST_NAME	varchar(100)	NO		NULL	
	LAST_NAME	varchar(100)	YES		NULL	
	GENDER	varchar(1)	NO		NULL	
	ROLE	varchar(100)	NO		NULL	
	DEPT	varchar(100)	NO		NULL	
	EXP	int	NO		NULL	
	COUNTRY	varchar(80)	NO		NULL	
	CONTINENT	varchar(50)	NO		NULL	
	MANAGER_ID	varchar(100)	YES		NULL	

Use Case: Project and Team Management

Step 6: Insert the required data from the downloaded **EMP_RECORDS.csv** file into the **EMP_RECORDS** table as shown below.

SQL Query

```
INSERT INTO

PROJ_DB.EMP_RECORDS(EMP_ID,FIRST_NAME,LAST_NAME,GENDER,ROLE,DEPT,EXP,COUNTRY,CONTINENT,MANAGE
R_ID)

VALUES

("E083","Patrick","Voltz","M","MANAGER","HEALTHCARE",15,"USA","NORTH AMERICA","E002"),

("E052","Dianna","Wilson","F","SENIOR DATA SCIENTIST","HEALTHCARE",6,"CANADA","NORTH
AMERICA","E083"),

...

...

("E002","Cynthia","Brooks","F","PRESIDENT","ALL",17,"CANADA","NORTH AMERICA","E001"),

("E001","Arthur","Black","M","CEO","ALL",20,"USA","NORTH AMERICA","E001");
```

Use Case: Project and Team Management

Step 7: Analyze the data entered into the **EMP_RECORDS** table with the **SELECT** statement.

SQL Query

```
SELECT * FROM PROJ_DB.EMP_RECORDS;
```

Output:

EMP_ID	FIRST_NAME	LAST_NAME	GENDER	ROLE	DEPT	EXP	COUNTRY	CONTINENT	MANAGER_ID
E001	Arthur	Black	M	CEO	ALL	20	USA	NORTH AMERICA	E001
E002	Cynthia	Brooks	F	PRESIDENT	ALL	17	CANADA	NORTH AMERICA	E001
E005	Eric	Hoffman	M	LEAD DATA SCIENTIST	FINANCE	11	USA	NORTH AMERICA	E103
E052	Dianna	Wilson	F	SENIOR DATA SCIENTIST	HEALTHCARE	6	CANADA	NORTH AMERICA	E083
E057	Dorothy	Wilson	F	SENIOR DATA SCIENTIST	HEALTHCARE	9	USA	NORTH AMERICA	E083
E083	Patrick	Voltz	M	MANAGER	HEALTHCARE	15	USA	NORTH AMERICA	E002
E103	Emily	Grove	F	MANAGER	FINANCE	14	CANADA	NORTH AMERICA	E002
E245	Nian	Zhen	M	SENIOR DATA SCIENTIST	RETAIL	6	CHINA	ASIA	E583
E260	Roy	Collins	M	SENIOR DATA SCIENTIST	RETAIL	7	INDIA	ASIA	E583
E403	Steve	Hoffman	M	ASSOCIATE DATA SCIENTIST	FINANCE	4	USA	NORTH AMERICA	E103
E428	Pete	Allen	M	MANAGER	AUTOMOTIVE	14	GERMANY	EUROPE	E002
E505	Chad	Wilson	M	ASSOCIATE DATA SCIENTIST	HEALTHCARE	5	CANADA	NORTH AMERICA	E083
E532	Claire	Brennan	F	ASSOCIATE DATA SCIENTIST	AUTOMOTIVE	3	GERMANY	EUROPE	E428
E583	Janet	Hale	F	MANAGER	RETAIL	14	COLOMBIA	SOUTH AMERICA	E002
E612	Tracy	Norris	F	MANAGER	RETAIL	13	INDIA	ASIA	E002
E620	Katrina	Allen	F	JUNIOR DATA SCIENTIST	RETAIL	2	INDIA	ASIA	E583
E640	Jenifer	Jhones	F	JUNIOR DATA SCIENTIST	RETAIL	1	COLOMBIA	SOUTH AMERICA	E583

Use Case: Project and Team Management

Similarly, the managers have provided a detailed description of the required projects table given below.

Column Name	Value Type
PROJ_ID	A unique ID assigned to each project after planning
PROJ_NAME	A unique name assigned to each project based on the client requirements and application domain
START _DATE	The planned date within the DEV_QTR for starting the project development (Format - YYYY-MM-DD)
CLOSURE_DATE	The planned date within the DEV_QTR for finishing the project development (Format - YYYY-MM-DD)
DOMAIN	The domain of focus for the project
DEV_QTR	The quarter in the current financial year selected for end-to-end development of the project
STATUS	The development status of the project as YTS (Yet To Start), WIP (Work In Progress), DONE (Finished on time), and DELAYED (Delayed and Ongoing)

Use Case: Project and Team Management

Step 8: Create the required **PROJ_RECORDS** table in the **PROJ_DB** database with the **CREATE TABLE** statement as given below.

SQL Query

```
CREATE TABLE IF NOT EXISTS PROJ_DB.PROJ_RECORDS (
    PROJ_ID VARCHAR(4) NOT NULL PRIMARY KEY,
    PROJ_NAME VARCHAR(200) NOT NULL,
    DOMAIN VARCHAR(100) NOT NULL,
    START_DATE DATE NOT NULL,
    CLOSURE_DATE DATE NOT NULL,
    DEV_QTR VARCHAR(2) NOT NULL,
    STATUS VARCHAR(7),
    CONSTRAINT projid_check CHECK ( SUBSTR(PROJ_ID,1,1) = 'P'),
    CONSTRAINT check_start_date CHECK (START_DATE >= '2021-04-01'),
    CONSTRAINT check_closure_date CHECK (CLOSURE_DATE <= '2022-03-30'),
    CONSTRAINT chk_qtr CHECK (DEV_QTR IN ('Q1', 'Q2', 'Q3', 'Q4')),
    CONSTRAINT chk_status CHECK (STATUS IN ('YTS', 'WIP', 'DONE', 'DELAYED'))
)  ENGINE=INNODB;
```

Use Case: Project and Team Management

Step 9: Analyze the structure of the **EMP_RECORDS** table with the **DESCRIBE** statement.

SQL Query

```
DESCRIBE PROJ_DB.PROJ_RECORDS;
```

Output:

	Field	Type	Null	Key	Default	Extra
▶	PROJ_ID	varchar(4)	NO	PRI	NULL	
	PROJ_NAME	varchar(200)	NO		NULL	
	DOMAIN	varchar(100)	NO		NULL	
	START_DATE	date	NO	NO	NULL	
	CLOSURE_DATE	date	NO		NULL	
	DEV_QTR	varchar(2)	NO		NULL	
	STATUS	varchar(7)	YES		NULL	

Use Case: Project and Team Management

Step 10: Insert the required data from the downloaded **PROJ_RECORDS.csv** file into the **PROJ_RECORDS** table as shown below.

SQL Query

```
INSERT INTO
PROJ_DB.PROJ_RECORDS(PROJ_ID,PROJ_NAME,DOMAIN,START_DATE,CLOSURE_DATE,DEV_QTR,STATUS)
VALUES
("P103","Drug Discovery","HEALTHCARE","2021-04-06","2021-06-20","Q1","DONE"),
("P105","Fraud Detection","FINANCE","2021-04-11","2021-06-25","Q1","DONE"),
...
...
("P109","Market Basket Analysis","RETAIL","2021-04-12","2021-06-21","Q1","DELAYED");
```

Use Case: Project and Team Management

Step 11: Analyze the data entered into the **PROJ_RECORDS** table with the **SELECT** statement.

SQL Query

```
SELECT * FROM PROJ_DB.PROJ_RECORDS;
```

Output:

PROJ_ID	PROJ_NAME	DOMAIN	START_DATE	CLOSURE_DATE	DEV_QTR	STATUS
P103	Drug Discovery	HEALTHCARE	2021-04-06	2021-06-20	Q1	DONE
P105	Fraud Detection	FINANCE	2021-04-11	2021-06-25	Q1	DONE
P109	Market Basket Analysis	RETAIL	2021-04-12	2021-06-21	Q1	DELAYED
P302	Early Detection of Lung Cancer	HEALTHCARE	2021-10-08	2021-12-18	Q3	YTS
P406	Customer Sentiment Analysis	RETAIL	2021-07-09	2021-09-24	Q2	WIP

Use Case: Project and Team Management

Also, the managers have provided a detailed description of the required project assignment table, which links each individual's employee ID to the project ID of the project to which they have been assigned.

Column Name	Value Type
EMP_ID	A unique ID assigned to each employee while joining the organization
PROJ_ID	A unique ID assigned to each project after planning

Use Case: Project and Team Management

Step 12: Create the required **PROJ_ASSIGN** table in the **PROJ_DB** database with the **CREATE TABLE** statement as given below.

```
CREATE TABLE IF NOT EXISTS PROJ_DB.PROJ_ASSIGN (
    EMP_ID VARCHAR(4) NOT NULL,
    PROJ_ID VARCHAR(4) NOT NULL,
    CONSTRAINT empid_check_2 CHECK ( SUBSTR(EMP_ID,1,1) = 'E'),
    CONSTRAINT projid_check_2 CHECK ( SUBSTR(PROJ_ID,1,1) = 'P'),
    FOREIGN KEY(EMP_ID) REFERENCES PROJ_DB.EMP_RECORDS(EMP_ID),
    FOREIGN KEY(PROJ_ID) REFERENCES PROJ_DB.PROJ_RECORDS(PROJ_ID)
)  ENGINE=INNODB;
```

Use Case: Project and Team Management

Step 13: Analyze the structure of the **PROJ_ASSIGN** table with the **DESCRIBE** statement.

SQL Query

```
DESCRIBE PROJ_DB.PROJ_ASSIGN;
```

Output:

	Field	Type	Null	Key	Default	Extra
▶	EMP_ID	varchar(4)	NO	MUL	NULL	
	PROJ_ID	varchar(4)	NO	MUL	NULL	

Use Case: Project and Team Management

Step 14: Insert the required data from the downloaded **PROJ_ASSIGN.csv** file into the **PROJ_RECORDS** table as shown below.

SQL Query

```
INSERT INTO PROJ_DB.PROJ_ASSIGN(EMP_ID,PROJ_ID)
VALUES ("E052","P103"),
       ("E505","P103"),
        ...
        ...
       ("E083","P103");
```

Use Case: Project and Team Management

Step 15: Analyze the data entered into the **PROJ_ASSIGN** table with the **SELECT** statement.

SQL Query

```
SELECT * FROM PROJ_DB.PROJ_ASSIGN;
```

Output:

	EMP_ID	PROJ_ID
▶	E052	P103
	E505	P103
	E583	P406
	E583	P109
	E620	P406
	E245	P109
	E640	P406
	E005	P105
	E057	P103
	E403	P105
	E103	P105
	E083	P103

DATA AND
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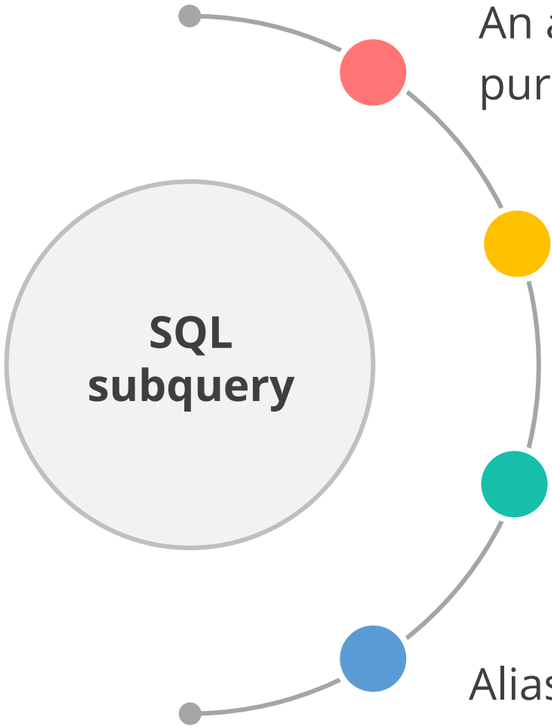
Introduction to Alias

Alias in SQL



An alias is a temporary name assigned to a table, column, or expression for the purpose of an SQL query, and it exists only for the duration of the query.

The AS keyword is used to make an alias.

If an alias contains space, it must be enclosed in quotation marks.

Aliases are typically used to make column names easier to comprehend.

Types of Alias

Column Alias

A column alias is a temporary name assigned to a column having a long or descriptive technical name in order to simplify the query output.

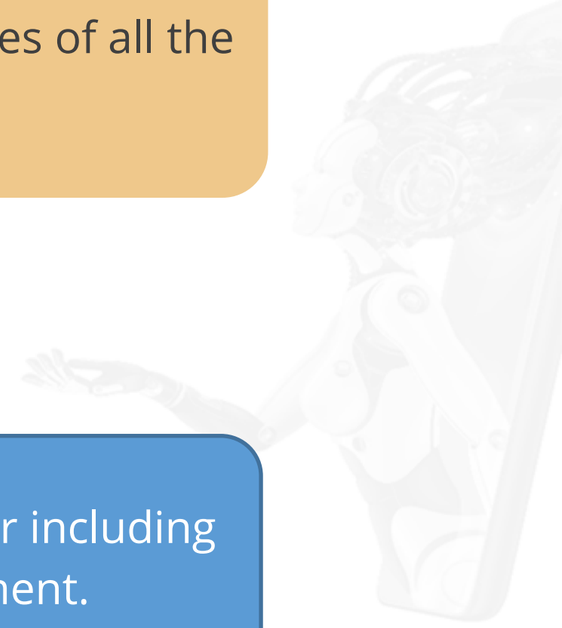
Syntax

```
SELECT
   [column_1 | expression] AS
column_alias_name
FROM
   table_name;
```

A column alias cannot be used in the WHERE clause because the WHERE clause is evaluated before the values of columns specified in the SELECT statement during query execution in MySQL.

Column Alias

Problem Statement: Your manager expects you to identify the last and first names of all the employees from the healthcare department.



Objective: Write two MySQL queries, one omitting the column alias and the other including it to list the last and first names of all employees of the healthcare department.

Column Alias: Example

Step 1: Use the **CONCAT_WS** function in the **SELECT** statement as given below.

SQL Query

```
SELECT CONCAT_WS(', ', LAST_NAME, FIRST_NAME)
FROM PROJ_DB.EMP_RECORDS
WHERE DEPT = "HEALTHCARE";
```

Output:

CONCAT_WS(', ', LAST_NAME, FIRST_NAME)
Wilson, Dianna
Wilson, Dorothy
Voltz, Patrick
Wilson, Chad

Column Alias: Example

Step 2: Use the **CONCAT_WS** function in the **SELECT** statement followed by the **AS** keyword as given below.

SQL Query

```
SELECT CONCAT_WS(', ', LAST_NAME, FIRST_NAME) AS `FULL
NAME`
FROM PROJ_DB.EMP_RECORDS
WHERE DEPT = "HEALTHCARE";
```

Output:

	FULL NAME
▶	Wilson, Dianna
	Wilson, Dorothy
	Voltz, Patrick
	Wilson, Chad

Table Alias

A table alias is a temporary name assigned to a table that has a descriptive technical name to simplify the query output.

Syntax

```
SELECT
   [column_1 | expression], column_2
FROM
   table_name AS table_alias_name;
```


Table aliases are preferred when there are multiple tables involved in an SQL query. It helps in collecting data and connecting the tables via field relations.

Table Alias

Problem Statement: Your manager expects you to identify the first and last names of all the employees separately from the healthcare department.

Objective: Write a MySQL queries to list the first name and last name of all employees from the healthcare department using a table alias to refer to the table.

Table Alias: Example

Step 1: Use the **SELECT** statement with an alias name for the table as given below.

SQL Query – Par 1

```
SELECT e.FIRST_NAME, e.LAST_NAME
FROM PROJ_DB.EMP_RECORDS e
WHERE e.DEPT = "HEALTHCARE";
```

Output:

	FIRST_NAME	LAST_NAME
▶	Dianna	Wilson
	Dorothy	Wilson
	Patrick	Voltz
	Chad	Wilson

DATA AND
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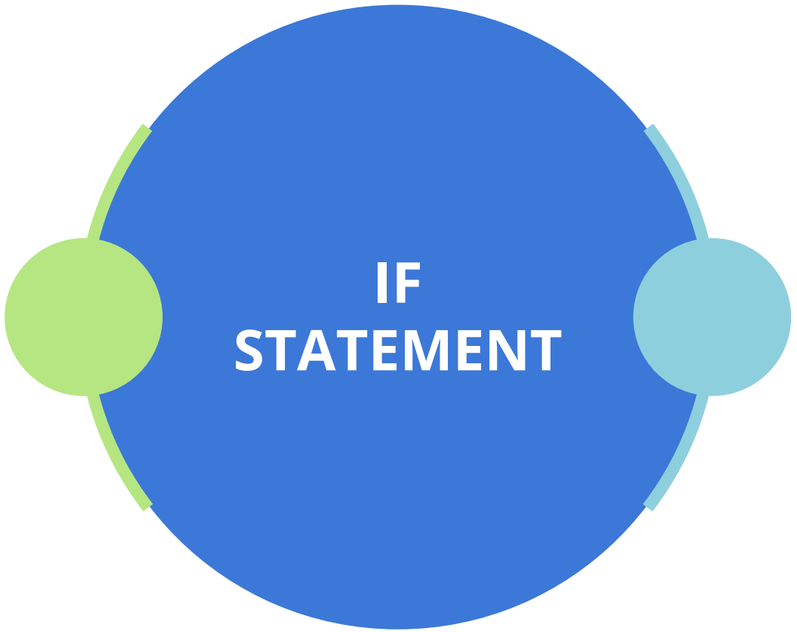
Introduction to JOINS

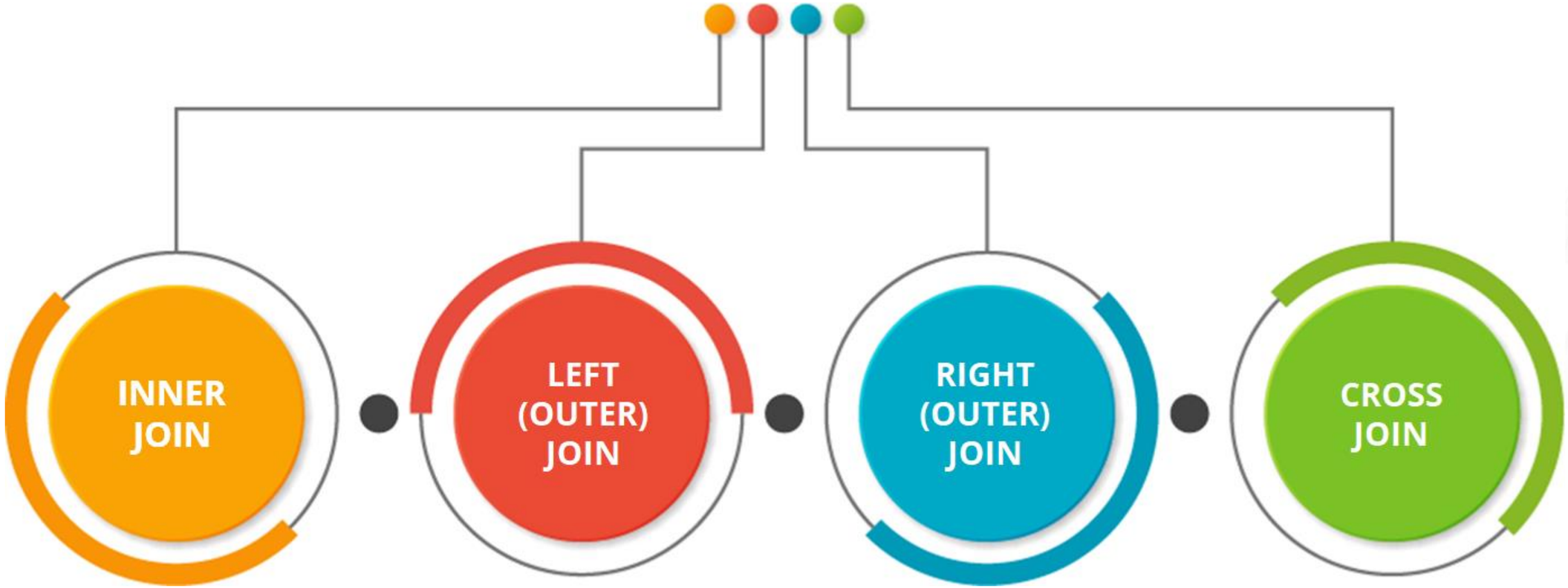
JOINS in MySQL

A JOIN is a method of linking data between one (self-join) or more tables based on a related column between them.

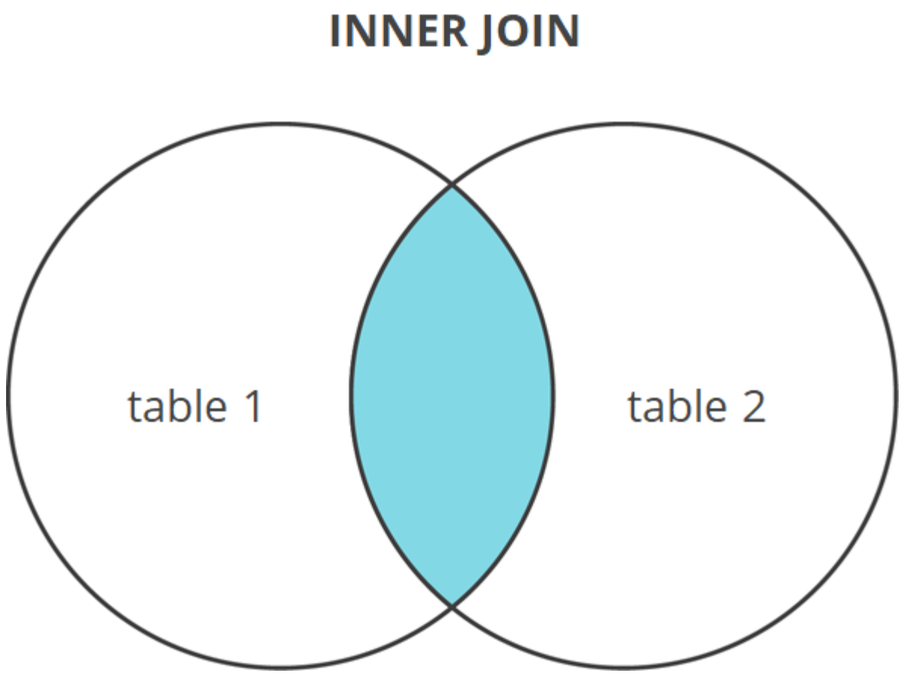


Joins are frequently used in SELECT, UPDATE, and DELETE statements. It is also used in subqueries to join multiple tables.

Types of JOINS



INNER JOIN



- The INNER JOIN clause joins two tables based on a condition which is known as a join predicate.
- It returns only the matching rows from both tables.
- The column names are enclosed in the USING clause if the JOIN condition utilizes the equal operator (=) and the column names in both tables, used for matching, are the same.

INNER JOIN

Syntax 01 - INNER JOIN

```
SELECT column_list
FROM table_1
INNER JOIN table_2 ON join_condition;
```

Syntax 02 - INNER JOIN with USING

```
SELECT column_list
FROM table_1
INNER JOIN table_2 USING (column_name);
```

INNER JOIN: Example

Problem Statement: Your manager expects you to identify employees assigned to projects.

Objective: Write an SQL query using the **INNER JOIN** clause with either **ON** or **USING** keyword to perform the inner join on the **EMP_RECORDS** and **PROJ_ASSIGN** tables in MySQL.

INNER JOIN: Example

Step 1: Use the **INNER JOIN** clause with the **ON** keyword in the **SELECT** statement to join **EMP_RECORDS** and **PROJ_ASSIGN** tables as given below.

SQL Query – INNER JOIN with ON

```
SELECT
  e.EMP_ID, e.FIRST_NAME, e.LAST_NAME,
  e.DEPT, e.MANAGER_ID,
  p.PROJ_ID
FROM
  EMP_RECORDS e
INNER JOIN PROJ_ASSIGN p ON e.EMP_ID = p.EMP_ID
WHERE e.ROLE NOT IN ("MANAGER", "PRESIDENT", "CEO")
ORDER BY e.MANAGER_ID;
```

Output:

EMP_ID	FIRST_NAME	LAST_NAME	DEPT	MANAGER_ID	PROJ_ID
E052	Dianna	Wilson	HEALTHCARE	E083	P103
E505	Chad	Wilson	HEALTHCARE	E083	P103
E057	Dorothy	Wilson	HEALTHCARE	E083	P103
E005	Eric	Hoffman	FINANCE	E103	P105
E403	Steve	Hoffman	FINANCE	E103	P105
E620	Katrina	Allen	RETAIL	E583	P406
E245	Nian	Zhen	RETAIL	E583	P109
E640	Jenifer	Jhones	RETAIL	E583	P406

INNER JOIN: Example

Step 2: Use the **INNER JOIN** clause with the **USING** keyword in the **SELECT** statement to join **EMP_RECORDS** and **PROJ_ASSIGN** tables as given below.

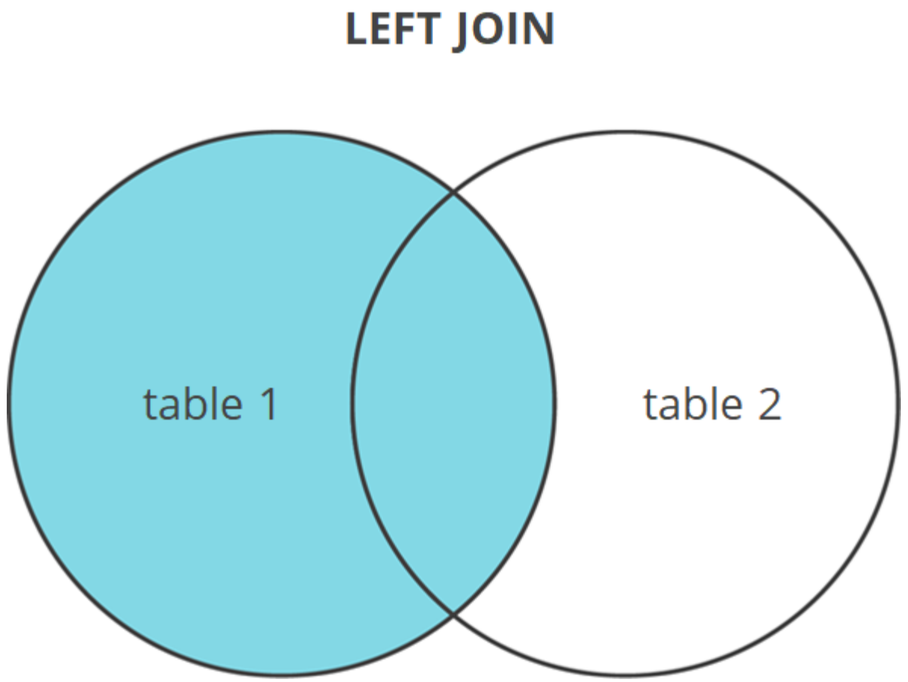
SQL Query – INNER JOIN with USING

```
SELECT
  e.EMP_ID, e.FIRST_NAME, e.LAST_NAME,
  e.DEPT, e.MANAGER_ID,
  p.PROJ_ID
FROM
  EMP_RECORDS e
INNER JOIN PROJ_ASSIGN p USING(EMP_ID)
WHERE e.ROLE NOT IN ("MANAGER", "PRESIDENT", "CEO")
ORDER BY e.MANAGER_ID;
```

Output:

EMP_ID	FIRST_NAME	LAST_NAME	DEPT	MANAGER_ID	PROJ_ID
E052	Dianna	Wilson	HEALTHCARE	E083	P103
E505	Chad	Wilson	HEALTHCARE	E083	P103
E057	Dorothy	Wilson	HEALTHCARE	E083	P103
E005	Eric	Hoffman	FINANCE	E103	P105
E403	Steve	Hoffman	FINANCE	E103	P105
E620	Katrina	Allen	RETAIL	E583	P406
E245	Nian	Zhen	RETAIL	E583	P109
E640	Jenifer	Jhones	RETAIL	E583	P406

LEFT JOIN



- Similar to INNER JOIN clause, the LEFT JOIN clause also requires a join predicate to join two tables.
- The LEFT JOIN keyword returns all records from the left table (table1), and the matching records from the right table (table 2). If there is no match on the right side, the outcome is 0 records.
- The LEFT JOIN also supports the USING clause.

LEFT JOIN

The LEFT JOIN selects all data from the left table, regardless of whether there are matching rows in the right table.

Syntax

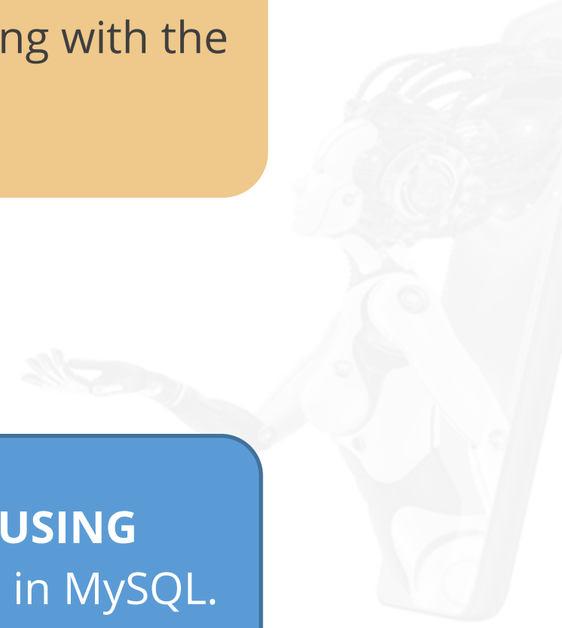
```
SELECT column_list
FROM table_1
LEFT JOIN table_2 ON join_condition;
```


If no matching rows from the right table are found, the LEFT JOIN utilizes NULLs in the result set for columns of the row from the right table.

LEFT JOIN: Example

Problem Statement: Your manager wants the details of the ongoing projects along with the number of employees working on them.

Objective: Write an SQL query using the **LEFT JOIN** clause with either **ON** or **USING** keyword to perform the left join on the **PROJ_RECORDS** and **PROJ_ASSIGN** tables in MySQL.



LEFT JOIN: Example

Step 1: Use the **LEFT JOIN** clause with the **ON** keyword in the **SELECT** statement to join **PROJ_RECORDS** and **PROJ_ASSIGN** tables as given below.

SQL Query – LEFT JOIN with ON

```
SELECT
  p.PROJ_ID, p.PROJ_NAME, p.DOMAIN,
  COUNT(DISTINCT a.EMP_ID) AS `EMP_COUNT`,
  p.DEV_QTR, p.STATUS
FROM
  PROJ_RECORDS p
LEFT JOIN PROJ_ASSIGN a ON p.PROJ_ID = a.PROJ_ID
WHERE p.STATUS IN ("DONE", "WIP")
GROUP BY p.PROJ_NAME
ORDER BY p.PROJ_ID;
```

Output:

PROJ_ID	PROJ_NAME	DOMAIN	EMP_COUNT	DEV_QTR	STATUS
P103	Drug Discovery	HEALTHCARE	4	Q1	DONE
P105	Fraud Detection	FINANCE	3	Q1	DONE
P406	Customer Sentiment Analysis	RETAIL	3	Q2	WIP

LEFT JOIN: Example

Step 2: Use the **LEFT JOIN** clause with the **USING** keyword in the **SELECT** statement to join **PROJ_RECORDS** and **PROJ_ASSIGN** tables as given below.

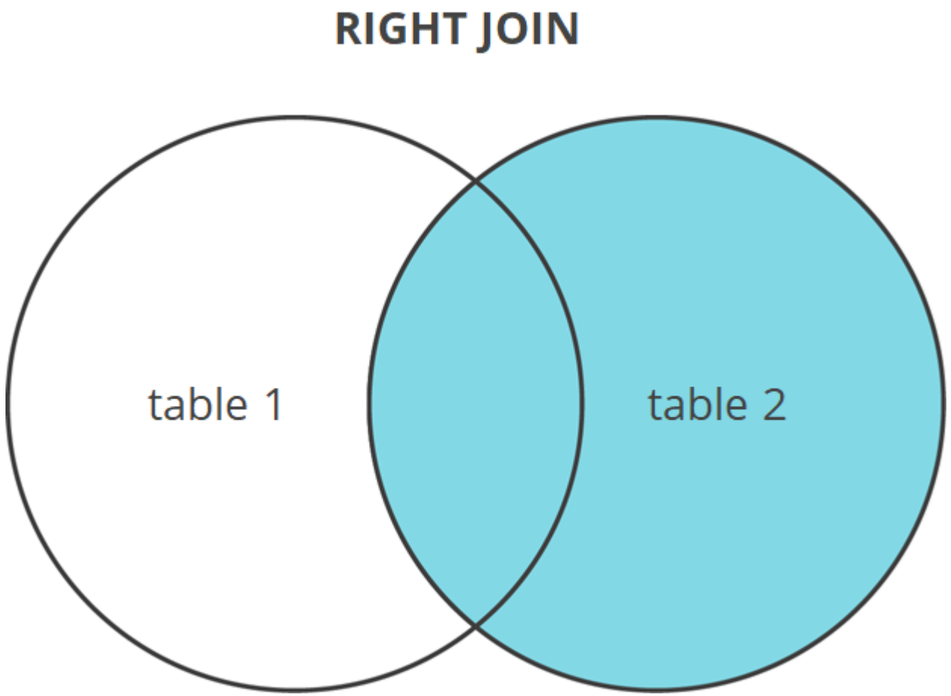
SQL Query – LEFT JOIN with USING

```
SELECT
  p.PROJ_ID, p.PROJ_NAME, p.DOMAIN,
  COUNT(DISTINCT a.EMP_ID) AS `EMP_COUNT`,
  p.DEV_QTR, p.STATUS
FROM
  PROJ_RECORDS p
LEFT JOIN PROJ_ASSIGN a USING(PROJ_ID)
WHERE p.STATUS IN ("DONE", "WIP")
GROUP BY p.PROJ_NAME
ORDER BY p.PROJ_ID;
```

Output:

PROJ_ID	PROJ_NAME	DOMAIN	EMP_COUNT	DEV_QTR	STATUS
P103	Drug Discovery	HEALTHCARE	4	Q1	DONE
P105	Fraud Detection	FINANCE	3	Q1	DONE
P406	Customer Sentiment Analysis	RETAIL	3	Q2	WIP

RIGHT JOIN



- The RIGHT JOIN is just the opposite of the LEFT JOIN and requires a join predicate to join two tables.
- The RIGHT JOIN keyword returns all records from the right table (table 1), and the matching records from the left table (table 2). The result is 0 records from the left side if there is no match.
- The RIGHT JOIN also supports the USING clause.

RIGHT JOIN

The RIGHT JOIN selects all data from the right table, regardless of whether there are matching rows in the left table.

Syntax

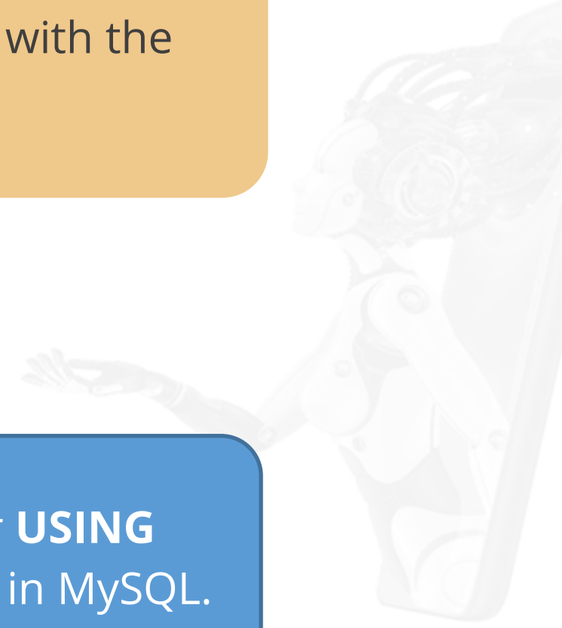
```
SELECT column_list
FROM table_1
RIGHT JOIN table_2 ON join_condition;
```


If no matching rows from the left table are found, the RIGHT JOIN utilizes NULLs in the result set for columns of the row from the left table.

RIGHT JOIN: Example

Problem Statement: Your manager wants the details of each employee along with the number of projects assigned to them.

Objective: Write an SQL query using the **RIGHT JOIN** clause with either **ON** or **USING** keyword to perform the left join on the **EMP_RECORDS** and **PROJ_ASSIGN** tables in MySQL.



RIGHT JOIN: Example

Step 1: Use the **RIGHT JOIN** clause with the **ON** keyword in the **SELECT** statement to join **EMP_RECORDS** and **PROJ_ASSIGN** tables as given below.

SQL Query – LEFT JOIN with ON

```
SELECT
  e.EMP_ID, e.FIRST_NAME, e.LAST_NAME,
  e.ROLE, e.DEPT, e.MANAGER_ID,
  COUNT(DISTINCT a.PROJ_ID) AS `PROJ_COUNT`
FROM
  PROJ_ASSIGN a
RIGHT JOIN EMP_RECORDS e ON a.EMP_ID = e.EMP_ID
WHERE e.ROLE NOT IN ("MANAGER", "PRESIDENT", "CEO")
GROUP BY e.EMP_ID
ORDER BY e.MANAGER_ID;
```

Output:

EMP_ID	FIRST_NAME	LAST_NAME	ROLE	DEPT	MANAGER_ID	PROJ_COUNT
E052	Dianna	Wilson	SENIOR DATA SCIENTIST	HEALTHCARE	E083	1
E057	Dorothy	Wilson	SENIOR DATA SCIENTIST	HEALTHCARE	E083	1
E505	Chad	Wilson	ASSOCIATE DATA SCIENTIST	HEALTHCARE	E083	1
E005	Eric	Hoffman	LEAD DATA SCIENTIST	FINANCE	E103	1
E403	Steve	Hoffman	ASSOCIATE DATA SCIENTIST	FINANCE	E103	1
E532	Claire	Brennan	ASSOCIATE DATA SCIENTIST	AUTOMOTIVE	E428	0
E245	Nian	Zhen	SENIOR DATA SCIENTIST	RETAIL	E583	1
E260	Roy	Collins	SENIOR DATA SCIENTIST	RETAIL	E583	0
E620	Katrina	Allen	JUNIOR DATA SCIENTIST	RETAIL	E583	1
E640	Jenifer	Jhones	JUNIOR DATA SCIENTIST	RETAIL	E583	1

RIGHT JOIN: Example

Step 2: Use the **RIGHT JOIN** clause with the **USING** keyword in the **SELECT** statement to join **EMP_RECORDS** and **PROJ_ASSIGN** tables as given below.

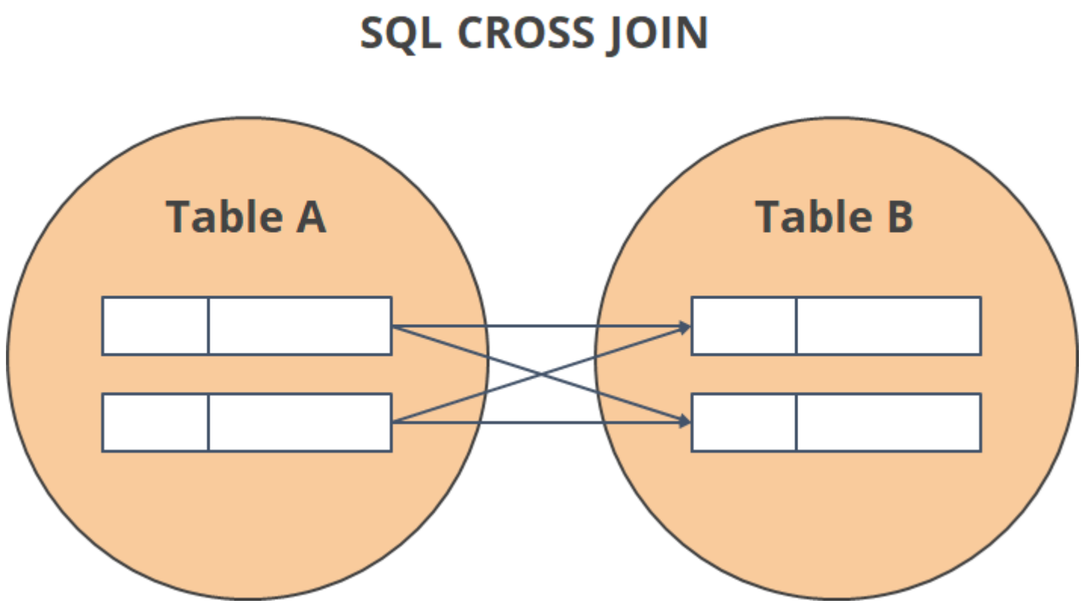
SQL Query – LEFT JOIN with USING

```
SELECT
  e.EMP_ID, e.FIRST_NAME, e.LAST_NAME,
  e.ROLE, e.DEPT, e.MANAGER_ID,
  COUNT(DISTINCT a.PROJ_ID) AS `PROJ_COUNT`
FROM
  PROJ_ASSIGN a
RIGHT JOIN EMP_RECORDS e USING(EMP_ID)
WHERE e.ROLE NOT IN ("MANAGER", "PRESIDENT", "CEO")
GROUP BY e.EMP_ID
ORDER BY e.MANAGER_ID;
```

Output:

EMP_ID	FIRST_NAME	LAST_NAME	ROLE	DEPT	MANAGER_ID	PROJ_COUNT
E052	Dianna	Wilson	SENIOR DATA SCIENTIST	HEALTHCARE	E083	1
E057	Dorothy	Wilson	SENIOR DATA SCIENTIST	HEALTHCARE	E083	1
E505	Chad	Wilson	ASSOCIATE DATA SCIENTIST	HEALTHCARE	E083	1
E005	Eric	Hoffman	LEAD DATA SCIENTIST	FINANCE	E103	1
E403	Steve	Hoffman	ASSOCIATE DATA SCIENTIST	FINANCE	E103	1
E532	Claire	Brennan	ASSOCIATE DATA SCIENTIST	AUTOMOTIVE	E428	0
E245	Nian	Zhen	SENIOR DATA SCIENTIST	RETAIL	E583	1
E260	Roy	Collins	SENIOR DATA SCIENTIST	RETAIL	E583	0
E620	Katrina	Allen	JUNIOR DATA SCIENTIST	RETAIL	E583	1
E640	Jenifer	Jhones	JUNIOR DATA SCIENTIST	RETAIL	E583	1

CROSS JOIN



- Unlike the INNER JOIN, LEFT JOIN, and RIGHT JOIN clauses, the CROSS JOIN clause lacks a join condition.
- The CROSS JOIN creates a Cartesian product of the rows in the joined tables.
- To create the result set, the CROSS JOIN combines every row from the left table with every row from the right table.

CROSS JOIN

Syntax

```
SELECT select_list
FROM table_1
CROSS JOIN table_2;
```

CROSS JOIN: Example

Problem Statement: Your manager expects you to perform the cartesian product of the rows in both the employee and project records tables.

Objective: Write an SQL query using the **CROSS JOIN** clause to perform the cross join on the **EMP_RECORDS** and **PROJ_ASSIGN** tables to obtain their cartesian product in MySQL.

CROSS JOIN: Example

Step 1: Use the **CROSS JOIN** clause in the **SELECT** statement to join **EMP_RECORDS** and **PROJ_ASSIGN** tables as given below.

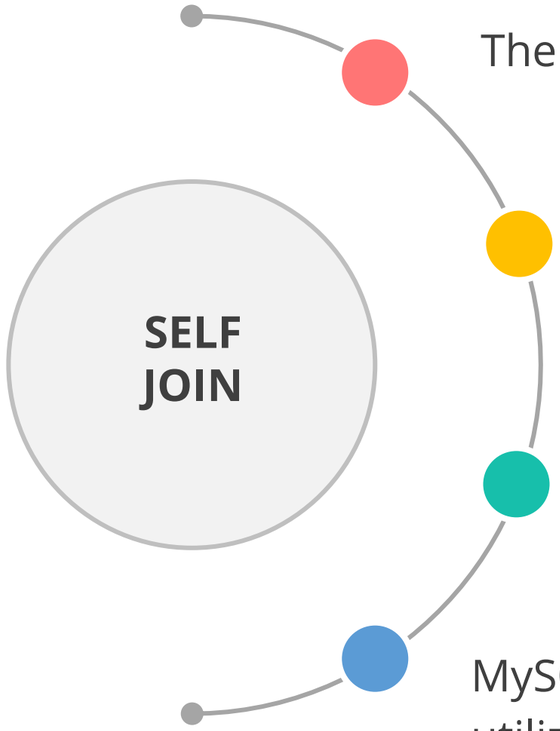
SQL Query

```
SELECT
  e.EMP_ID, e.FIRST_NAME, e.LAST_NAME,
  e.DEPT, e.MANAGER_ID,
  a.PROJ_ID
FROM
  PROJ_ASSIGN a
CROSS JOIN EMP_RECORDS e
WHERE e.ROLE NOT IN ("MANAGER", "PRESIDENT", "CEO")
ORDER BY e.FIRST_NAME;
```

Output:

EMP_ID	FIRST_NAME	LAST_NAME	DEPT	MANAGER_ID	PROJ_ID
E505	Chad	Wilson	HEALTHCARE	E083	P105
E505	Chad	Wilson	HEALTHCARE	E083	P105
E505	Chad	Wilson	HEALTHCARE	E083	P105
E505	Chad	Wilson	HEALTHCARE	E083	P103
E505	Chad	Wilson	HEALTHCARE	E083	P103
E505	Chad	Wilson	HEALTHCARE	E083	P103
E505	Chad	Wilson	HEALTHCARE	E083	P103
E505	Chad	Wilson	HEALTHCARE	E083	P109
E505	Chad	Wilson	HEALTHCARE	E083	P109
E505	Chad	Wilson	HEALTHCARE	E083	P406
E505	Chad	Wilson	HEALTHCARE	E083	P406
E505	Chad	Wilson	HEALTHCARE	E083	P406
E532	Claire	Brennan	AUTOMOTIVE	E428	P103
E532	Claire	Brennan	AUTOMOTIVE	E428	P406
E532	Claire	Brennan	AUTOMOTIVE	E428	P406
E532	Claire	Brennan	AUTOMOTIVE	E428	P406

SELF JOIN



The SELF JOIN clause joins a table to itself using the INNER JOIN or LEFT JOIN.

The SELF JOIN is often used to query hierarchical data or to compare rows within the same table.

To perform a SELF JOIN, table aliases must be used to avoid repeating the same table name in a single query.

MySQL throws an error if a table is referenced twice or more in a query without utilizing table aliases.

SELF JOIN: Example

Problem Statement: Your manager wants you to identify the number of employees reporting to each manager including the President and the CEO.

Objective: Write an SQL query using either **INNER JOIN** or **LEFT JOIN** clause to simulate the **SELF JOIN** clause on the **EMP_RECORDS** table in MySQL.

SELF JOIN: Example

Step 1: Use the **INNER JOIN** clause in the **SELECT** statement to simulate the **SELF JOIN** clause to join **EMP_RECORDS** table as given below.

SQL Query – SELF JOIN using INNER JOIN

```
SELECT
  m.EMP_ID, m.FIRST_NAME, m.LAST_NAME, m.ROLE,
  m.EXP, m.DEPT, COUNT(e.EMP_ID) as "EMP_COUNT"
FROM
  EMP_RECORDS m
INNER JOIN EMP_RECORDS e
  ON m.EMP_ID = e.MANAGER_ID
  AND e.EMP_ID != e.MANAGER_ID
WHERE m.ROLE IN ("MANAGER", "PRESIDENT", "CEO")
GROUP BY m.EMP_ID
ORDER BY m.EMP_ID;
```

Output:

EMP_ID	FIRST_NAME	LAST_NAME	ROLE	EXP	DEPT	EMP_COUNT
E001	Arthur	Black	CEO	20	ALL	1
E002	Cynthia	Brooks	PRESIDENT	17	ALL	5
E083	Patrick	Voltz	MANAGER	15	HEALTHCARE	3
E103	Emily	Grove	MANAGER	14	FINANCE	2
E428	Pete	Allen	MANAGER	14	AUTOMOTIVE	1
E583	Janet	Hale	MANAGER	14	RETAIL	4

SELF JOIN: Example

Step 2: Use the **LEFT JOIN** clause in the **SELECT** statement to simulate the **SELF JOIN** clause to join **EMP_RECORDS** table as given below.

SQL Query – SELF JOIN using LEFT JOIN

```
SELECT
  m.EMP_ID, m.FIRST_NAME, m.LAST_NAME, m.ROLE,
  m.EXP, m.DEPT, COUNT(e.EMP_ID) AS `EMP_COUNT`
FROM
  EMP_RECORDS m
LEFT JOIN EMP_RECORDS e
  ON m.EMP_ID = e.MANAGER_ID
  AND e.EMP_ID != e.MANAGER_ID
WHERE m.ROLE IN ("MANAGER", "PRESIDENT", "CEO")
GROUP BY m.EMP_ID
ORDER BY m.EMP_ID;
```

Output:

EMP_ID	FIRST_NAME	LAST_NAME	ROLE	EXP	DEPT	EMP_COUNT
E001	Arthur	Black	CEO	20	ALL	1
E002	Cynthia	Brooks	PRESIDENT	17	ALL	5
E083	Patrick	Voltz	MANAGER	15	HEALTHCARE	3
E103	Emily	Grove	MANAGER	14	FINANCE	2
E428	Pete	Allen	MANAGER	14	AUTOMOTIVE	1
E583	Janet	Hale	MANAGER	14	RETAIL	4
E612	Tracy	Norris	MANAGER	13	RETAIL	0

DATA AND
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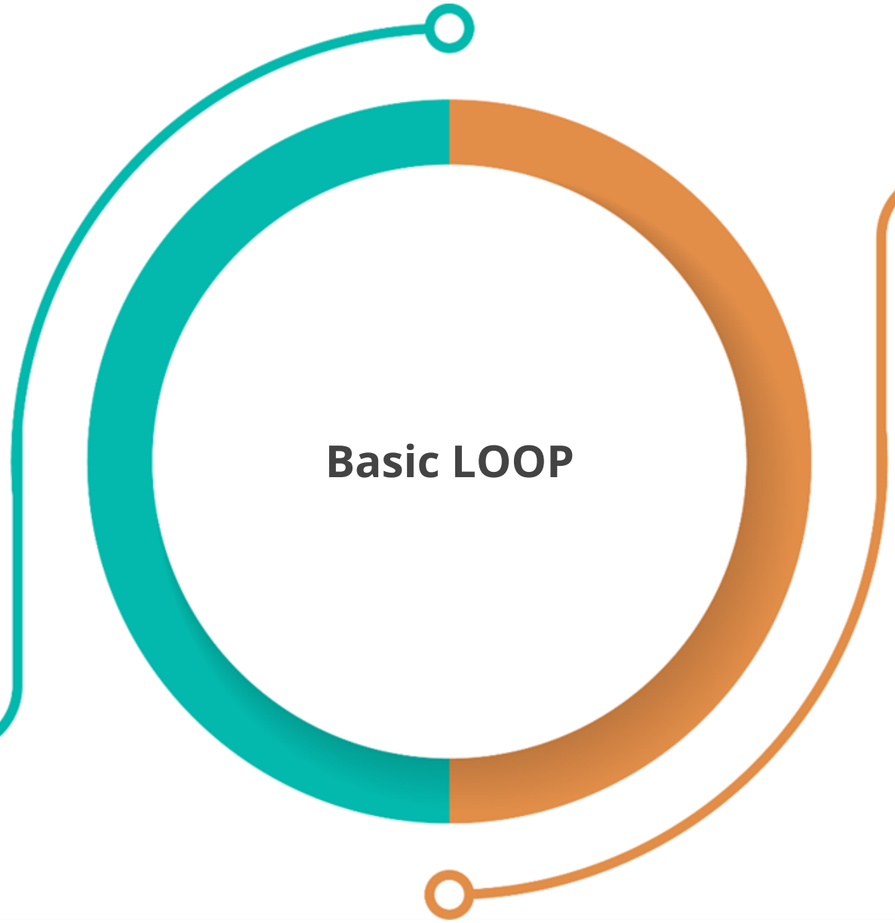
Operators in MySQL

SET Operators

DEFINITION

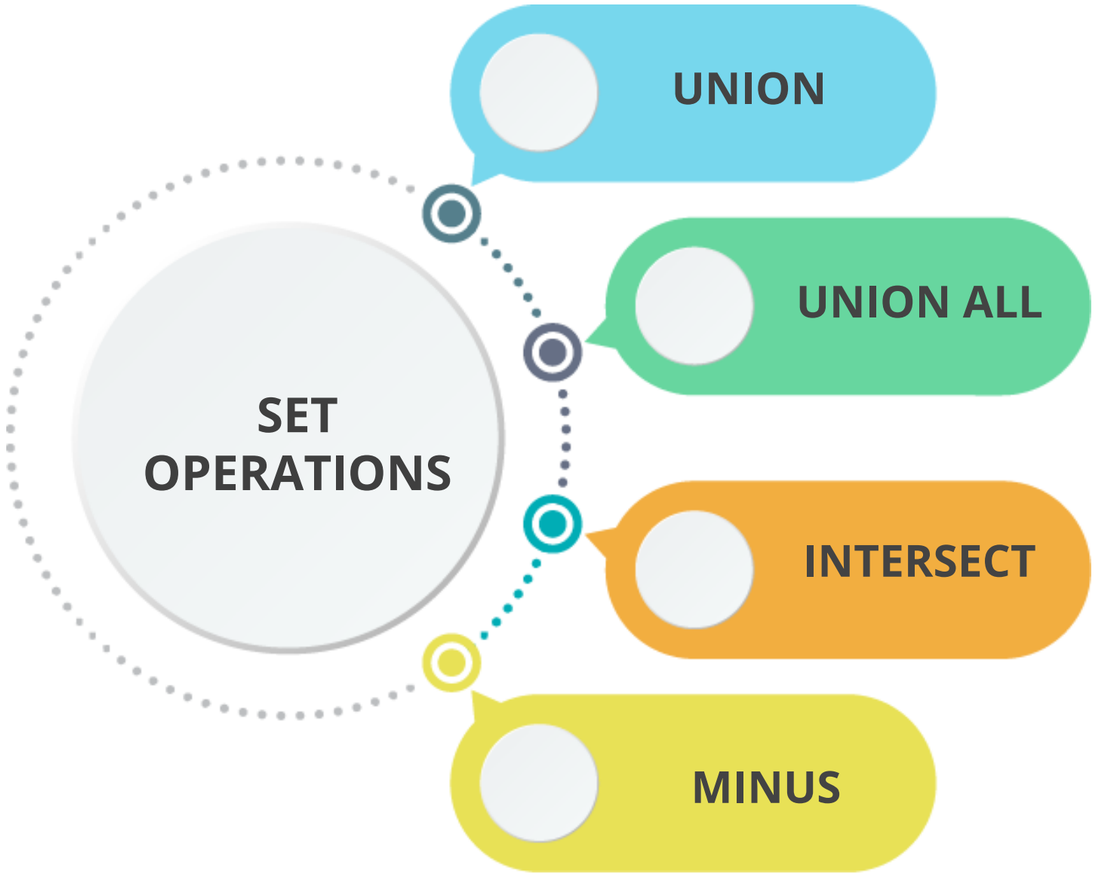
Set operators combine the results of two component queries into a single result.



FUNCTIONALITY

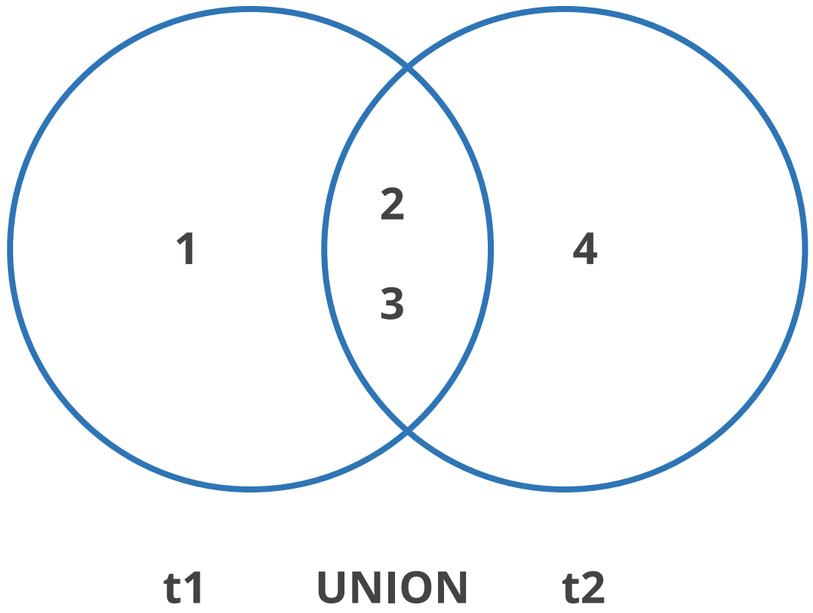
Set operators are used to get meaningful results from data stored in the table under different special conditions.

Types of SET Operators



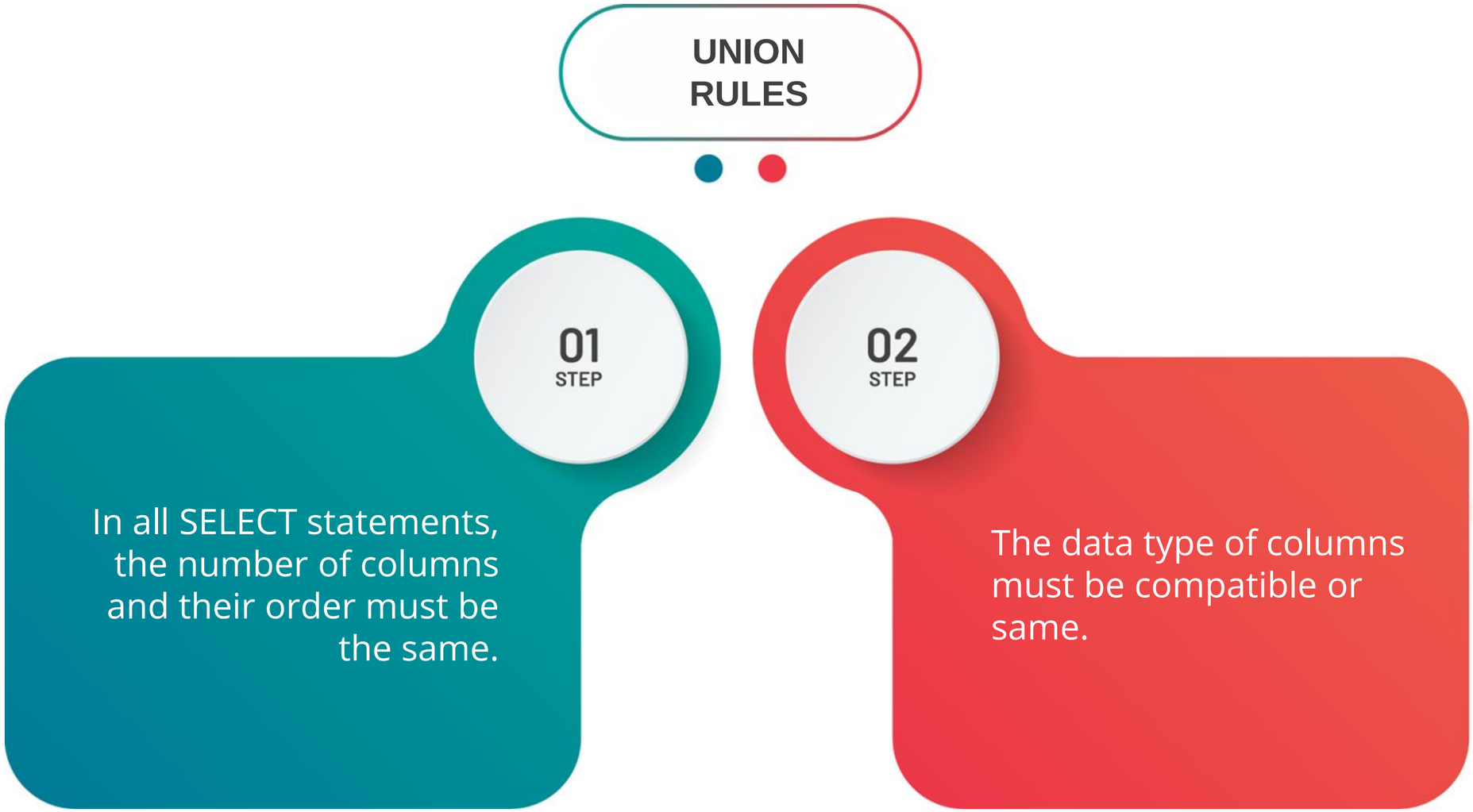
INTERSECT and MINUS set operations are not supported by MySQL; however, they can be emulated by combining other MySQL components.

UNION Operator



- The UNION operator is used to combine two or more result sets from multiple SELECT statements into a single result set.
- By default, the UNION operator eliminates duplicate rows even if the DISTINCT operator is not explicitly provided.

UNION Operator



UNION Operator

Syntax

```
SELECT column_list
UNION [DISTINCT | ALL]
SELECT column_list
UNION [DISTINCT | ALL]
SELECT column_list
...
```

UNION Operator: Example

Problem Statement: Your manager wants you to provide the full names and departments of the employees along with the name and domain of projects as **name** and **department** from both the employee and project records tables.

Objective: Write an SQL query using the **UNION** operator to perform the union of the **EMP_RECORDS** and **PROJ_RECORDS** tables to obtain the required data in MySQL.

UNION Operator: Example

Step 1: Use the **UNION** operator in the **SELECT** statement to perform the union of the **EMP_RECORDS** and **PROJ_RECORDS** tables as given below.

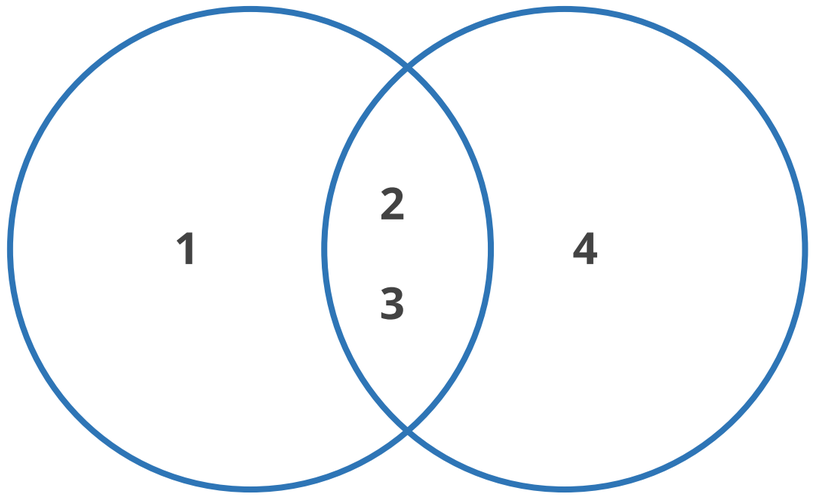
SQL Query

```
SELECT e.EMP_ID,
  CONCAT(e.FIRST_NAME,' ',e.LAST_NAME) AS `FULL_NAME`,
  e.DEPT
FROM EMP_RECORDS e
WHERE e.ROLE IN ("MANAGER")
UNION
SELECT p.PROJ_ID, p.PROJ_NAME, p.DOMAIN
FROM PROJ_RECORDS p
ORDER BY DEPT, EMP_ID;
```

Output:

EMP_ID	FULL_NAME	DEPT
E428	Pete Allen	AUTOMOTIVE
E103	Emily Grove	FINANCE
P105	Fraud Detection	FINANCE
E083	Patrick Voltz	HEALTHCARE
P103	Drug Discovery	HEALTHCARE
P302	Early Detection of Lung Cancer	HEALTHCARE
E583	Janet Hale	RETAIL
E612	Tracy Norris	RETAIL
P109	Market Basket Analysis	RETAIL
P406	Customer Sentiment Analysis	RETAIL

UNION ALL Operator



- The UNION operator can be substituted by the UNION ALL operator to maintain the duplicate rows in the result set.
- The UNION ALL operator performs the same functions as the UNION operator, but it is significantly faster since it does not have to deal with duplicate rows.

UNION ALL Operator

Syntax

```
SELECT column_list
UNION ALL [DISTINCT | ALL]
SELECT column_list
UNION ALL [DISTINCT | ALL]
SELECT column_list
...
```

UNION ALL Operator: Example

Problem Statement: Your manager wants you to provide all the available entries with the full names of all employees and projects along with their department or domain as their domain in both the employee and project records tables together.

Objective: Write an SQL query using the **UNION ALL** operator to perform the union of the **EMP_RECORDS** and **PROJ_RECORDS** tables to obtain the required data while considering the duplicate rows in MySQL.

UNION ALL Operator: Example

Step 1: Use the **UNION ALL** operator in the **SELECT** statement to perform the union of the **EMP_RECORDS** and **PROJ_RECORDS** tables while considering the duplicate rows as given below.

SQL Query

```
SELECT e.EMP_ID,
  CONCAT(e.FIRST_NAME,' ',e.LAST_NAME) AS `FULL_NAME`,
  e.DEPT
FROM EMP_RECORDS e
WHERE e.ROLE IN ("MANAGER")
UNION
SELECT p.PROJ_ID, p.PROJ_NAME, p.DOMAIN
FROM PROJ_RECORDS p
ORDER BY DEPT, EMP_ID;
```

Output:

EMP_ID	FULL_NAME	DEPT
E428	Pete Allen	AUTOMOTIVE
E103	Emily Grove	FINANCE
P105	Fraud Detection	FINANCE
E083	Patrick Voltz	HEALTHCARE
P103	Drug Discovery	HEALTHCARE
P302	Early Detection of Lung Cancer	HEALTHCARE
E583	Janet Hale	RETAIL
E612	Tracy Norris	RETAIL
P109	Market Basket Analysis	RETAIL
P406	Customer Sentiment Analysis	RETAIL

UNION vs. JOIN

UNION

- Combines data from various tables based on a matched condition between them
- Combines result sets horizontally
- Combines data into new columns
- Number of columns selected from each table may not be the same

JOIN

- Combines the result set of two or more SELECT statements
- Appends result set vertically
- Combines data into new rows
- Number of columns selected from each table must be the same

UNION vs. JOIN

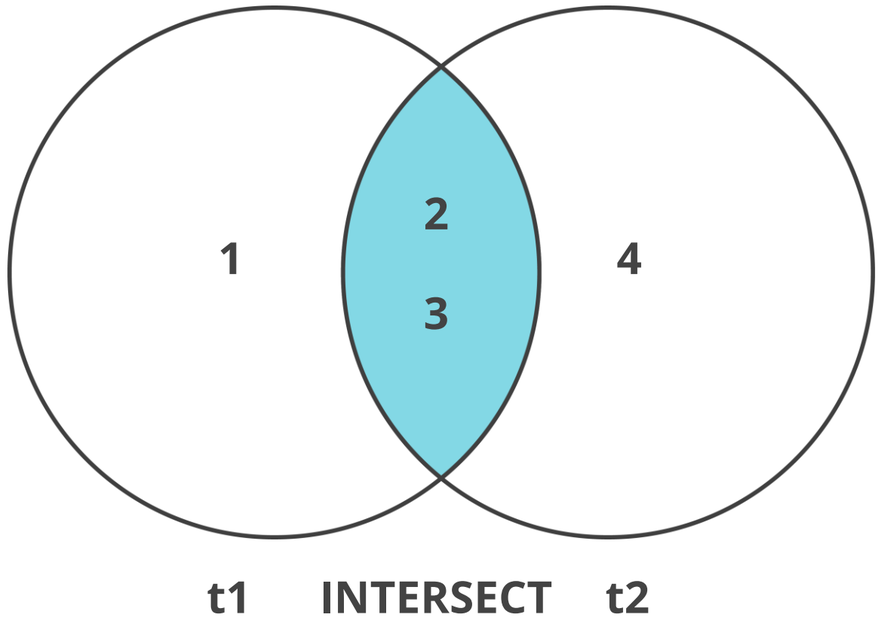
UNION

- Can have different datatypes in corresponding columns selected from each table
- It may not return distinct columns

JOIN

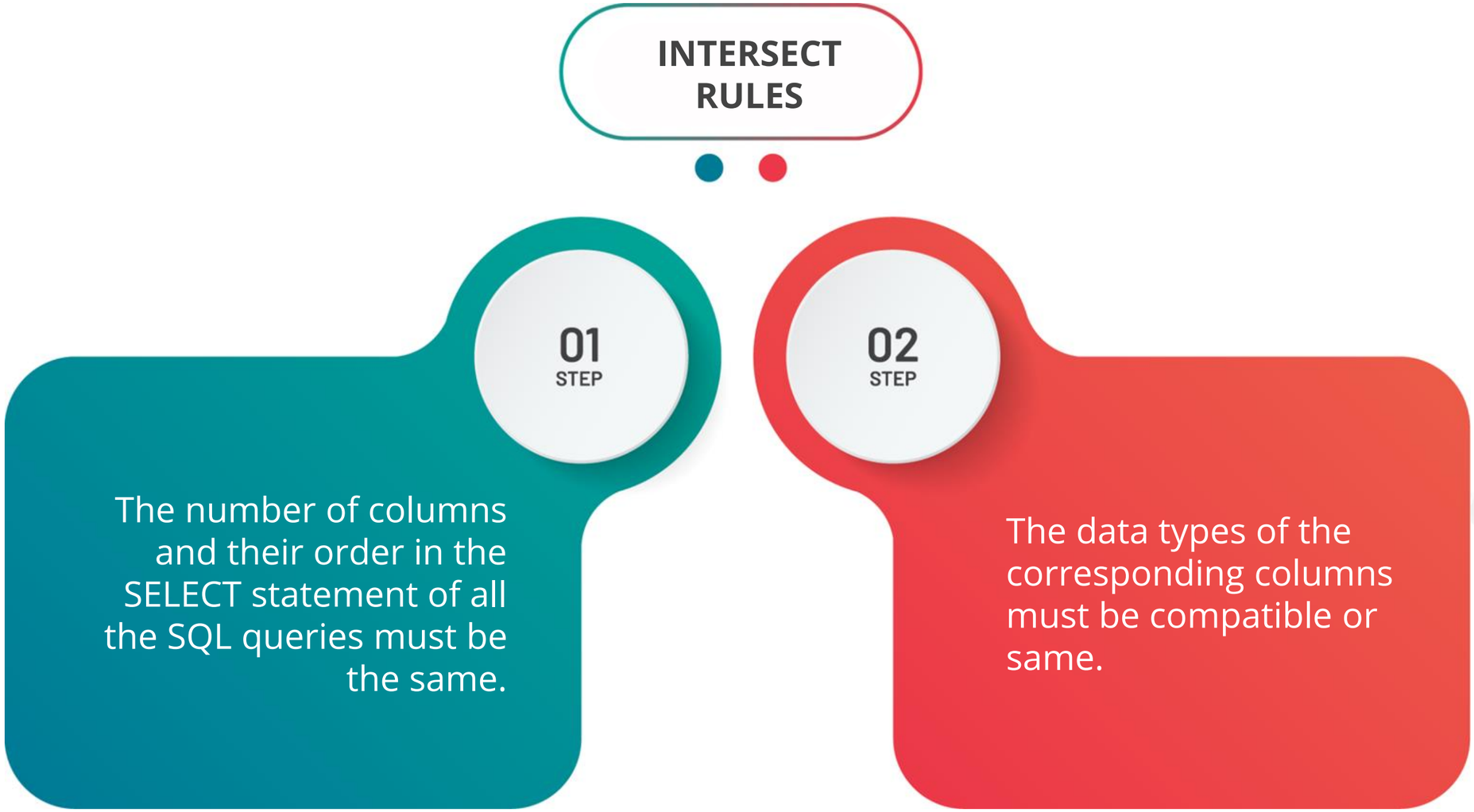
- Must have the same datatypes in corresponding columns selected from each table
- It returns distinct rows

INTERSECT Operator



- The INTERSECT operator compares the result sets of two or more queries and returns only the distinct rows produced by both queries.
- Unlike the UNION operator, the INTERSECT operator returns the intersection between two circles.

INTERSECT Operator



INTERSECT Operator

Syntax

```
(SELECT column_list
FROM table_1)
INTERSECT
(SELECT column_list
FROM table_2);
```

Emulating INTERSECT in MySQL

The INTERSECT operator is not supported by MySQL; however, it can be emulated.

The INTERSECT operator in MySQL can be emulated in two ways:

1. Using DISTINCT and INNER JOIN clause

2. Using IN and Subquery

INTERSECT Using DISTINCT and INNER JOIN

To perform INTERSECT operation, the INNER JOIN clause can be used to retrieve rows from both the left and right tables, while the DISTINCT operator can be used to eliminate duplicate rows.

Syntax

```
SELECT
   DISTINCT column_name_1
FROM table_1
   INNER JOIN table_2 USING(column_name_1);
```

INTERSECT Using DISTINCT and INNER JOIN: Example

Problem Statement: Your manager wants you to list the employee IDs of all the managers who are involved with at least one project.

Objective: Write an SQL query using either **INNER JOIN** clause with the **DISTINCT** keyword or **IN** operator with **Subquery** to simulate the **INTERSECT** operator on the **EMP_RECORDS** and **PROJ_ASSIGN** tables in MySQL.

INTERSECT Using DISTINCT and INNER JOIN: Example

Step 1: Use the **INNER JOIN** clause with **DISTINCT** keyword in the **SELECT** statement to simulate the **INTERSECT** operator on the **EMP_RECORDS** and **PROJ_ASSIGN** tables as given below.

SQL Query

```
SELECT DISTINCT e.EMP_ID,
FROM EMP_RECORDS e
INNER JOIN PROJ_ASSIGN p USING(EMP_ID)
WHERE e.ROLE IN ("MANAGER")
ORDER BY e.EMP_ID;
```

Output:

EMP_ID
E083
E103
E583

INTERSECT Using IN and Subquery

To perform INTERSECT operation, the IN operator can be used in the outer query to retrieve rows that exist in first result set, while the DISTINCT operator can be used to ensure that only distinct values are selected.

Syntax

```
SELECT
  DISTINCT column_name_1,
FROM
  table_1
WHERE column_name_1 IN (
  SELECT column_name_1
  FROM table_2
);
```

INTERSECT Using IN and Subquery: Example

Step 2: Use the **IN** operator with **Subquery** in the **SELECT** statement to simulate the **INTERSECT** operator on the **EMP_RECORDS** and **PROJ_ASSIGN** tables as given below.

SQL Query

```
SELECT DISTINCT e.EMP_ID
FROM EMP_RECORDS e
WHERE e.EMP_ID IN (
  SELECT a.EMP_ID
  FROM PROJ_ASSIGN a
) AND e.ROLE IN ("MANAGER")
ORDER BY e.EMP_ID;
```

Output:

EMP_ID
E083
E103
E583

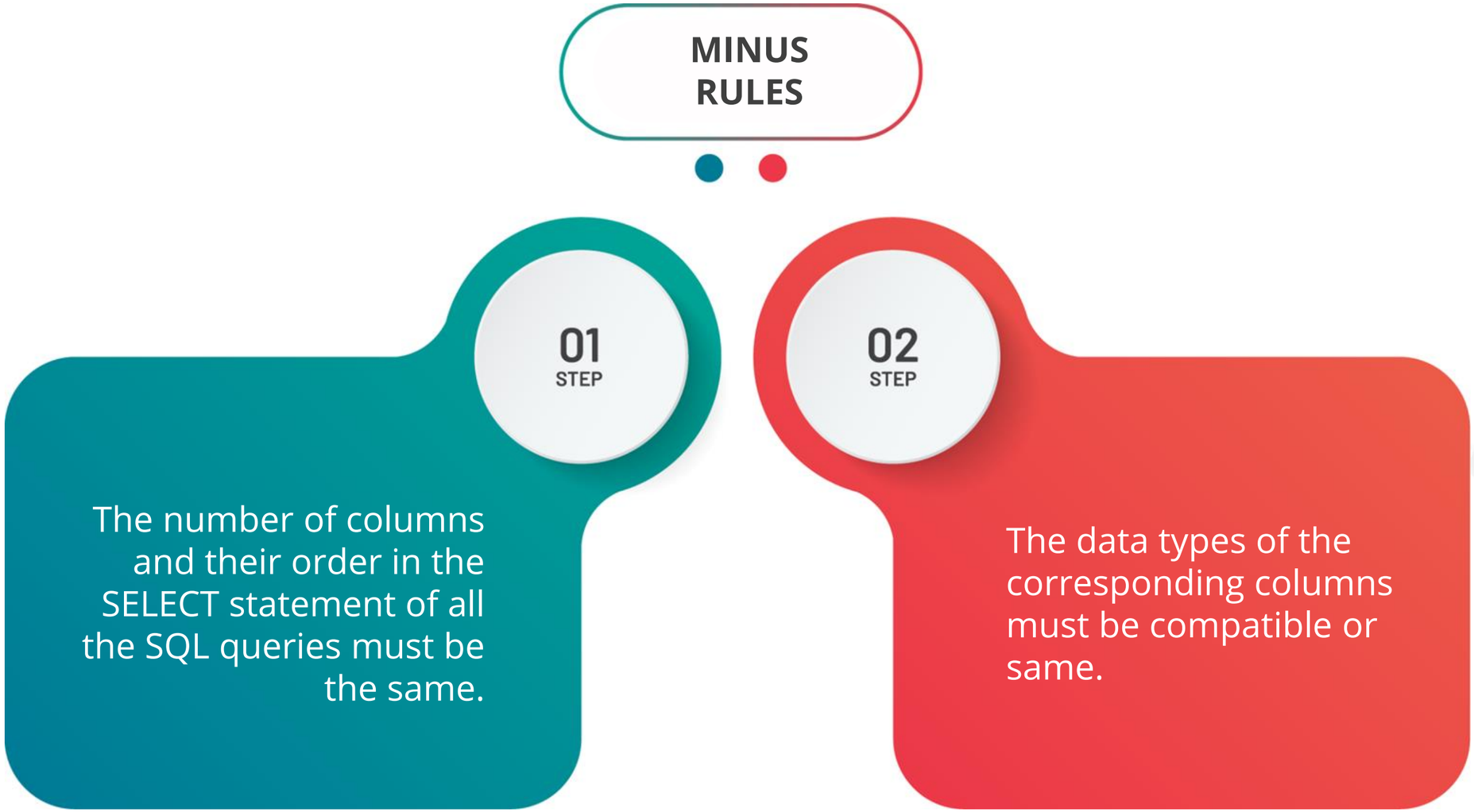
MINUS Operator

The MINUS operator compares the results of two queries. It returns distinct rows from the result set of the first query that does not appear in the result set of the second query.

Syntax

```
SELECT select_list1
FROM table_name1
MINUS
SELECT select_list2
FROM table_name2;
```

MINUS Operator



Emulating MINUS in MySQL

The MINUS operator is not supported by MySQL; however, it can be emulated using the JOIN clause.

Syntax

```
SELECT
    select_list
FROM
    table1
LEFT JOIN table2
    ON join_predicate
WHERE
    table2.column_name IS NULL;
```

MINUS Using LEFT JOIN

To perform INTERSECT operation, the INNER JOIN clause can be used to retrieve rows from both the left and right tables, while the DISTINCT operator can be used to eliminate duplicate rows.

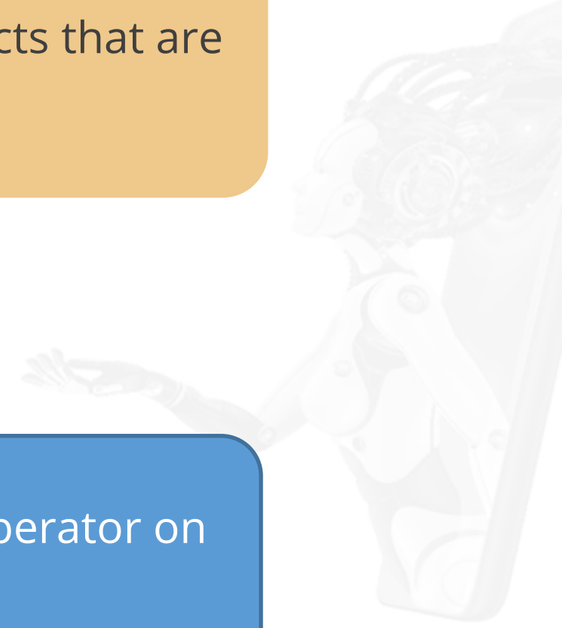
Syntax

```
SELECT
    column_name_1
FROM
    table_1
LEFT JOIN
    table_2 USING (column_name_1)
WHERE
    table_2.column_name_1 IS NULL;
```

MINUS Using LEFT JOIN: Example

Problem Statement: Your manager wants you to list the project IDs of the projects that are not yet assigned to any manager or employee.

Objective: Write an SQL query using **LEFT JOIN** clause to simulate the **MINUS** operator on the **PROJ_RECORDS** and **PROJ_ASSIGN** tables in MySQL.



MINUS Using LEFT JOIN: Example

Step 1: Use the **LEFT JOIN** clause in the **SELECT** statement to simulate the **MINUS** operator on the **PROJ_RECORDS** and **PROJ_ASSIGN** tables as given below.

SQL Query

```
SELECT
    p.PROJ_ID
FROM
    PROJ_RECORDS p
LEFT JOIN
    PROJ_ASSIGN a USING (PROJ_ID)
WHERE
    a.PROJ_ID IS NULL;
```

Output:

	PROJ_ID
▶	P302

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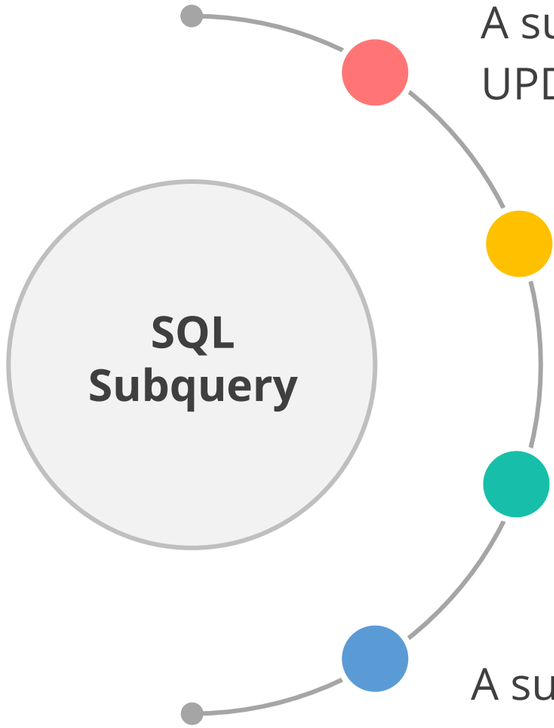
Subquery in SQL

Subquery in SQL



A subquery is a query nested within another query such as SELECT, INSERT, UPDATE, or DELETE.

It is also called an **Inner Query** or **Inner Select** while the statement that contains the subquery is called an outer query or outer select.

It can be used anywhere an expression is used and must be closed in parentheses.

A subquery can also be nested within another subquery.

Subquery in SQL

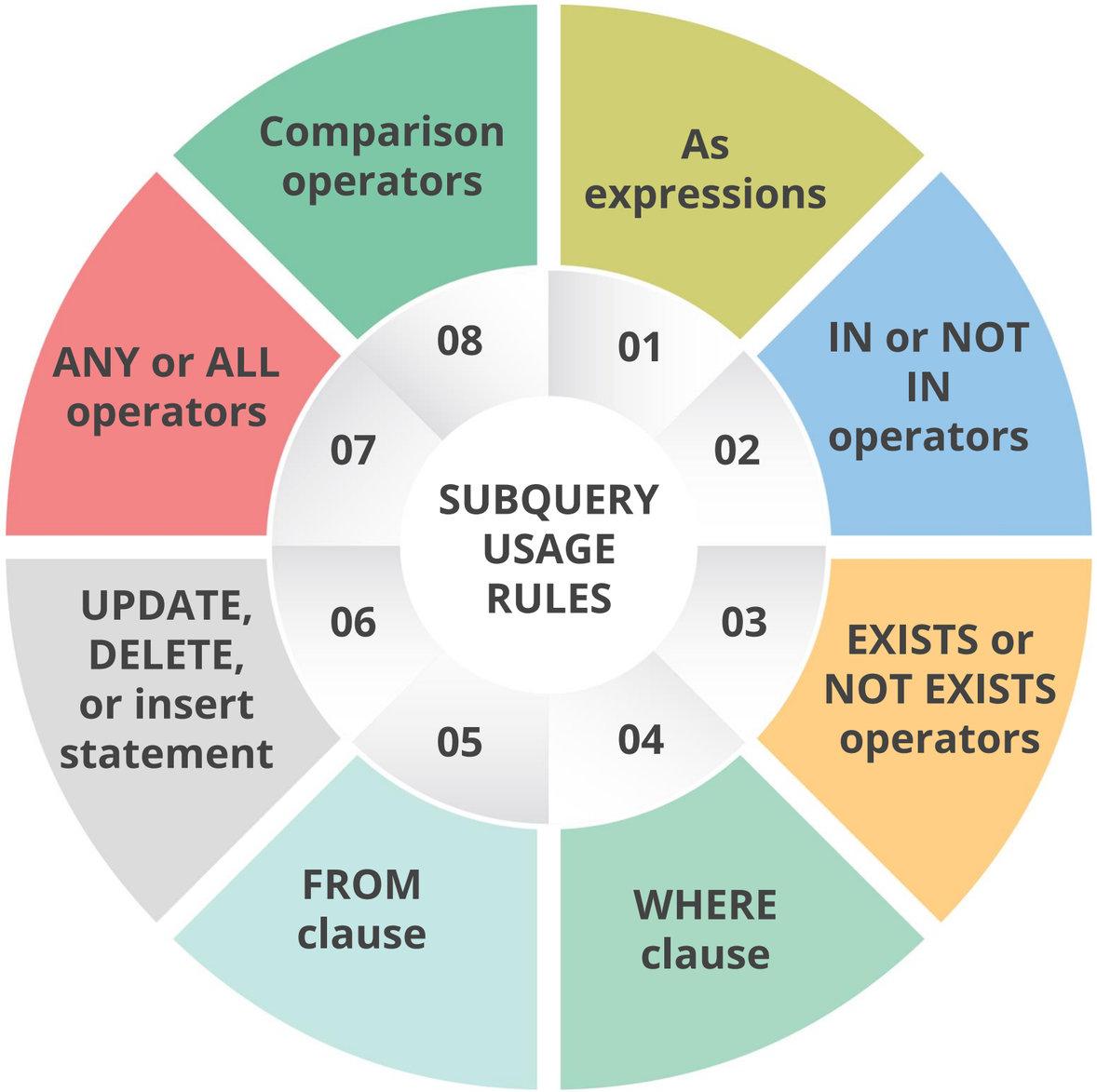
Example

```
SELECT branchName, branchCity
FROM dataBranches
WHERE branchCode IN (
        SELECT branchCode
        FROM dataCenters
        WHERE country = 'USA'
);
```

Outer query

Inner query

Subquery Rules



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Subqueries with Statements and Operators

simplilearn

Subquery as Expressions

A subquery that returns a single value can be used as an expression.

SQL Query

```
SELECT m.DEPT, COUNT(DISTINCT m.EMP_ID) AS `MANAGER_COUNT`,
  ( SELECT COUNT(DISTINCT e.EMP_ID) FROM EMP_RECORDS e
    WHERE e.ROLE NOT IN ("MANAGER", "PRESIDENT", "CEO")
    AND e.DEPT IN ("RETAIL") ) AS `TEAM_STRENGTH`
FROM EMP_RECORDS m
WHERE m.ROLE IN ("MANAGER") AND m.DEPT IN ("RETAIL");
```

Output:

	DEPT	MANAGER_COUNT	TEAM_STRENGTH
▶	RETAIL	2	4

Suppose you need to determine the count of managers and the total team strength excluding them in the retail domain in MySQL.

Subquery With WHERE Clause

A subquery can be used with a WHERE clause.

SQL Query

```
SELECT p.PROJ_ID, p.PROJ_NAME, p.DOMAIN
FROM PROJ_RECORDS p
WHERE p.PROJ_ID NOT IN (
  SELECT DISTINCT a.PROJ_ID
  FROM PROJ_ASSIGN a
) AND p.STATUS IN ("YTS");
```

Output:

	PROJ_ID	PROJ_NAME	DOMAIN
▶	P302	Early Detection of Lung Cancer	HEALTHCARE

Suppose you need to determine the list of upcoming projects with no manager and team member assigned to them in MySQL.

Subquery With Comparison Operators

Comparison operators can be used to compare a single value returned by a subquery with the expression in the WHERE clause.

SQL Query

```
SELECT
  e.EMP_ID,
  CONCAT(e.FIRST_NAME,' ',e.LAST_NAME) AS `FULL_NAME`,
  e.ROLE, e.DEPT
FROM EMP_RECORDS e
WHERE e.EXP = (SELECT MAX(EXP) FROM EMP_RECORDS);
```

Output:

	EMP_ID	FULL_NAME	ROLE	DEPT
▶	E001	Arthur Black	CEO	ALL

Suppose you need to determine the employee with the highest experience in the organization in MySQL.

Subquery With IN and NOT IN Operators

A subquery that returns more than one value can be used with IN or NOT IN operators in the WHERE clause.

SQL Query

```
SELECT
  e.EMP_ID, e.FIRST_NAME, e.LAST_NAME, e.ROLE, e.DEPT
FROM EMP_RECORDS e
WHERE e.EMP_ID NOT IN (
    SELECT DISTINCT a.EMP_ID FROM PROJ_ASSIGN a
  ) AND e.ROLE IN ("MANAGER");
```

Output:

EMP_ID	FIRST_NAME	LAST_NAME	ROLE	DEPT
E428	Pete	Allen	MANAGER	AUTOMOTIVE
E612	Tracy	Norris	MANAGER	RETAIL

Suppose you need to determine the list of all managers who have not been assigned to any projects in the organization in MySQL.

Subquery With ANY Operator

A subquery that returns a list of values that can be used with ANY operator in the WHERE clause.

The ANY operator compares each value provided by the subquery with the comparison expression and returns TRUE if any comparison pair evaluates to TRUE; otherwise, it returns FALSE.

Subquery With ANY Operator

Suppose you need to determine any five employees with more than or equal to the average experience of all employees in the organization in MySQL.

SQL Query

```
SELECT
  e.EMP_ID,
  CONCAT(e.FIRST_NAME,' ',e.LAST_NAME) AS `FULL_NAME`,
  e.ROLE, e.DEPT, e.EXP
FROM EMP_RECORDS e
WHERE e.EXP >= ANY (SELECT AVG(EXP) FROM EMP_RECORDS)
LIMIT 5;
```

Output:

EMP_ID	FULL_NAME	ROLE	DEPT	EXP
E001	Arthur Black	CEO	ALL	20
E002	Cynthia Brooks	PRESIDENT	ALL	17
E083	Patrick Voltz	MANAGER	HEALTHCARE	15
E103	Emily Grove	MANAGER	FINANCE	14
E428	Pete Allen	MANAGER	AUTOMOTIVE	14

Subquery With ALL Operator

A subquery that returns a list of values can also be used with ALL operators in the WHERE clause.

The ALL operator compares each value provided by the subquery with the comparison expression and returns TRUE if all the comparison pairs evaluate to TRUE; otherwise, it returns FALSE.

Subquery With ALL Operator

Suppose you need to determine all the employees with less than the average experience of all employees in MySQL.

SQL Query

```
SELECT
  e.EMP_ID,
  CONCAT(e.FIRST_NAME,' ',e.LAST_NAME) AS `FULL_NAME`,
  e.ROLE, e.DEPT, e.EXP
FROM EMP_RECORDS e
WHERE e.EXP < ALL (SELECT AVG(EXP) FROM EMP_RECORDS);
```

Output:

EMP_ID	FULL_NAME	ROLE	DEPT	EXP
E052	Dianna Wilson	SENIOR DATA SCIENTIST	HEALTHCARE	6
E057	Dorothy Wilson	SENIOR DATA SCIENTIST	HEALTHCARE	9
E245	Nian Zhen	SENIOR DATA SCIENTIST	RETAIL	6
E260	Roy C	NIOR DATA SCIENTIST	RETAIL	7
E403	Steve Hoffman	ASSOCIATE DATA SCIENTIST	FINANCE	4
E505	Chad Wilson	ASSOCIATE DATA SCIENTIST	HEALTHCARE	5
E532	Claire Brennan	ASSOCIATE DATA SCIENTIST	AUTOMOTIVE	3
E620	Katrina Allen	JUNIOR DATA SCIENTIST	RETAIL	2
E640	Jenifer Jhones	JUNIOR DATA SCIENTIST	RETAIL	1

Roy Collins

Subquery With EXISTS or NOT EXISTS Operators

A subquery can also be used with the EXISTS and NOT EXISTS operators.

The EXISTS operator returns TRUE if the subquery returns the results; otherwise, it returns FALSE. The NOT EXISTS operator is opposite to the EXISTS operator.

Subquery With EXISTS or NOT EXISTS Operators

Suppose you need to print the names of all the projects only if even one project is assigned to any employee in MySQL.

SQL Query

```
SELECT PROJ_NAME
FROM PROJ_RECORDS
WHERE EXISTS (
  SELECT PROJ_ID
  FROM PROJ_ASSIGN
) ORDER BY PROJ_ID;
```

Output:

PROJ_NAME
Drug Discovery
Fraud Detection
Market Basket Analysis
Early Detection of Lung Cancer
Customer Sentiment Analysis

Subquery in the FROM Clause

The FROM clause creates a temporary table from the result set returned by a subquery, often known as a derived table or materialized subquery.

SQL Query

```
SELECT
  MAX(EXP) AS `MAX_EXP`, MIN(EXP) AS `MIN_EXP`,
  FLOOR(AVG(EXP)) AS `AVG_EXP`
FROM (
     SELECT EMP_ID, EXP FROM EMP_RECORDS
     GROUP BY EXP ORDER BY EXP
) AS TOTAL_EXP;
```

Output:

	MAX_EXP	MIN_EXP	AVG_EXP
▶	20	1	9

Suppose you need to determine the maximum, minimum, and average employee experience in the organization in MySQL.

Subquery With SELECT Statement

Subqueries are frequently used with the SELECT statement.

SQL Query

```
SELECT
  PROJ_ID, PROJ_NAME,
  DOMAIN, STATUS
FROM PROJ_RECORDS
WHERE PROJ_ID IN (
  SELECT DISTINCT PROJ_ID FROM PROJ_ASSIGN
) ORDER BY PROJ_ID, DOMAIN;
```

Output:

	PROJ_ID	PROJ_NAME	DOMAIN	STATUS
▶	P103	Drug Discovery	HEALTHCARE	DONE
	P105	Fraud Detection	FINANCE	DONE
	P109	Market Basket Analysis	RETAIL	DELAYED
	P406	Customer Sentiment Analysis	RETAIL	WIP

Suppose you need to determine all those projects that are assigned to at least one of the employees in MySQL.

Subquery With INSERT Statement

Let us make a table comparable to **PROJ_RECORDS** with the name **PROJ_RECORDS_BKUP** in the **PROJ_DB** database in MySQL.

SQL Query

```
CREATE TABLE IF NOT EXISTS PROJ_DB.PROJ_RECORDS_BKUP (
    PROJ_ID VARCHAR(4) NOT NULL CHECK (SUBSTR(PROJ_ID,1,1) = 'P'),
    PROJ_NAME VARCHAR(200) NOT NULL,
    DOMAIN VARCHAR(100) NOT NULL,
    START_DATE DATE NOT NULL CHECK (START_DATE >= '2021-04-01'),
    CLOSURE_DATE DATE NOT NULL CHECK (CLOSURE_DATE <= '2022-03-30'),
    DEV_QTR VARCHAR(2) NOT NULL,
    STATUS VARCHAR(7),
    CONSTRAINT chk_qtr_2 CHECK (DEV_QTR IN ('Q1', 'Q2', 'Q3', 'Q4')),
    CONSTRAINT chk_status_2 CHECK (STATUS IN ('YTS', 'WIP', 'DONE', 'DELAYED'))
)  ENGINE=INNODB;
```

Subquery With INSERT Statement

Let us now analyze the structure of the **PROJ_RECORDS_BKUP** table created in MySQL.

SQL Query

```
DESCRIBE PROJ_DB.PROJ_RECORDS_BKUP;
```

Output:

	Field	Type	Null	Key	Default	Extra
▶	PROJ_ID	varchar(4)	NO		NULL	
	PROJ_NAME	varchar(200)	NO		NULL	
	DOMAIN	varchar(100)	NO		NULL	
	START_DATE	date	NO		NULL	
	CLOSURE_DATE	date	NO		NULL	
	DEV_QTR	varchar(2)	NO		NULL	
	STATUS	varchar(7)	YES		NULL	

Subquery With INSERT Statement

Suppose you need to back up the data of all those projects which have no employee assigned into the new **PROJ_RECORDS_BKUP** table in MySQL.

SQL Query

```
INSERT INTO PROJ_RECORDS_BKUP
SELECT * FROM PROJ_RECORDS p
WHERE p.PROJ_ID NOT IN (
  SELECT DISTINCT PROJ_ID FROM PROJ_ASSIGN
);
```

Subquery With INSERT Statement

Now, you need to fetch the data for all the columns from the **PROJ_RECORDS_BKUP** table in MySQL to verify the table data.

SQL Query

```
SELECT * FROM PROJ_DB.EMP_RECORDS_BKUP;
```

Output:

	PROJ_ID	PROJ_NAME	DOMAIN	START_DATE	CLOSURE_DATE	DEV_QTR	STATUS
▶	P302	Early Detection of Lung Cancer	HEALTHCARE	2021-10-08	2021-12-18	Q3	YTS

Subquery With UPDATE Statement

The subquery can be used in conjunction with the UPDATE statement to update either single or multiple columns in a table.

SQL Query

```
UPDATE PROJ_RECORDS_BKUP
SET DEV_QTR = "Q2"
WHERE START_DATE = (
  SELECT START_DATE FROM PROJ_RECORDS WHERE DEV_QTR = "Q3"
) AND CLOSURE_DATE = (
  SELECT CLOSURE_DATE FROM PROJ_RECORDS WHERE DEV_QTR = "Q3"
);
```


Suppose you need to change the development quarter along with its start and closure dates for one of the projects in the **PROJ_RECORDS_BKUP** table in MySQL.

Subquery With UPDATE Statement

Now, you need to check the updated data in all the columns of the **PROJ_RECORDS_BKUP** table in MySQL to verify the update.

SQL Query

```
SELECT * FROM PROJ_DB.EMP_RECORDS_BKUP;
```

Output:

	PROJ_ID	PROJ_NAME	DOMAIN	START_DATE	CLOSURE_DATE	DEV_QTR	STATUS
▶	P302	Early Detection of Lung Cancer	HEALTHCARE	2021-10-08	2021-12-18	Q2	YTS

Subquery With DELETE Statement

The subquery can also be used with the DELETE statement.

SQL Query

```
DELETE FROM PROJ_RECORDS_BKUP
WHERE PROJ_ID IN (
  SELECT p.PROJ_ID FROM PROJ_RECORDS p
  WHERE p.STATUS = "YTS" GROUP BY p.STATUS
);
```


Let us say you need to remove a project from the **PROJ_RECORDS_BKUP** table that has the status YTS in the **PROJ_RECORDS** table in MySQL.

Subquery With DELETE Statement

Now, you need to check the updated data for all the columns in the **PROJ_RECORDS_BKUP** table in MySQL to verify the update.

SQL Query

```
SELECT * FROM PROJ_DB.EMP_RECORDS_BKUP;
```

Output:

	PROJ_ID	PROJ_NAME	DOMAIN	START_DATE	CLOSURE_DATE	DEV_QTR	STATUS

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Derived Tables in SQL

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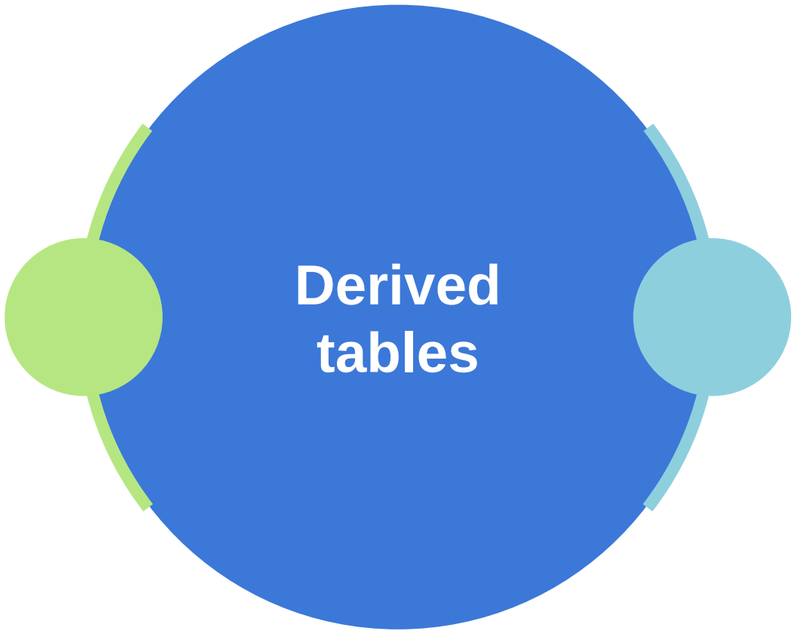
Derived Tables

A derived table is a virtual table returned by a SELECT statement.



A derived table is created by using a stand-alone subquery in the FROM clause of a SELECT statement.

Derived Tables

Example

```
SELECT select_list
FROM (

    SELECT select_list
    FROM table_1

) derived_table_name
WHERE derived_table_name.c1 > 0;
```

Derived Tables

MySQL raises an error in the absence of an alias for a derived table.

Error

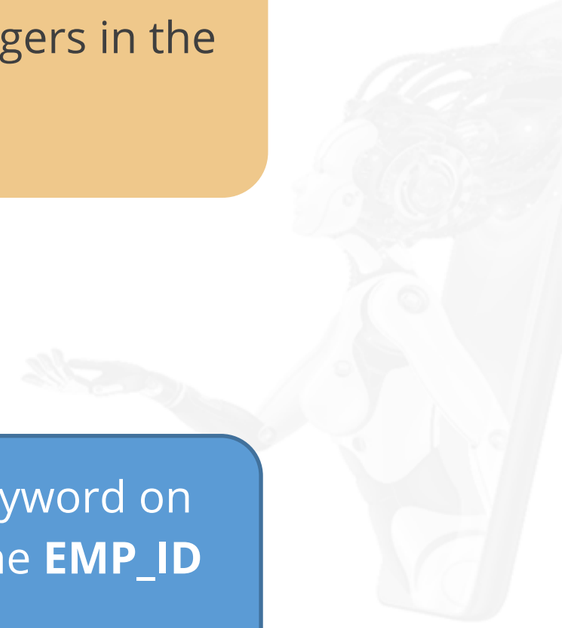
```
Every derived table must have its own alias
```

It is mandatory for a derived table to have an alias so that it can be referenced in the query.

Derived Tables: Example

Problem Statement: Your manager wants you to find the total number of managers in the organization.

Objective: Write an SQL query using the **COUNT** function with the **DISTINCT** keyword on the output returned by a **subquery** which creates a **DERIVED TABLE** to return the **EMP_ID** of all managers from the **EMP_RECORDS** tables in MySQL.



Derived Tables: Example

Step 1: Use the **COUNT** function with the **DISTINCT** keyword on the output returned by a subquery which creates a **DERIVED TABLE** for returning the **EMP_ID** of all managers as given below.

SQL Query – Par 1

```
SELECT COUNT(DISTINCT EMP_ID) AS `MANAGER_COUNT`
FROM (
  SELECT DISTINCT EMP_ID FROM EMP_RECORDS
  WHERE ROLE IN ("MANAGER")
) employees
WHERE EMP_ID = employees.EMP_ID;
```

Output:

	MANAGER_COUNT
▶	5

EXISTS Operator

EXISTS Operator

The EXISTS operator is a Boolean operator that returns true or false and is frequently used to check if rows returned by a subquery exist.

Syntax

```
SELECT
    select_list
FROM
    a_table
WHERE
    [NOT] EXISTS(subquery);
```

EXISTS Operator: Example

Problem Statement: Your manager wants you to provide the basic information of all the managers in the organization.

Objective: Write an SQL query using the **EXISTS** operator to verify the existence of managers and return their details if available from the **EMP_RECORDS** tables in MySQL.

EXISTS Operator: Example

Step 1: Use the **EXISTS** operator in the **SELECT** statement to verify the existence of managers and return their details if available from the **EMP_RECORDS** tables as given below.

SQL Query

```
SELECT m.EMP_ID, m.FIRST_NAME, m.LAST_NAME,
       m.ROLE, m.DEPT
FROM EMP_RECORDS m
WHERE EXISTS(
  SELECT 1 FROM EMP_RECORDS WHERE ROLE IN ("MANAGER")
) AND ROLE IN ("MANAGER");
```

Output:

EMP_ID	FIRST_NAME	LAST_NAME	ROLE	DEPT
E083	Patrick	Voltz	MANAGER	HEALTHCARE
E103	Emily	Grove	MANAGER	FINANCE
E428	Pete	Allen	MANAGER	AUTOMOTIVE
E583	Janet	Hale	MANAGER	RETAIL
E612	Tracy	Norris	MANAGER	RETAIL

NOT EXISTS Operator

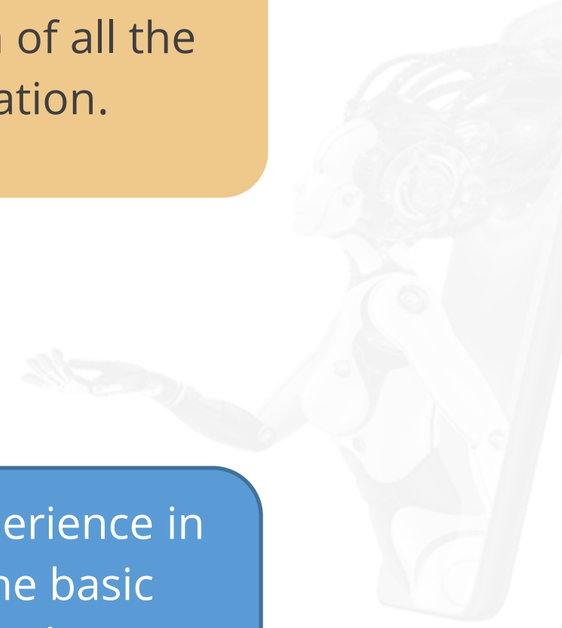
Alternatively, the NOT EXISTS operator is the opposite of EXISTS operator.

Syntax

```
SELECT
    select_list
FROM
    a_table
WHERE
    NOT EXISTS(subquery);
```

NOT EXISTS Operator: Example

Problem Statement: Your manager wants you to provide the basic information of all the employees with one year or less than one year of experience in the organization.



Objective: Write an SQL query that verifies if there is no entry for a negative experience in the **EMP_RECORDS** tables using the **NOT EXISTS** operator, and then returns the basic information for all employees in that table with an experience of less than or equal to one in MySQL.

NOT EXISTS Operator: Example

Step 1: Use the **NOT EXISTS** operator in the **SELECT** statement to verify if there is no negative entry experience.

Step 2: Return the basic information of all the employees with an experience of less than or equals to one in the **EMP_RECORDS** table as given below.

SQL Query

```
SELECT m.EMP_ID, m.FIRST_NAME, m.LAST_NAME,
       m.DEPT, m.EXP
FROM EMP_RECORDS m
WHERE NOT EXISTS(
  SELECT 1 FROM EMP_RECORDS WHERE EXP < 0
) AND m.EXP <= 1;
```

Output:

	EMP_ID	FIRST_NAME	LAST_NAME	DEPT	EXP
▶	E640	Jenifer	Jhones	RETAIL	1

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EXISTS vs. IN Operators

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EXISTS vs. IN

EXISTS operator

- Faster than IN operator
- Does not depend on subquery
- Works on the at least found principle
- Stops scanning the table as soon as a matching row is found

IN operator

- Slower than EXISTS operator
- Depends on subquery
- Used in conjunction with a subquery
- Waits for MySQL to complete the execution of the subquery to utilize its result

Key Takeaways

- MySQL supports four different types of joins: INNER, LEFT, RIGHT, and CROSS.
- Because the INTERSECT and MINUS set operators are not supported by MySQL, they must be mimicked by combining other MySQL components.
- A derived table is formed by inserting a stand-alone subquery into the FROM clause of a SELECT statement.
- The EXISTS operator is commonly used to determine whether rows returned by a subquery exist by returning a Boolean value.
- The EXISTS operator operates on the least found principle, whereas the IN operator is employed with a subquery.

Knowledge Check

Knowledge Check

1

The JOIN where all possible row combinations are produced is called _____.

A. INNER JOIN

B. OUTER

C. NATURAL

D. CARTESIAN

Knowledge Check

1

The JOIN where all possible row combinations are produced is called _____.

A. INNER JOIN

B. OUTER

C. NATURAL

D. CARTESIAN

The correct answer is **D**

In the 'cartesian product', each row of each table is combined with each row of every other table to generate every possible combination. Since the number is the product of rows, this results in an extremely high number of rows.

Knowledge Check

2

What is joining a table to itself called?

A. SELF JOIN

B. COMPLETE

C. OBSOLETE

D. CROSS

Knowledge Check

2

What is joining a table to itself called?

A. SELF JOIN

B. COMPLETE

C. OBSOLETE

D. CROSS

The correct answer is **A**

The term "self join" refers to the joining of a tables to itself in a database. A table name qualifier is not required when doing a self-join because the table is utilized several times within the query.

Knowledge Check

3

In which JOIN all the rows from the left table appear in the output irrespective of the content of the other table?

A. RIGHT JOIN

B. LEFT JOIN

C. INNER JOIN

D. OUTER JOIN

Knowledge Check

3

In which JOIN all the rows from the left table appear in the output irrespective of the content of the other table?

A. RIGHT JOIN

B. LEFT JOIN

C. INNER JOIN

D. OUTER JOIN

The correct answer is **B**

A ‘LEFT JOIN' produces output for every row in the left table, even if that row does not exist in the right table. This is why it's referred to as a 'LEFT JOIN.' The ‘LEFT JOIN' is a type of OUTER JOIN.

Knowledge Check

4

Which clause is used to sort a UNION result as a whole?

A. LIMIT

B. GROUP BY

C. ORDER BY

D. SORT

Knowledge Check

4

Which clause is used to sort a UNION result as a whole?

A. LIMIT

B. GROUP BY

C. ORDER BY

D. SORT

The correct answer is **C**

To sort a ‘UNION' result as a whole, the ‘ORDER BY' clause is used with the ‘UNION' statement. It is placed after the final SELECT statement which is enclosed in the parentheses.