MySQL Fundamentals Part 2

JOINS, UNIONS AND SUBQUERIES

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Prerequisites

MySQL Server

MySQL Workbench or any other IDE

Sample Database – sakila

A SQL JOIN combines columns from two or more tables in a single result set.

Joins

Inner Join

Outer Join

- Left Outer Join
- Right Outer Join
- Full Outer Join

Cross Join

Self Join

Equi Join

Natural Join

Straight Join*

* Discussed in Performance Tuning Course

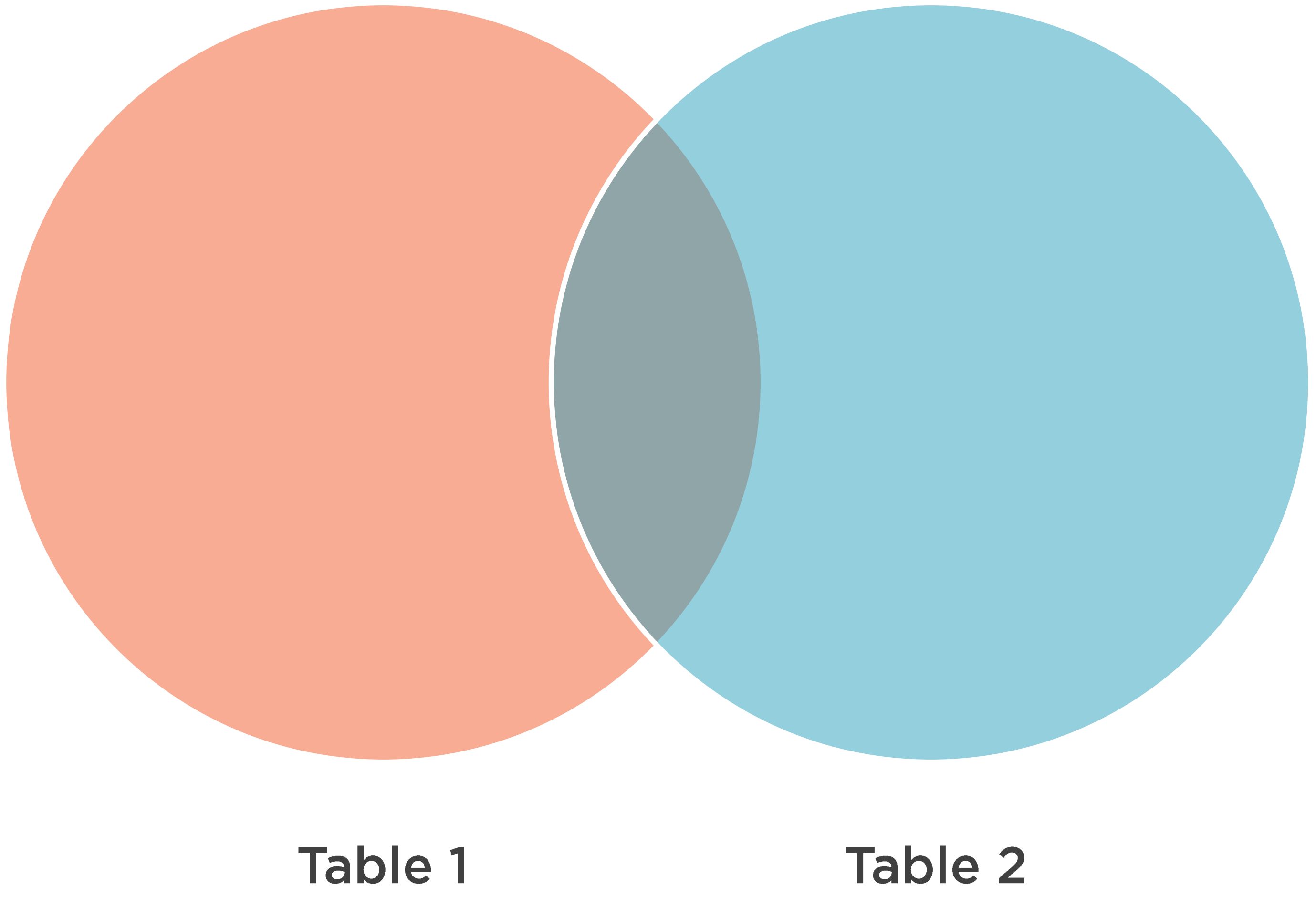


Table 1
Table 2

Inner Join

INNER joins returns rows when there is at least one match in both the tables

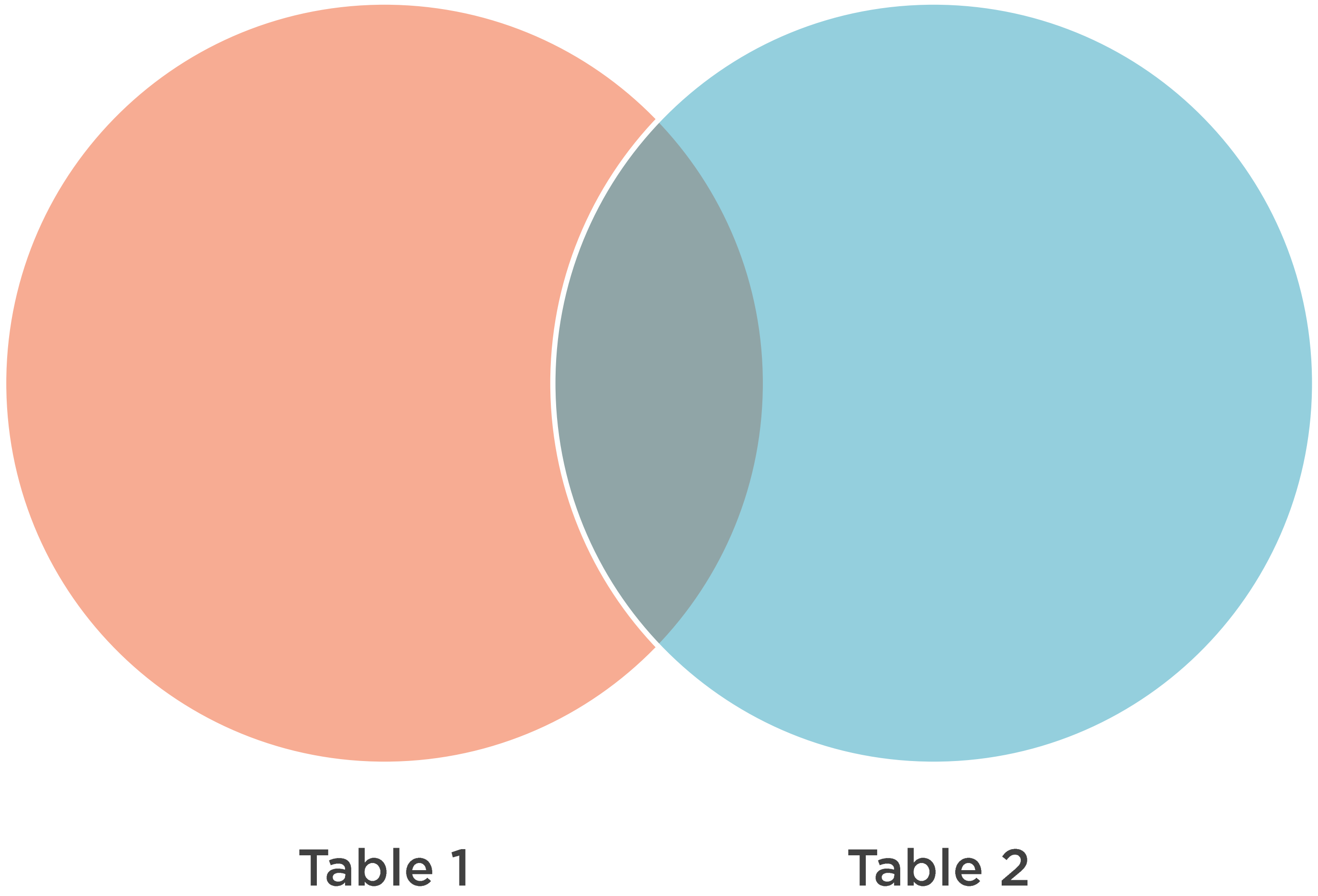
Avoid ambiguity by qualifying each column name with table name

Join tables based on relationships as well ad-hoc

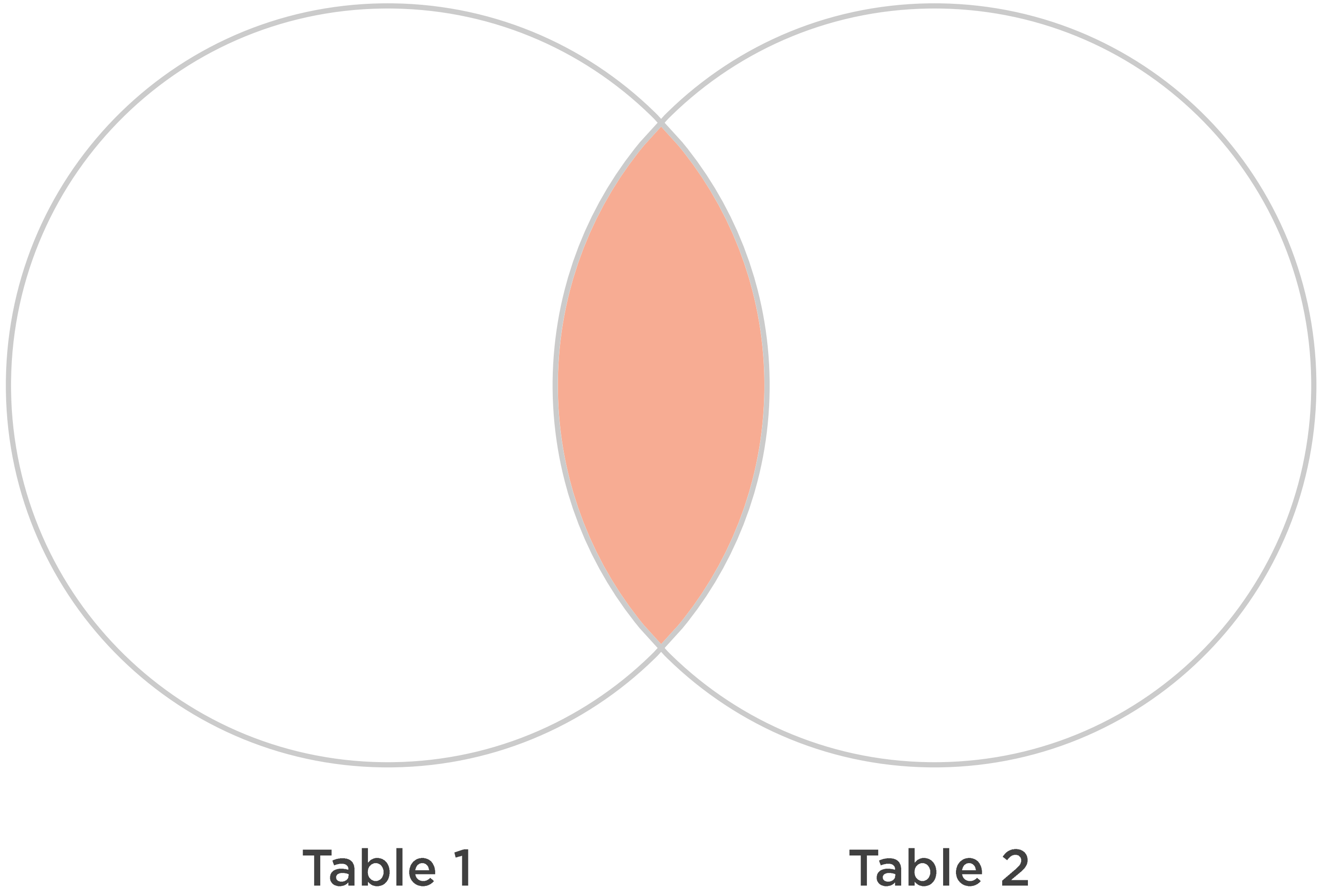
Operators for Join

= > < <= >=

Inner Join



Inner Join



Inner Join

ID	Value
1	First
2	Second
3	Third
4	Fourth
5	Fifth

Table 1

ID	Value
1	First
2	Second
3	Third
6	Sixth
7	Seventh
8	Eighth

Table 2

Inner Join

ID	Value
1	First
2	Second
3	Third
4	Fourth
5	Fifth

Table 1

ID	Value
1	First
2	Second
3	Third
6	Sixth
7	Seventh
8	Eighth

Table 2

Implicit Syntax vs. Explicit Syntax

```
SELECT t1.*, t2.*
FROM Table1 t1, Table2 t2
WHERE t1.ID = t2.ID
```

◀ **Implicit Syntax**

```
SELECT t1.*, t2.*
FROM Table1 t1
INNER JOIN Table2 t2 ON t1.ID=t2.ID
```

◀ **Explicit Syntax (SQL-92)**

Outer Join

Left Outer Join

Right Outer Join

Full Outer Join*

Outer keyword is optional

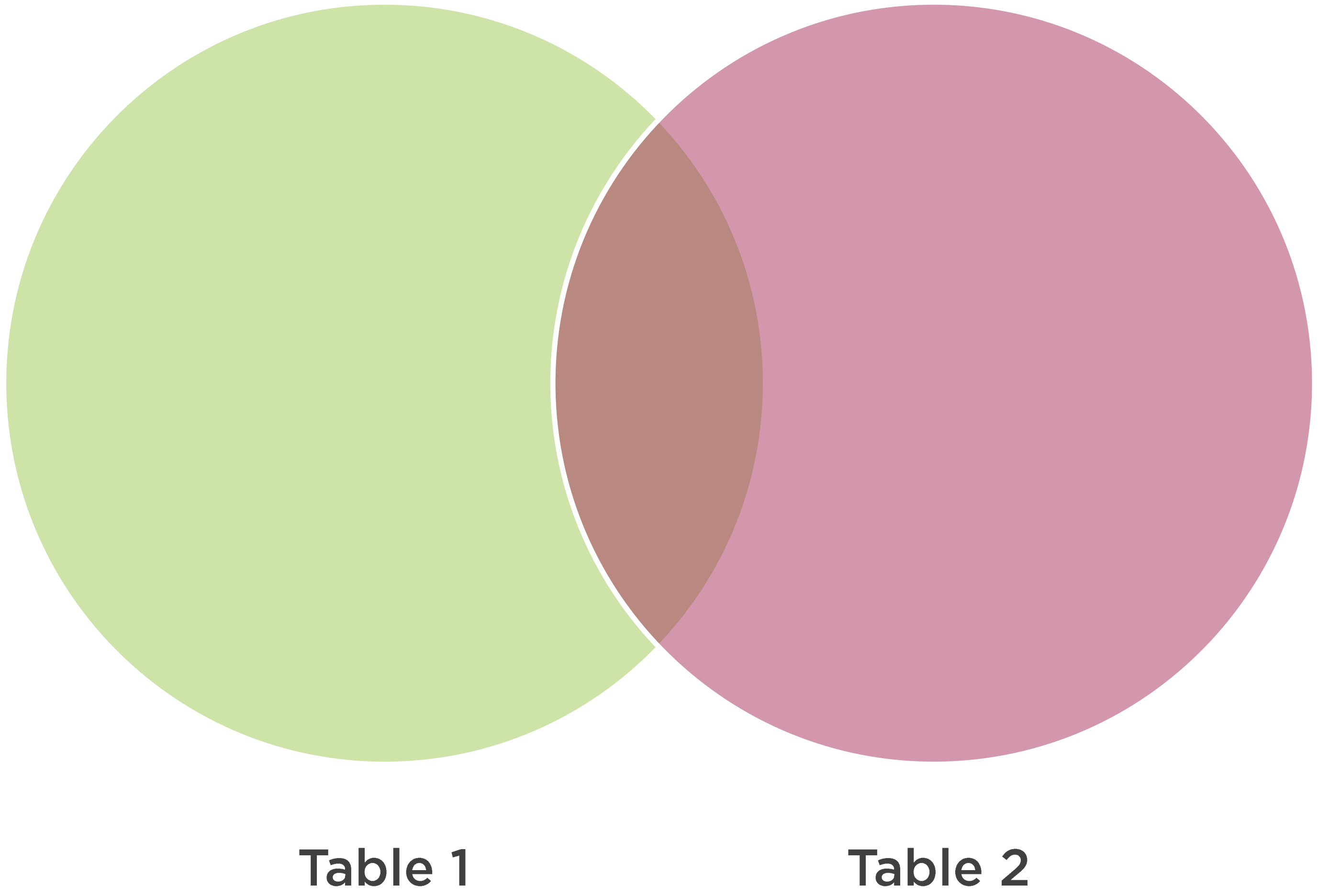
* MySQL does not support full outer join syntax

Left Outer Join

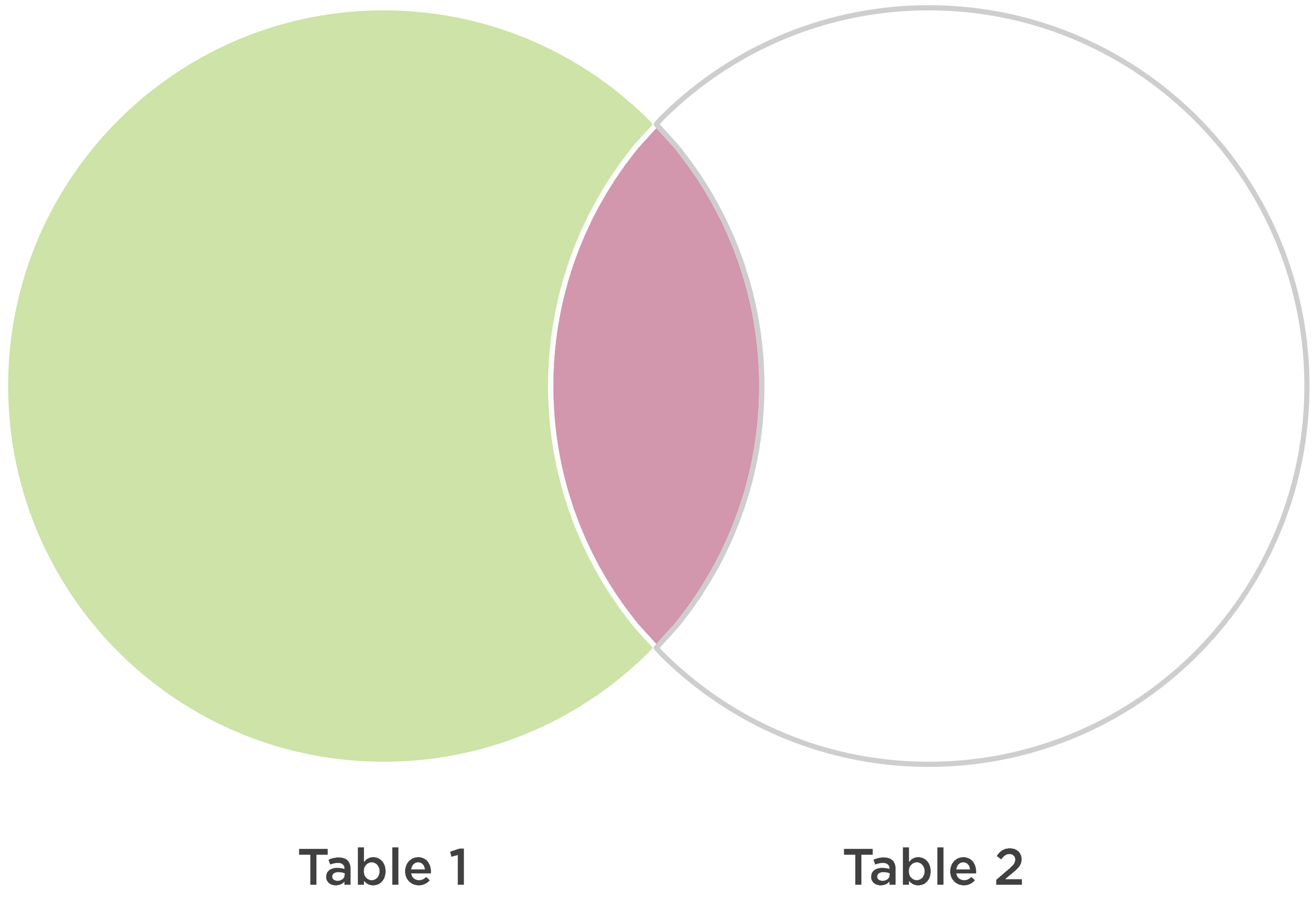
LEFT OUTER join returns all the rows from the left table with the matching rows from the right table

If there are no columns matching in the right table, it returns NULL values

Left Outer Join



Left Outer Join



Left Outer Join

ID	Value
1	First
2	Second
3	Third
4	Fourth
5	Fifth

Table 1

ID	Value
1	First
2	Second
3	Third
6	Sixth
7	Seventh
8	Eighth

Table 2

Left Outer Join

ID	Value
1	First
2	Second
3	Third
4	Fourth
5	Fifth

Table 1

ID	Value
1	First
2	Second
3	Third
6	Sixth
7	Seventh
8	Eighth

Table 2

Left Outer Join

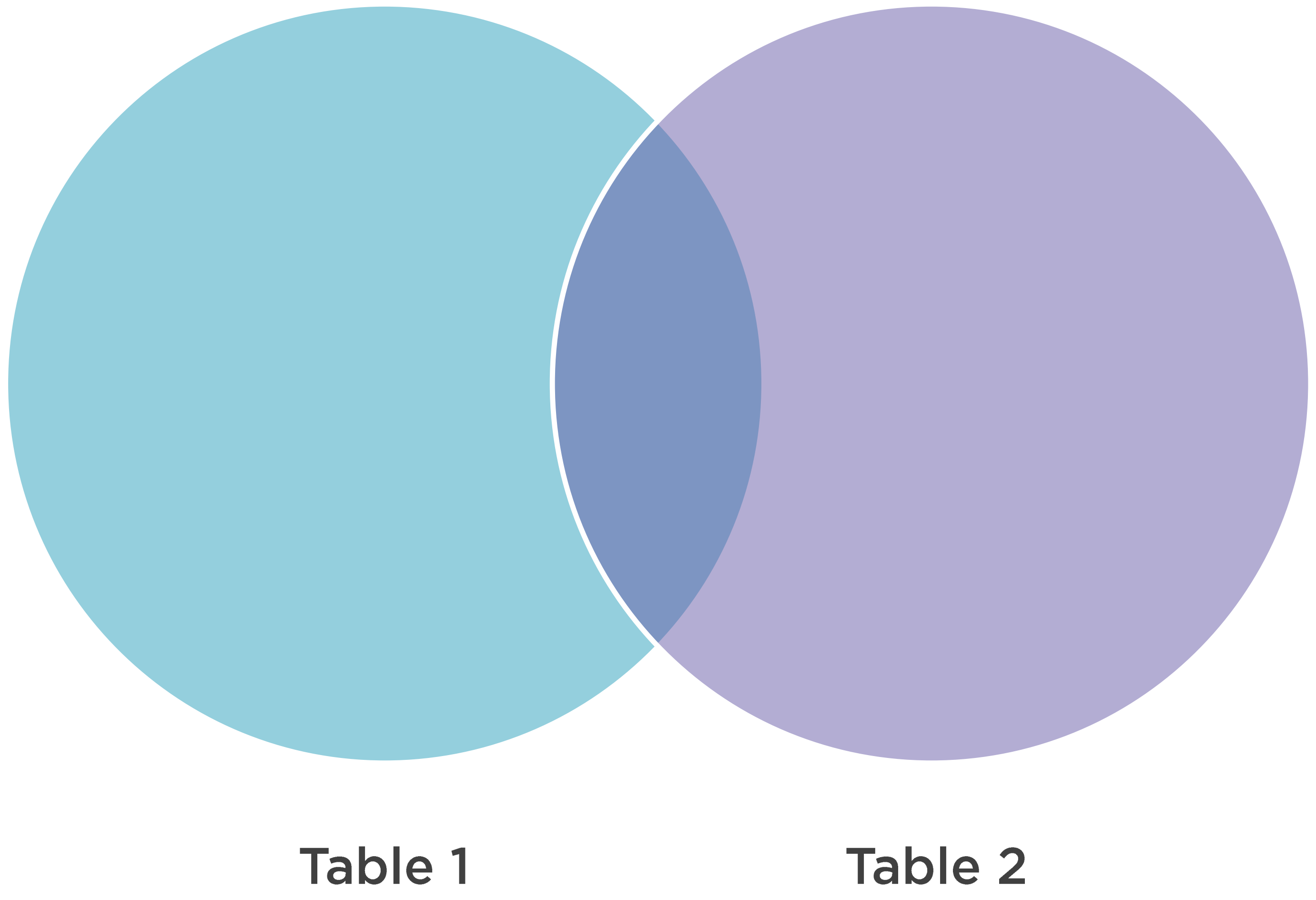
```
SELECT t1.*, t2.*

FROM Table1 t1

LEFT OUTER JOIN Table2 t2 ON t1.ID = t2.ID
```

Right Outer Join

RIGHT OUTER join returns all the rows from the right table with the matching rows from the left table

If there are no columns matching in the left table, it returns NULL values

Right Outer Join



Right Outer Join

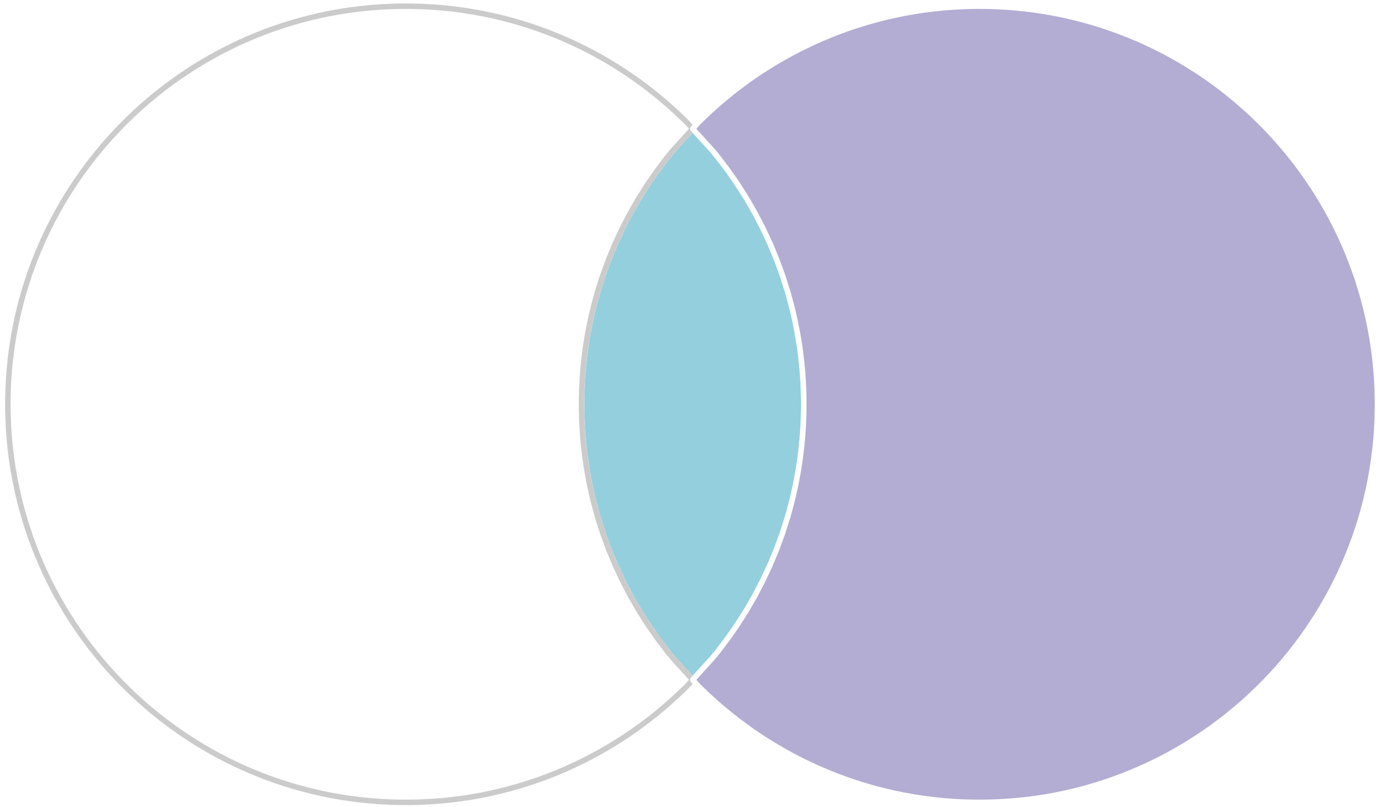


Table 1

Table 2

Right Outer Join

ID	Value
1	First
2	Second
3	Third
4	Fourth
5	Fifth

Table 1

ID	Value
1	First
2	Second
3	Third
6	Sixth
7	Seventh
8	Eighth

Table 2

Right Outer Join

ID	Value
1	First
2	Second
3	Third
4	Fourth
5	Fifth

Table 1

ID	Value
1	First
2	Second
3	Third
6	Sixth
7	Seventh
8	Eighth

Table 2

Right Outer Join

```
SELECT t1.*, t2.*

FROM Table1 t1

RIGHT OUTER JOIN Table2 t2 ON t1.ID = t2.ID
```

Full Outer Join

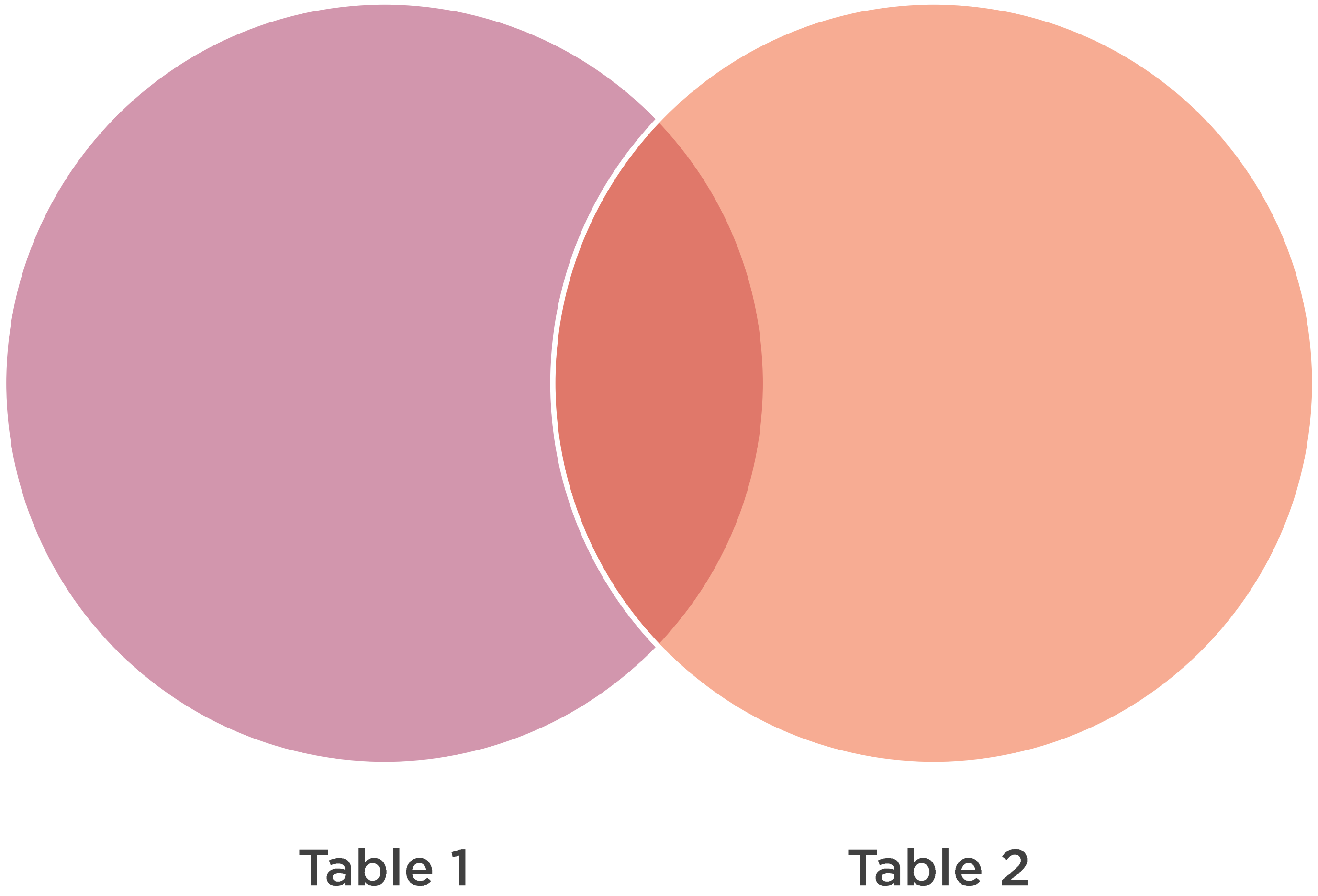
FULL OUTER join combines left outer join and right outer join

This join returns rows from either table when the conditions are met and returns a null value when there is no match

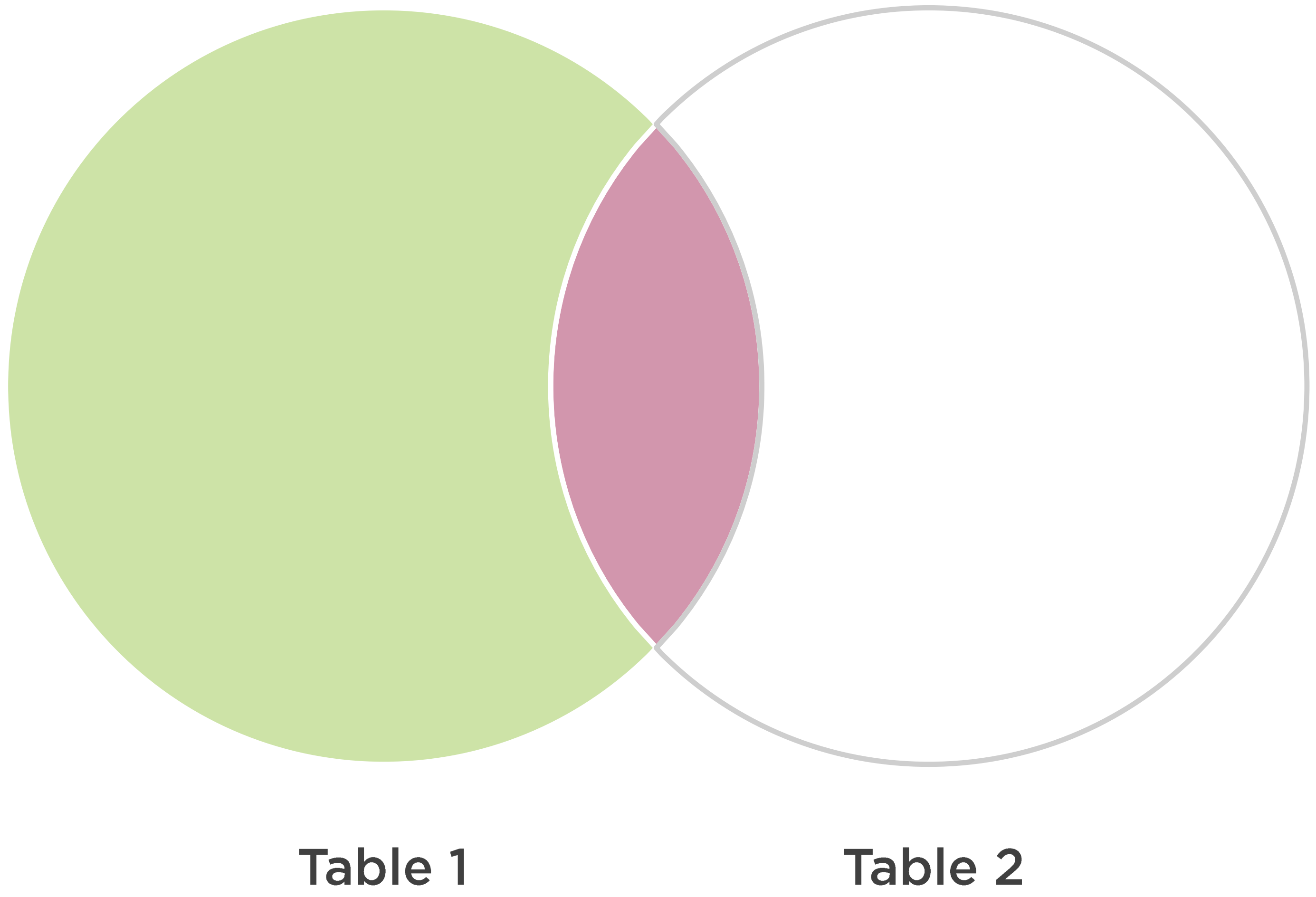
MySQL does not support FULL OUTER JOIN syntax

- Simulate FULL OUTER JOIN using LEFT and RIGHT join with UNION

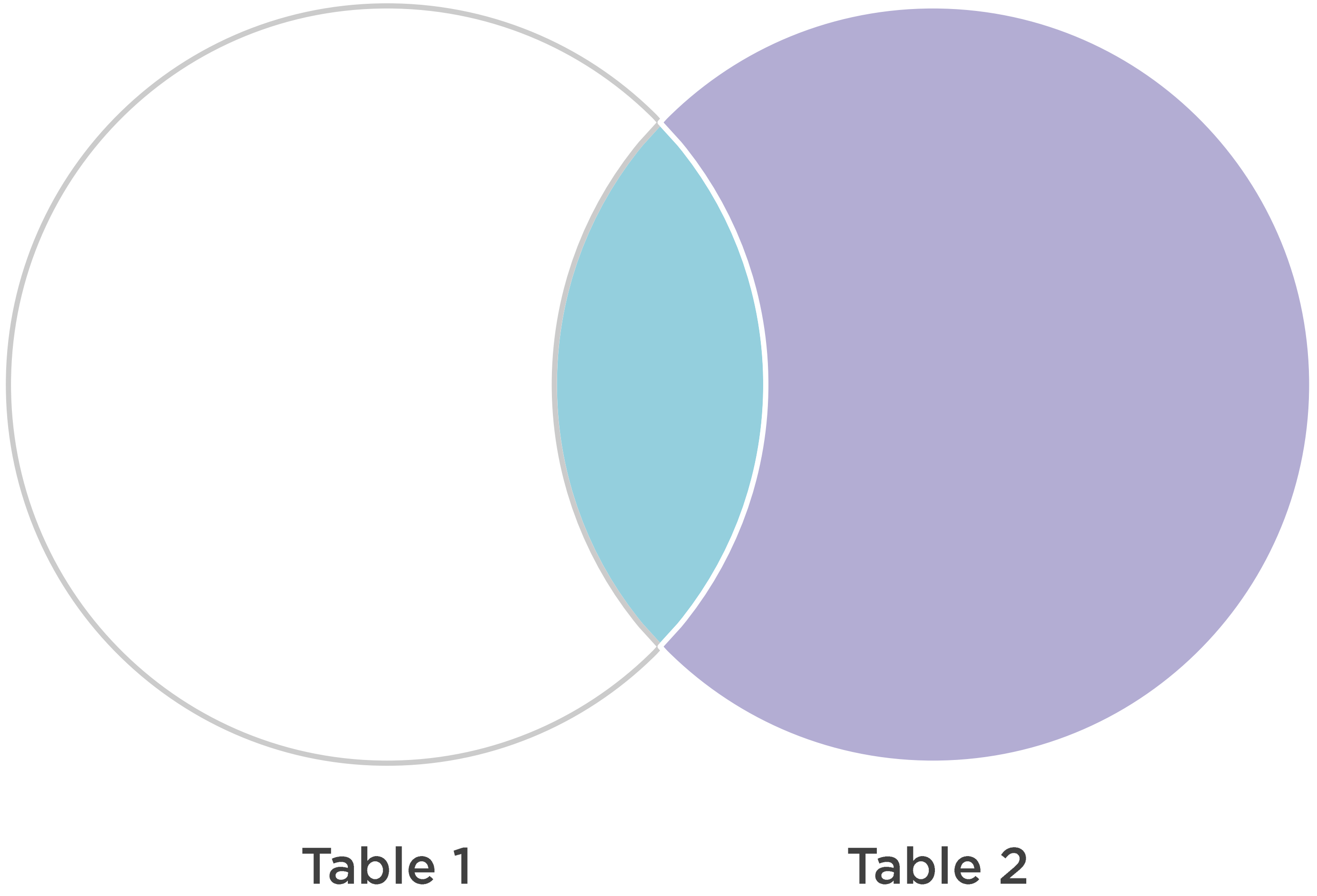
Full Outer Join



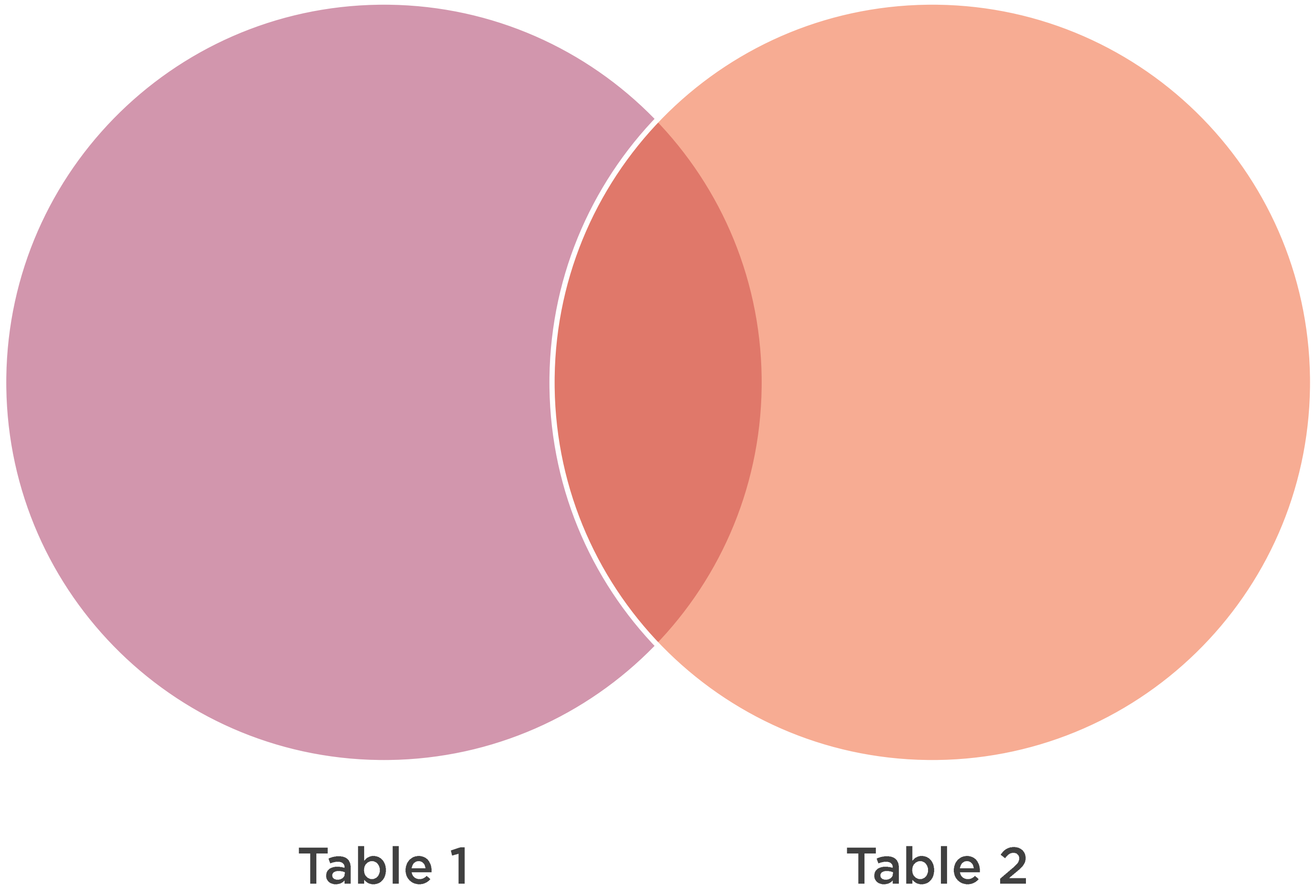
Left Outer Join



Right Outer Join



Full Outer Join

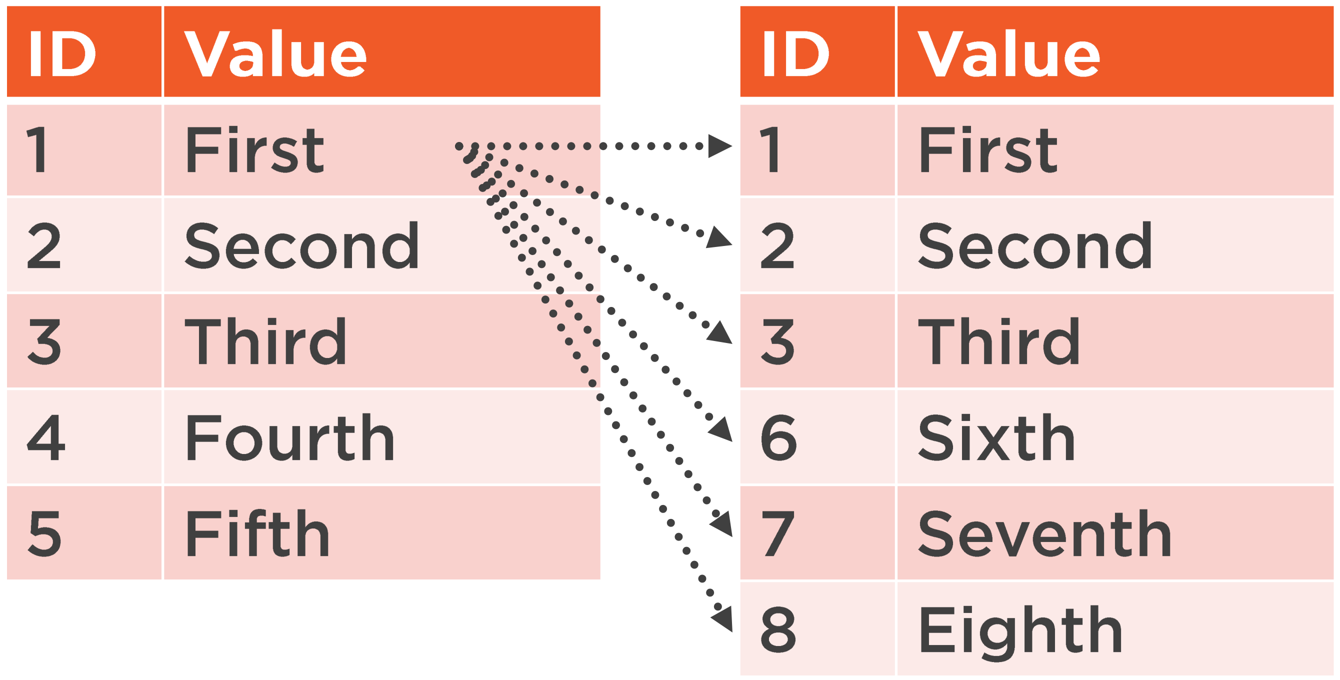


Cross Join

CROSS join is a Cartesian join that does not necessitate any condition to join

The result set contains records that are multiples of the record number of both the tables

Cross Join



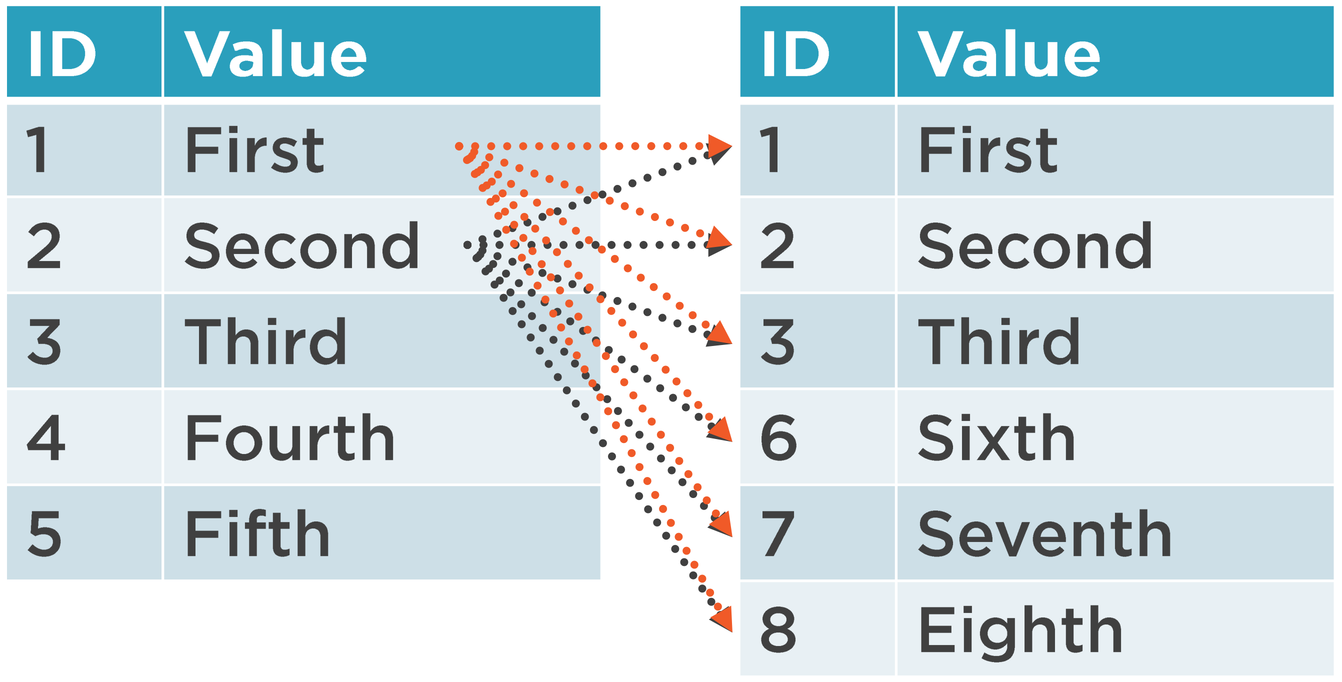
ID	Value
1	First
2	Second
3	Third
4	Fourth
5	Fifth

Table 1

ID	Value
1	First
2	Second
3	Third
6	Sixth
7	Seventh
8	Eighth

Table 2

Cross Join



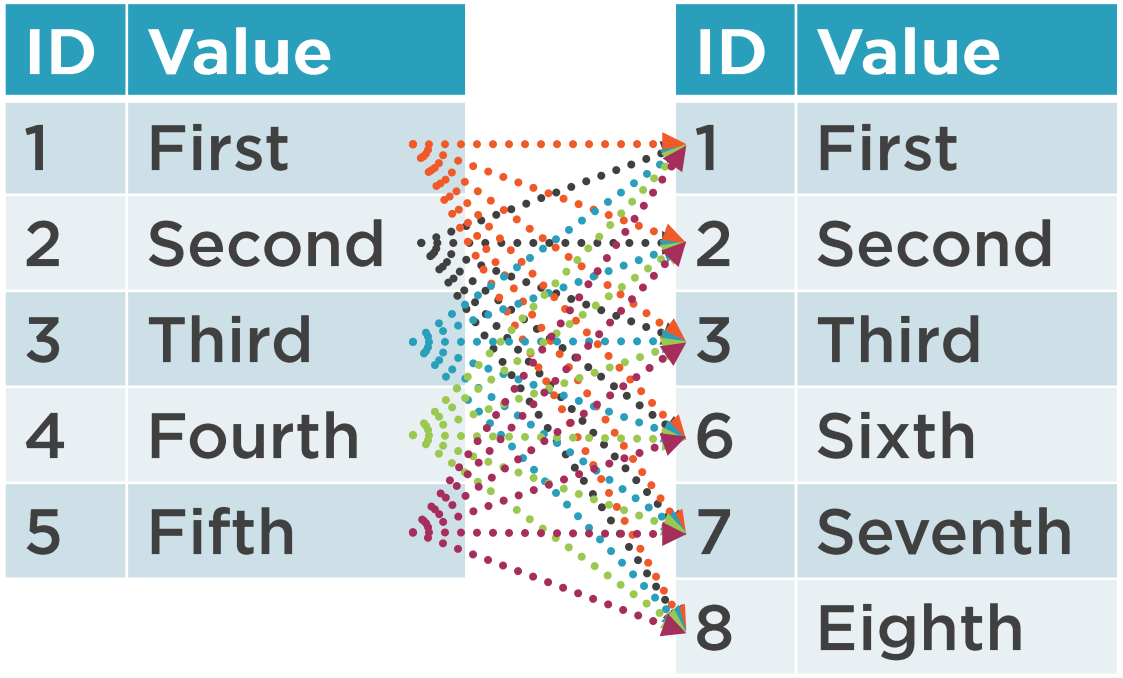
ID	Value
1	First
2	Second
3	Third
4	Fourth
5	Fifth

Table 1

ID	Value
1	First
2	Second
3	Third
6	Sixth
7	Seventh
8	Eighth

Table 2

Cross Join



ID	Value
1	First
2	Second
3	Third
4	Fourth
5	Fifth

Table 1

ID	Value
1	First
2	Second
3	Third
6	Sixth
7	Seventh
8	Eighth

Table 2

	ID	Value	ID	Value
1	1	First	1	First
2	1	First	2	Second
3	1	First	3	Third
4	1	First	6	Sixth
5	1	First	7	Seventh
6	1	First	8	Eighth
7	2	Second	1	First
8	2	Second	2	Second
9	2	Second	3	Third
10	2	Second	6	Sixth
11	2	Second	7	Seventh
12	2	Second	8	Eighth

Pop Quiz

Students

StudentID	StudentName
1	John
2	Matt
3	James

Classes

ClassID	ClassName
1	Math
2	Art
3	History

StudentClass

ClassID	StudentID
1	1
1	2
3	1
3	2
3	3

Scenario:

- We have three tables:
  1) Students 2) Classes and 3) StudentClass
- The student can sign up maximum of three classes
- In summer, student can opt out and can sign up for no classes

Question 1: What will be the best possible join if we want to retrieve all the students who have signed up for the classes in the summer?

Question 2: What will be the best possible join if we want to retrieve all the students who have signed up for no classes in summer?

Equi Join

```
SELECT t1.*, t2.*
FROM Table1 t1
INNER JOIN Table2 t2 ON t1.ID = t2.ID
```

- An EQUI join is a specific type of comparator-based join, that uses only equality comparisons in the join-predicate

Non-equi Join

```
SELECT t1.*, t2.*
FROM Table1 t1
INNER JOIN Table2 t2 ON t1.ID > t2.ID
```

- A NON-EQUI join is a specific type of comparator-based join, that does not use equality comparisons in the join-predicate

Self Join

```
SELECT t1.*, t2.*
FROM Table1 t1
INNER JOIN Table1 t2 ON t1.ID > t2.ID
```

- A SELF join is a join in which a table is joined with itself
- The user must alias tables used in self join
- The user must qualify each column name used in SELECT clauses with a table alias to avoid ambiguity

Natural Join

```
SELECT t1.*, t2.*
FROM Table1 t1
NATURAL JOIN Table2 t2
```

- A NATURAL join is kind of join which joins two (or more) tables based on all the columns in the two tables with the same name
- It can be either INNER or OUTER join

Joins with USING Keyword

```
SELECT t1.*, t2.*
FROM Table1 t1
INNER JOIN Table2 t2 USING (ID, VALUE)
```

- USING keyword simplifies syntax for joining tables when the columns have the same name in both the tables
- USING keyword can be used with INNER or OUTER joins
- You can use more than one column with USING keywords

UNION Operators

UNION Combines two or more SELECT statements into a single result set

Each SELECT statement of UNION operator must have the same number of Columns

UNION removes duplicate rows

UNION ALL does not remove duplicate rows

Only one ORDER BY clause sorting entire result set

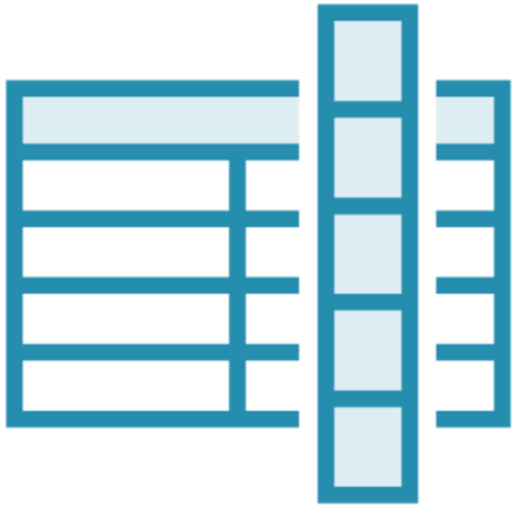
Simulate FULL OUTER JOIN using LEFT and RIGHT join with UNION

Subqueries

```
SELECT t1.*
FROM Table1 t1
WHERE t1.ID NOT IN
(SELECT t2.ID FROM Table2 t2)
```

- A subquery is a nested query where the results of one query can be used in another query via a relational operator or aggregation function
- A subquery must be enclosed with parentheses
- A subquery can have only one column in the SELECT clause if used in WHERE clause
- An ORDER BY clause is not allowed in a subquery
- Subqueries can be nested within other subqueries
- Subqueries are used in WHERE, HAVING, FROM and SELECT clause

Joins vs. Subqueries



Joins

- Can include columns from joining tables in the SELECT clause
- Easy to read and more intuitive

Subqueries

- Can pass the aggregate values to the main query
- Simplifies long and complex queries

Correlated Subqueries

```
SELECT t1.*
FROM Table1 t1
WHERE t1.ID IN
(SELECT t2.ID
FROM Table2 t2
WHERE t2.value = t1.value)
```

- A correlated subquery is a subquery that is executed once for each row
- A correlated subquery returns results based on the column of the main query

Subqueries Operators

Any or Some

Condition	Equivalent
Var > ANY (10, 20, 30)	Var > 10
Var < ANY (10, 20, 30)	Var < 20
Var = ANY (10, 20, 30)	VAR IN (10, 20, 30)
Var <> ANY (10, 20, 30)	Var <> 10 OR Var <> 20 OR Var <> 30

All

Condition	Equivalent
Var > ALL (10, 20, 30)	Var > 20
Var < ALL (10, 20, 30)	Var < 10
Var = ALL (10, 20, 30)	Var = 10 AND Var = 20 AND Var = 30
Var <> ALL (10, 20, 30)	VAR NOT IN (10, 20, 30)

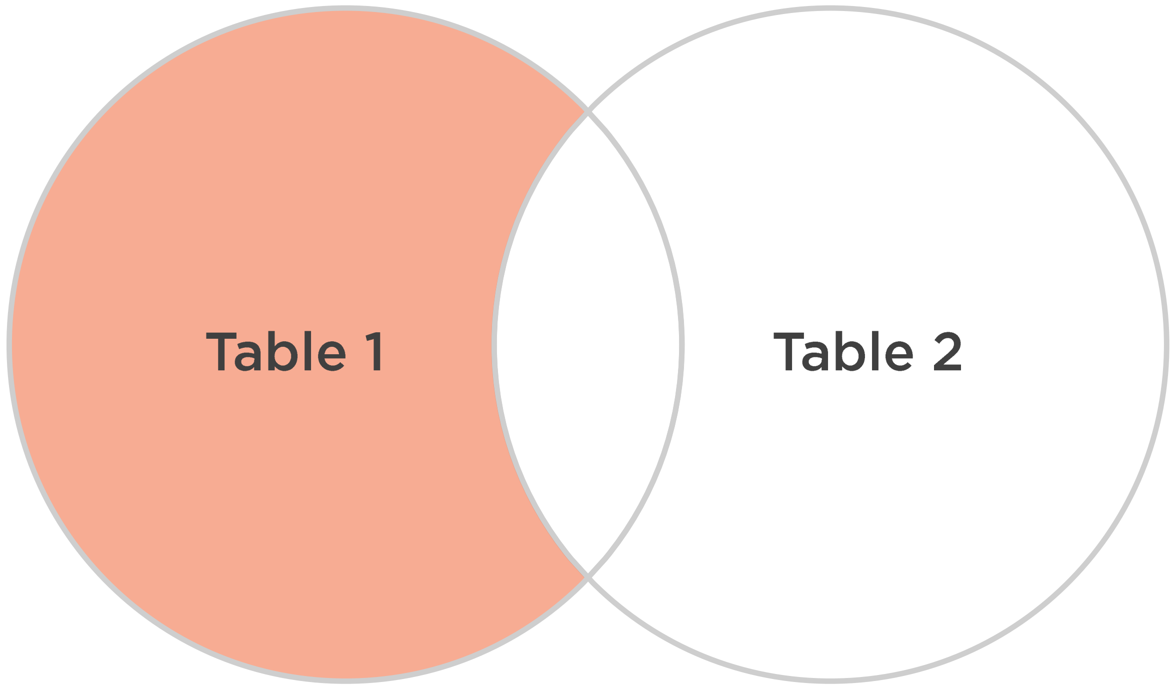
Exists

Outer Join with NULL

```
SELECT t1.*
FROM Table1 t1
WHERE t1.ID NOT IN
(SELECT t2.ID FROM Table2 t2)
```

- **Problem: Rewrite following SQL subquery using SQL Joins**

Left Outer Join – Where Null



```
SELECT*
FROM Table1 t1
LEFT OUTER JOIN Table2 t2
    ON t1.Col1 = t2.Col1
WHERE t2.Col1 IS NULL
```

Summary

An SQL JOIN combines columns from two or more tables in a single result set

Always alias your column with table to avoid ambiguity in the code

UNION keyword removes duplicate from resultset but UNION ALL keyword does not

A correlated subquery is executed once for each row in the main query