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# Joining Data in SQL

## Cheat Sheet

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## > Definitions used throughout this cheat sheet

**Primary key:**
A primary key is a field in a table that uniquely identifies each record in the table. In relational databases, primary keys can be used as fields to join tables on.

**Foreign key:**
A foreign key is a field in a table which references the primary key of another table. In a relational database, one way to join two tables is by connecting the foreign key from one table to the primary key of another.

**One-to-one relationship:**
Database relationships describe the relationships between records in different tables. When a one-to-one relationship exists between two tables, a given record in one table is uniquely related to exactly one record in the other table.

**One-to-many relationship:**
In a one-to-many relationship, a record in one table can be related to one or more records in a second table. However, a given record in the second table will only be related to one record in the first table.

**Many-to-many relationship:**
In a many-to-many relationship, records in a given table 'A' can be related to one or more records in another table 'B', and records in table B can also be related to many records in table A.

## > Sample Data

**Artist Table**

| artist_id | name |
|---|---|
| 1 | AC/DC |
| 2 | Aerosmith |
| 3 | Alanis Morissette |

**Album Table**

| album_id | title | artist_id |
|---|---|---|
| 1 | For those who rock | 1 |
| 2 | Dream on | 2 |
| 3 | Restless and wild | 2 |
| 4 | Let there be rock | 1 |
| 5 | Rumours | 6 |

## INNER JOIN

An inner join between two tables will return only records where a joining field, such as a key, finds a match in both tables.


**INNER JOIN join ON one field**

```
SELECT *
FROM artist AS art
INNER JOIN album AS alb
ON art.artist_id = alb.artist_id;
```

**Result after INNER JOIN:**

| album_id | name | artist_id |
|---|---|---|
| 1 | AC/DC | 1 |
| 4 | AC/DC | 4 |
| 2 | Aerosmith | 2 |
| 3 | Aerosmith | 3 |

**INNER JOIN with USING**

```
SELECT *
FROM artist AS art
INNER JOIN album AS alb
USING (artist_id);
```

## SELF JOIN

Self-joins are used to compare values in a table to other values of the same table by joining different parts of a table together.

```
SELECT
  art1.artist_id,
  art1.title AS art1_title,
  art2.title AS art2_title
FROM artist as art1
INNER JOIN artist as art2
ON art1.artist_id = art2.album_id;
```

**Result after Self join:**

| artist_id | art1_title | art2_title |
|---|---|---|
| 1 | For those who rock | For those who rock |
| 2 | Dream on | Dream on |
| 2 | Restless and wild | Dream on |
| 1 | Let there be rock | For those who rock |

## LEFT JOIN

A left join keeps all of the original records in the left table and returns missing values for any columns from the right table where the joining field did not find a match.


**LEFT JOIN on one field**

```
SELECT *
FROM artist AS art
LEFT JOIN album AS alb
ON art.artist_id = alb.album_id;
```

**Result after LEFT JOIN:**

| artist_id | name | album_id | title | name |
|---|---|---|---|---|
| 1 | AC/DC | 1 | For those who rock | 1 |
| 1 | AC/DC | 4 | Let there be rock | 1 |
| 2 | Aerosmith | 2 | Dream on | 2 |
| 2 | Aerosmith | 3 | Restless and wild | 2 |
| 3 | Alanis Morissette | null | null | null |

## RIGHT JOIN

A right join keeps all of the original records in the right table and returns missing values for any columns from the left table where the joining field did not find a match. Right joins are far less common than left joins, because right joins can always be re-written as left joins.


**RIGHT JOIN on one field**

```
SELECT*
FROM artist as art
RIGHT JOIN album AS alb
ON art.artist_id = alb.album_id;
```

**Result after RIGHT JOIN:**

| artist_id | name | album_id | title | name |
|---|---|---|---|---|
| 1 | AC/DC | 1 | For those who rock | 1 |
| 1 | Aerosmith | 2 | Dream on | 2 |
| 2 | Aerosmith | 3 | Restless and wild | 2 |
| 2 | AC/DC | 4 | Let there be rock | 1 |
| 3 | null | 5 | Rumours | 6 |

## FULL JOIN

A full join combines a left join and right join. A full join will return all records from a table, irrespective of whether there is a match on the joining field in the other table, returning null values accordingly.


**FULL JOIN on one field**

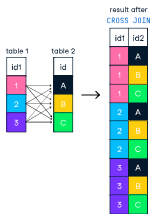
```
SELECT *
FROM artist as art
FULL OUTER JOIN album AS alb
ON art.artist_id = alb.album_id;
```

**Result after FULL JOIN:**

| artist_id | name | album_id | title | name |
|---|---|---|---|---|
| 1 | AC/DC | 1 | For those who rock | 1 |
| 1 | AC/DC | 4 | Let there be rock | 1 |
| 2 | Aerosmith | 2 | Balls to the wall | 2 |
| 2 | Aerosmith | 3 | Restless and wild | 2 |
| 3 | Alanis Morissette | null | null | null |
| null | null | 5 | Rumours | 6 |

## CROSS JOIN

`CROSS JOIN` creates all possible combinations of two tables. `CROSS JOIN` does not require a field to join `ON`.




```
SELECT name, title
FROM artist
CROSS JOIN album;
```

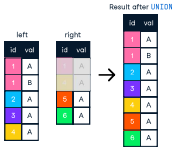
**Result after CROSS JOIN:**

| name | title |
|---|---|
| AC/DC | For those who rock |
| AC/DC | Dream on |
| AC/DC | Restless and wild |
| AC/DC | Let there be rock |
| AC/DC | Rumours |
| Aerosmith | For those who rock |
| Aerosmith | Dream on |
| Aerosmith | Restless and wild |
| Aerosmith | Let there be rock |
| Aerosmith | Rumours |
| Alanis Morissette | For those who rock |
| Alanis Morissette | Dream on |
| Alanis Morissette | Restless and wild |
| Alanis Morissette | Let there be rock |
| Alanis Morissette | Rumours |

## Set Theory Operators in SQL


## UNION

The `UNION` operator is used to vertically combine the results of two `SELECT` statements. For `UNION` to work without errors, all `SELECT` statements must have the same number of columns and corresponding columns must have the same data type. `UNION` does not return duplicates.



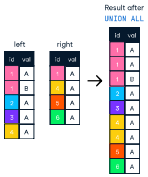

```
SELECT artist_id
FROM artist
UNION
SELECT artist_id
FROM album;
```

**Result after UNION:**

| artist_id |
|---|
| 1 |
| 2 |
| 3 |
| 6 |

## UNION ALL

The `UNION ALL` operator works just like `UNION`, but it returns duplicate values. The same restrictions of `UNION` hold true for `UNION ALL`



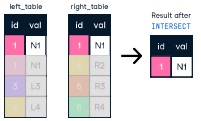

```
SELECT artist_id
FROM artist
UNION ALL
SELECT artist_id
FROM album;
```

**Result after UNION ALL:**

| artist_id |
|---|
| 1 |
| 2 |
| 3 |
| 1 |
| 2 |
| 2 |
| 1 |
| 6 |

## INTERSECT

The `INTERSECT` operator returns only identical rows from two tables.



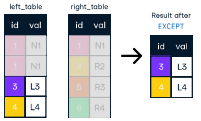

```
SELECT artist_id
FROM artist
INTERSECT
SELECT artist_id
FROM album;
```

**Result after INTERSECT:**

| artist_id |
|---|
| 1 |
| 2 |

## EXCEPT

The `EXCEPT` operator returns only those rows from the left table that are not present in the right table.



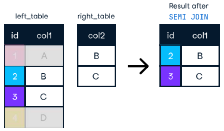

```
SELECT artist_id
FROM artist
EXCEPT
SELECT artist_id
FROM album;
```

**Result after EXCEPT:**

| artist_id |
|---|
| 4 |
| 2 |
| 3 |

## SEMI JOIN

A semi join chooses records in the first table where a condition is met in the second table. A semi join makes use of a `WHERE` clause to use the second table as a filter for the first.



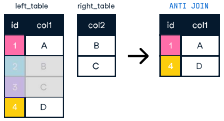

```
SELECT *
FROM album
WHERE artist_id IN
(SELECT artist_id
FROM artist);
```

**Result after Semi join:**

| album_id | title | artist_id |
|---|---|---|
| 1 | For those who rock | 1 |
| 2 | Dream on | 2 |
| 3 | Restless and wild | 2 |

## ANTI JOIN

The anti join chooses records in the first table where a condition is `NOT` met in the second table. It makes use of a `WHERE` clause to use exclude values from the second table.




```
SELECT *
FROM album
WHERE artist_id NOT IN
(SELECT artist_id
FROM artist);
```

**Result after Anti join:**

| album_id | title | artist_id |
|---|---|---|
| 5 | Rumours | 6 |

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