SQL numeric functions and aggregation

Aggregation and ordering in SQL

Aggregation and ordering

Aggregation and ordering help us to **summarize** and **arrange** data so that we can examine it from different viewpoints.

Aggregation refers to the process of **summarizing or combining multiple rows of data** into a single value or set of values.

Ordering refers to **sorting the result set** of an SQL query based on one or more columns.

Aggregation clauses

> An aggregate function in SQL **returns one value after calculating multiple values** of a column. We **use aggregate functions** with the `GROUP BY` and `HAVING` clauses and can use `ORDER BY` to sort the results.

`GROUP BY`

The `GROUP BY` clause is used with **aggregate functions** to **group the result set** by one or more columns.

`HAVING`

The `HAVING` clause is used to **filter the result set** based on an **aggregate function**.

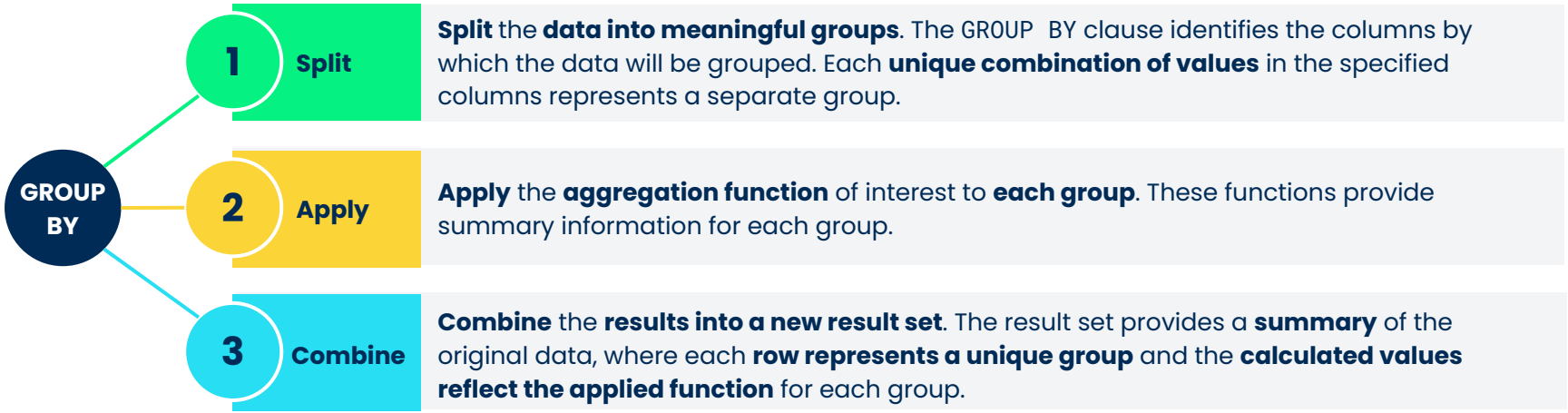
`ORDER BY`

The `ORDER BY` clause can be used with **aggregate functions** to **sort the result set** based on the calculated values of the aggregates.

GROUP BY

> The `GROUP BY` clause allows us to **divide a table into distinct sets** based on one or more columns. This division is based on a shared attribute within the data.

The `GROUP BY` clause follows a **split-apply-combine** paradigm, which helps in understanding its purpose and functionality.

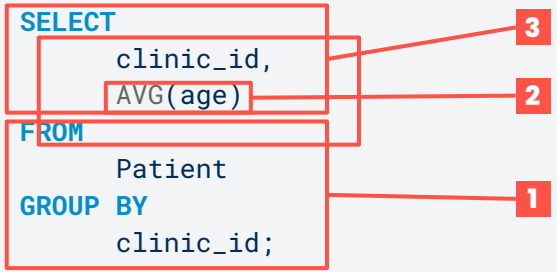


GROUP BY Syntax

Syntax

```
SELECT
      column1,
      FUNCTION(columnN)
FROM
      table_name
GROUP BY
      column1;
```

Example



The query **retrieves specific columns** from a table and **applies an aggregate function** to one of the columns. It then **groups the data** based on one or more columns specified in the `GROUP BY` clause.

Note: If we select **multiple columns,** we must include those **same columns** in the **`GROUP BY`** clause, or we will get an error.

1. **Split: Group** records from the **`Patient` table** based on their **clinic ID**, creating distinct groups of patients belonging to each clinic.
2. **Apply:** Calculate the **average age of the patients within each clinic group** by applying the **`AVG`** aggregation function to the age column.
3. **Combine:** Retrieve the **clinic ID** and **corresponding average age** as the result, providing the average age for each clinic based on the grouped patients.

GROUP BY query illustration

Patient table

Patient

Patient_id	Clinic_id	Age
1	1	54
2	3	22
3	1	51
4	2	30
5	2	36
6	3	20
7	1	67
8	1	74
9	2	61
10	3	46

1. Split

Patient_id	Clinic_id	Age
1	1	54
3	1	51
7	1	67
8	1	74

Patient_id	Clinic_id	Age
4	2	30
5	2	36
9	2	61

Patient_id	Clinic_id	Age
2	3	22
6	3	20
10	3	46

2. Apply (AVG)

Clinic_id	AVG(Age)
1	61.5

Clinic_id	AVG(Age)
2	42.333

Clinic_id	AVG(Age)
3	29.333

3. Combine

Clinic_id	AVG(Age)
1	61.5
2	42.333
3	29.333

HAVING

The **HAVING** clause is similar to the WHERE clause and used to **filter** the result set. The key difference is that **HAVING** can be used with **aggregate functions**.

Syntax

```
SELECT
      column1,
      FUNCTION(columnN)
FROM table_name
GROUP BY column1
HAVING condition;
```

Now we have added a **HAVING** clause, so the results are **filtered** using the **specified condition**.

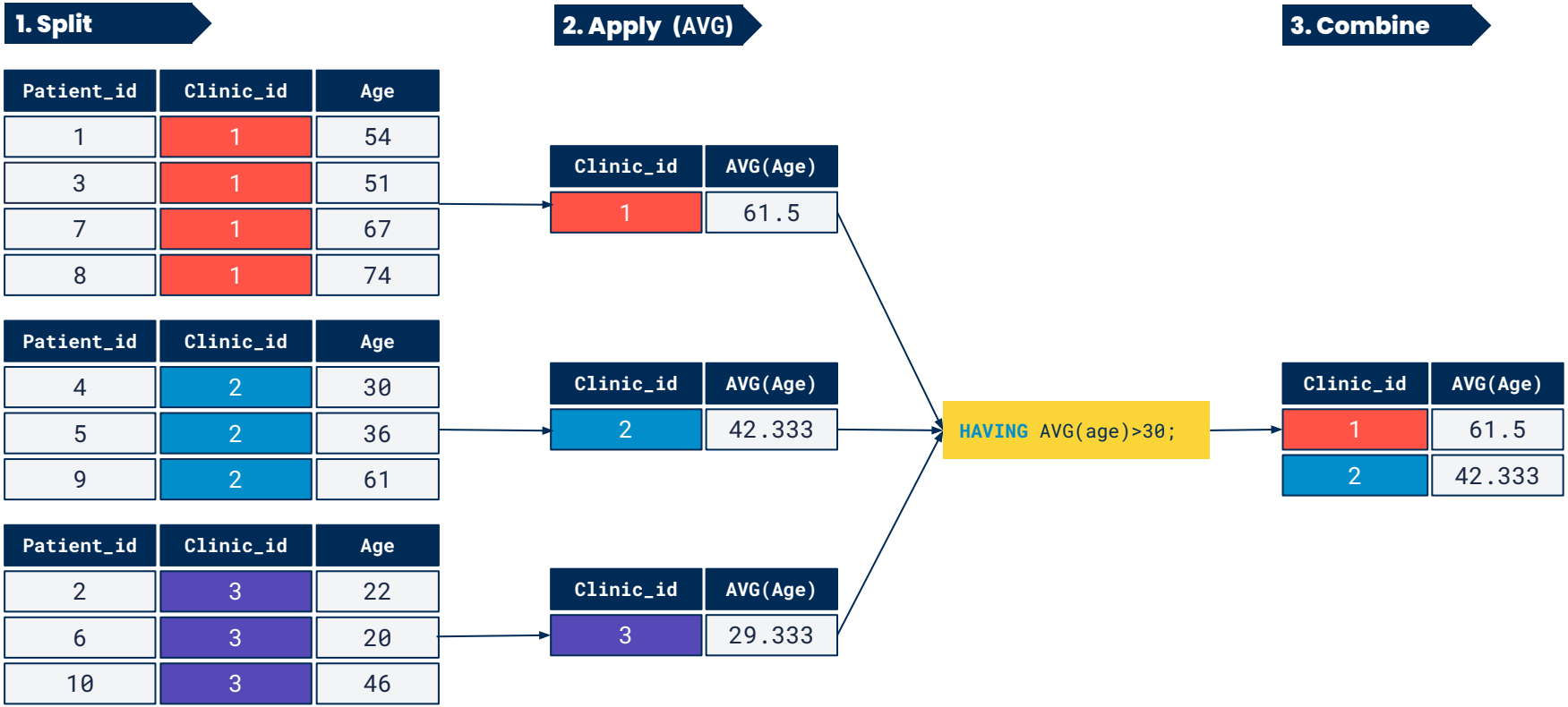
Example

```
SELECT
      clinic_id,
       AVG(age)
FROM Patient
GROUP BY clinic_id
HAVING AVG(age) > 30;
```

The addition of the **HAVING** clause means that the results grid will only display the **average age** for each clinic where **the average age is greater than 30.**

Note: WHERE and **HAVING** can be used in the **same query,** but the **WHERE clause** only works on **individual rows**, not on aggregated data. In general, we use **WHERE prior to GROUP BY** as a pre-filter and **HAVING after GROUP BY** as a post-filter.

GROUP BY with HAVING query illustration



ORDER BY

> **ORDER BY** can be used to **sort** the result set based on the **calculated values of the aggregations** (in ascending or descending order).

Syntax

```
SELECT
      column1,
      FUNCTION(columnN)
FROM table_name
GROUP BY column1
ORDER BY FUNCTION(columnN);
```

By using an ORDER BY clause, the results are **arranged according to the aggregated field** in either ascending or descending order.

Example

```
SELECT
      clinic_id,
      AVG(age)
FROM Patient
GROUP BY clinic_id
ORDER BY AVG(age) ASC;
```

The addition of the **ORDER BY** clause **orders the result set in ascending** order based on the **average age** at each clinic. (We use **DESC** for **descending order.).** If we left out **ASC**, it still sorts in **ascending order by default**.

Note: We can still have the **HAVING** and **WHERE** clauses, but they must come **before** the **ORDER BY** clause.

GROUP BY with ORDER BY query illustration