Data Analytics

Grouping in SQL

GENERAL ASSEMBLY

Where We Are in the DA Workflow

Extract: Select, import, and clean relevant data.

Wrangle/prepare: Clean and prepare relevant data.

Our Learning Goals

What you'll learn in class today...

- **NULLS** and working with NULLS
- Work with **CASE** to handle multiple conditions.
- Use SQL commands such as **GROUP BY** and **HAVING** to group and filter data.

Advanced JOINs and NULLs

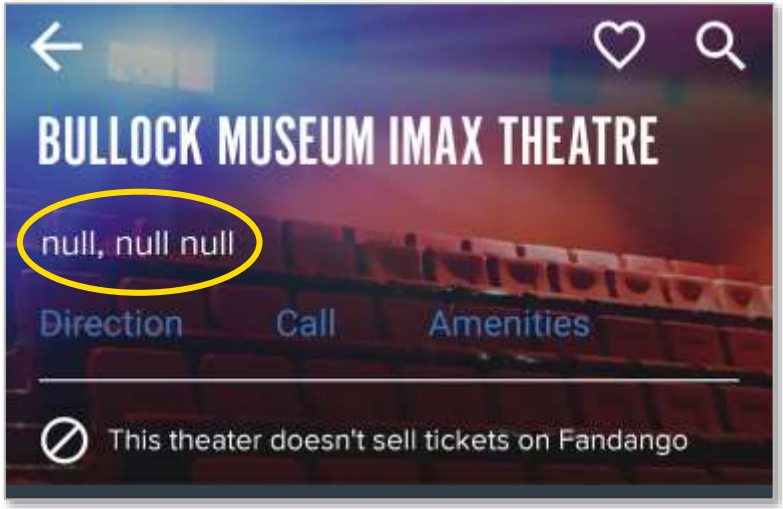
Nulls in SQL

Discussion:

Make “NULL” Mistake...

A **NULL** represents missing data but is not the same as zero values or blank fields.

Take a look at the ad on the right. What could the creators of this have done differently?



NULL Values

Any field can have the value **NULL**, which **represents a missing value**, but a NULL is different than a zero or a blank because:

- Zero is a value.
- A blank cell could have been left blank *on purpose*.
- In some cases, a blank represents data.

NULL values can be produced with all JOINs except INNER.

Knowing What's Missing | An Example

It's important to know *exactly* what **NULL** indicates for each field. For example, in the same PIN number field of a user login, **NULL** could mean:

- A user signed up but has not yet entered a PIN number.
- A user will never enter a PIN number because they are using another authentication method.
- A user signed up before PIN numbers were supported and is not required to enter one.

Other Values for Missing Data

Be careful! Depending on the datatype of a field, other values could *also* indicate missing values or data collection errors. Some common values include:

- Strings: “N/A”, “Unknown”, “Missing”
- Integers: 0
- Floats: NaN, Inf (Not a Number, Infinity)

Because of this, testing for **NULL** is not always enough.

Partner Exercise:

NULL Values

5 minutes

Referring to the list below, discuss with your partner: **What are some ways that the presence of NULL values can complicate the analysis for your project?**

- Nulls cannot be added or subtracted.
- Nulls can undermine data counts.
- Nulls can complicate JOINs.
- Dividing by a NULL yields another NULL.

Be prepared to share your answers.

Discussion:
Blanks and Zeros

So far, we've talked about NULLs and how missing data can be represented. Let's pause for a second and discuss the following:

When are blanks and zero values appropriate?

Advanced JOINs and NULLs

Working With NULLs

“WHERE” to Find NULLs

SELECT picks the columns.

FROM points to the table.

WHERE puts filters on rows.

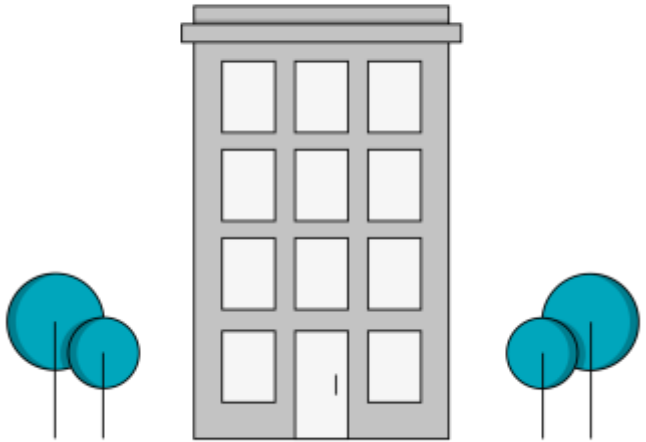
GROUP BY aggregates across values of a variable.

HAVING filters aggregated values ***after*** they have been grouped.

ORDER BY sorts the results.

LIMIT limits results to the first **n** rows.

The Query Building



Guided Walk-Through:
Finding NULLs in WHERE

You can find **NULL** data using a **WHERE** clause. Let's run the following query:

```
SELECT order_id, region_id

FROM orders

WHERE postal_code = 'NULL';
```

Do you expect problems with this query? Why or why not?

Guided Walk-Through:
Finding NULLs With **IS NULL**

You can find **NULL** data using **IS NULL**:

```
SELECT order_id, region_id
FROM orders
WHERE postal_code IS NULL;
```

This will return all of the rows where the **postal_code** field is blank.

Guided Walk-Through:

Finding Non-NULLs With **IS NOT NULL**

We can also find non-**NULL** values by using **IS NOT NULL**, which is the opposite of **IS NULL**.

Run this query:

```
SELECT order_id, region_id
FROM orders
WHERE postal_code IS NOT NULL;
```

Grouping in SQL

Handling Multiple Conditions With CASE

What If...

Let's take a look at this query from the last lesson:

```
SELECT *
FROM products
LIMIT 100;
```

What if, from the list of 100 products, we want to **break our product prices into groups (free, cheap, affordable, expensive)**?

To get the result, your query must include *multiple* conditions: free, cheap, affordable, and expensive.

What Are CASE Statements?

CASE statements group data into *categories* or *classifications*. They **go through multiple conditions and return a value when the *first* condition is met**.

- When a condition is true, CASE will stop reading and return the result.
- If no conditions are true, it will return the value in the ELSE clause.

CASE Syntax

```
SELECT column,
      CASE
            WHEN condition1 THEN result1
            WHEN condition2 THEN result2
            ELSE result3
      END AS output_name
FROM table;
```

CASE syntax in plain words:

- SELECT takes the column on which you want to run **CASE**.
- WHEN **<condition is true>**.
- THEN **<what to return as a value for that row>**.
- ELSE (optional condition).
- **END AS** <header title for the new column you just made>.
- FROM <table>.

Guided Walk-Through:

Handling Multiple Conditions With CASE

Let's try classifying the discounts in the Superstore data set into these groups:

- Free (100%)
- High (25–99%)
- Low (1–25%)
- None (0%)

Using CASE statements, let's write this out.

Guided Walk-Through:

Handling Multiple Conditions With CASE (Cont.)

Below is our query with a CASE statement. **Remember**: SQL will *only* return values that meet these conditions, but we can also add an "other" category using ELSE.

```
SELECT
  discount,
     CASE
    WHEN discount = 1 THEN 'Free'
    WHEN discount BETWEEN .25 AND 1 THEN 'High'
    WHEN discount = 0 THEN 'None'
    WHEN discount < .25 THEN 'Low'
  END AS discount_level
FROM orders
LIMIT 50;
```


Group Exercise:

Handling Multiple Conditions With CASE

10 minutes

Work with your group to create a CASE statement that groups **orders by whether or not they had a positive profit.**

Group Exercise:

How Did It Go? | Solution

How did it go? Your query should look like the following:

```
SELECT profit,
    CASE WHEN profit > 0 THEN ‘Positive’
        ELSE ‘Negative’ END AS profit_level
FROM orders
LIMIT 100;
```


Grouping in SQL

GROUP BY and HAVING

Clauses for Aggregate Functions

Aggregate functions are also used in these clauses:

- **GROUP BY** indicates the dimensions you want to group your data by (e.g., a category that you wish to sort into subgroups).
- **HAVING** is used to filter measures you've aggregated (e.g., to filter a SUM over a certain value).

Where They Live in a Query

SELECT picks the columns.

FROM points to the table.

WHERE puts filters on rows.

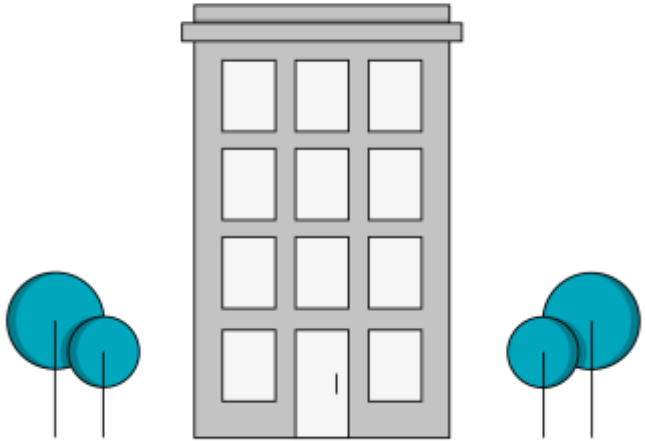
GROUP BY aggregates multiple rows, based on one or more aggregate functions (MIN, AVG, etc.).

HAVING filters aggregated values ***after*** they have been grouped.

ORDER BY sorts the results.

LIMIT limits results to the first **n** rows.

The Query Building



Guided Walk-Through:
What Will the Code Look Like?

Let's look at an example using a table called "People" with the columns "Gender" and "Height." From this table, we want to:

- Find the average height of people by gender.

What will our query look like?

```
SELECT gender, AVG(height) AS avg_height
FROM people
GROUP BY gender;
```

People	
Gender	**Height**
Female	5.8
Male	5.9
Non-binary	5.5
Female	5.3
...	...
...	...

Guided Walk-Through:
What Will the Code Look Like? (Cont.)

Now, we want to limit our analysis to only those people taller than three feet:

- Find the average height of people taller than three feet by gender.

What will our query look like?

```
SELECT gender, AVG(height) AS avg_height
FROM people
WHERE height > 3
GROUP BY gender;
```

People	
Gender	**Height**
Female	5.8
Male	5.9
Non-binary	5.5
Female	5.3
...	...
...	...

Guided Walk-Through:
What Will the Code Look Like? (Cont.)

Finally, we want to only return genders that have an average height of more than 5.5 feet.

- Determine which of those people have an average height greater than 5.5 feet tall, sorted by gender.

What will our query look like?

```
SELECT gender, AVG(height) AS avg_height
FROM people
WHERE height > 5.5
GROUP BY gender
HAVING AVG(height)>5.5;
--MALE AS 5.65 FEMALE AS 5.6, Non-binary as 5.7
```

People	
Gender	**Height**
Female	5.8
Male	5.9
Non-binary	5.5
Female	5.3
…	…
…	…

Guided Walk-Through:

What Will The Code Look Like? | **Solution**

```
SELECT gender, AVG(height)
FROM people
WHERE height >3
GROUP BY gender
HAVING AVG(height) >5.5
ORDER BY gender;
```

What each part of the query does:

- SELECT picks the columns.
- FROM determines and filters rows.
- WHERE adds more filters on those rows.
- **GROUP BY combines those rows into groups.**
- **HAVING filters groups.**
- ORDER BY arranges the remaining rows/groups.

Partner Exercise:

Let's Build a Few More Together!

10 minutes

With your partner, build the following queries with GROUP BY and HAVING:

```
SELECT segment,
        COUNT(*) AS
num_customers
FROM customers
GROUP BY segment
```

```
SELECT segment,
        COUNT(*) AS
num_customers
FROM customers
GROUP BY segment
HAVING COUNT(*) > 300
```

- How many results do you get with the **GROUP BY** statement?
- How many results do you get with the **HAVING** statement included?

Guided Walk-Through:
Aggregating Data With GROUP BY and HAVING

Superstore wants an order discount analysis to identify average order qty and amount by discount level. To write our query, we'll use:

1. **WHERE** to filter discount levels greater than 15%.
2. **GROUP BY** in our query to aggregate qty and sales.
3. **HAVING** to filter discount levels above an average sales threshold of 500.

```
SELECT discount, ROUND(AVG(quantity), 2) AS qty, AVG(sales)::money as sales
FROM orders
WHERE 1 > 0.15
GROUP BY discount
HAVING AVG(sales) > 500
ORDER BY 3 DESC
```


Solo Exercise:

Over to You

5 Minutes

Use the starter code below to find **the number of products by category** in the Superstore data set.

```
SELECT category, (aggregate of rows)
FROM products
GROUP BY category;
```


Solo Exercise:

Over to You | An Extra Challenge

5 minutes

Once you have filled in the parts of the starter code, try the following:

- Include only products with “computer” or “color” (case-insensitive) in the name.
- Further refine to those that *have* an aggregate 100 or more products.
- Alias your aggregate column to “count_of_products.”
- Sort the results by the “count_of_products” column.
- Limit the output to the first 10 rows.

Ask for help if you have questions or need a hint.

Solo Exercise:

How Did It Go? | Solution

Here is what your end query might look like:

```
SELECT category, COUNT(*) as count_of_products
FROM products
WHERE
  product_name ILIKE '%computer%'
  OR product_name ILIKE '%color%'
GROUP BY 1
HAVING COUNT(*) > 100
ORDER BY 2 DESC
LIMIT 10
;
```

Combining Group By and Case

Guided Walk-Through:
Using CASE and GROUP BY

Now, we're able to look at the total number of sales made in each of our discount categories from earlier:

```
SELECT CASE
    WHEN discount = 1 THEN 'Free'
    WHEN discount BETWEEN .25 AND 1 THEN 'High'
    WHEN discount = 0 THEN 'None'
    WHEN discount < .25 THEN 'Low'
  END AS discount_level, COUNT(*) AS num_sales
FROM orders
GROUP BY 1;
```


Solo Exercise:

Over to You

5 minutes

Use the starter code below to find **the number of orders by profit category** in the Superstore data set.

```
SELECT CASE WHEN profit > 0 THEN 'Positive'
            ELSE 'Negative' END AS profit_level,
            (aggregate of rows)
FROM ORDERS
;
```


Solo Exercise:

How Did It Go? | Solution

```
SELECT CASE WHEN profit > 0 THEN 'Positive'
            ELSE 'Negative' END AS profit_level,
            COUNT(*) as num_sales
FROM ORDERS
GROUP BY 1
;
```


Solo Exercise:

Over to You

5 minutes

We want to dig into how many of our sales have been for more than 1 item in a single sale (i.e., quantity 2+).

First, create a CASE statement that will group orders by their quantity, then count up the number of orders associated with your groupings.

Solo Exercise:

How Did It Go? | Solution

Here is what your end query might look like:

```
SELECT CASE
    WHEN quantity>1 THEN 'Multiple'
    ELSE 'Single' END AS quantity,
    COUNT(*) AS num_sales
FROM orders
GROUP BY 1
;
```


Wrapping Up

Solo Exercise:

Optional Homework

Use your tables to answer the following questions:

1. Do our customers prefer a certain type of shipping class? Find the number of orders per ship mode.
2. How many unique salespeople do we have employed in each region? How does that compare to the number of unique countries in each region?
3. Find the most popular reason for returns.
4. **Bonus:** Create a query that groups the total number of products available by vendor. The vendors we want to focus on are 3M, Apple, Avery, Cisco, Epson, Hewlett-Packard (HP, Hewlett Packard), Logitech, Panasonic, Samsung, and Xerox.(Hint: use product_name column to get the vendor details)

Recap

In today's class, we...

- Worked with **CASE** to handle if/then logic and apply multiple conditions.
- Practiced writing aggregate functions: **MIN**, **MAX**, **SUM**, **AVG**, and **COUNT**.
- Used SQL commands such as **GROUP BY** and **HAVING** to group and filter data.

Looking Ahead

Homework:

- Review todays class
- Optional myGA Lessons:
  Intermediate SQL (unit) —
  - JOINing Tables in SQL
  - JOINing Multiple Tables in SQL

Up Next: JOINs

Additional Resources

- SQL **HAVING** clause overview: https://goo.gl/Je3M85
- “Difference between WHERE, GROUP BY, and HAVING clauses,” by Manoj Pandey: https://goo.gl/cNCtBa

