GENERAL ASSEMBLY

CLEANING DATA IN SQL

THE SELECT QUERY: SYNTAX REVIEW

✓ `SELECT` picks the columns.

✓ `FROM` points to the table.

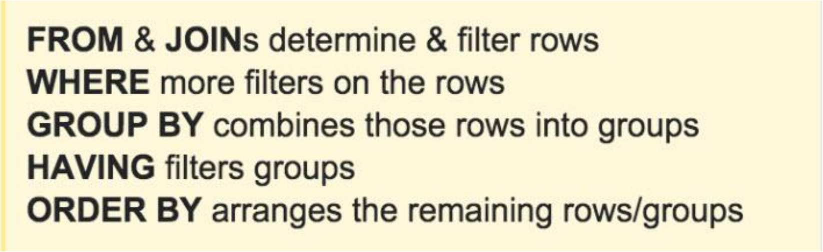
✓ `WHERE` puts filters on rows.

✓ `GROUP BY` aggregates across values of a variable.

✓ `HAVING` filters aggregated values.

✓ `ORDER BY` sorts the results.

✓ `LIMIT` limits result to the first **n** rows.



FROM & **JOINs** determine & filter rows
WHERE more filters on the rows
GROUP BY combines those rows into groups
HAVING filters groups
ORDER BY arranges the remaining rows/groups

LEARNING OBJECTIVES

- Explain the differences between `NULL` and zero.
- Explore the issues of math equations and `NULLs`.
- Use SQL `NULL` to create Boolean functions and handle zeros.
- Use `CASE` statements to add “`IF THEN ELSE`” logic to SQL.

DATA AGGREGATION IN SQL

INTRODUCTION: WORKING WITH NULLs

WORKING WITH NULLs

A **`NULL`** represents missing data, but a **`NULL`** is different than a zero or a blank.

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

When **`NULLs`** exist in a data set that was the result of joined tables, the presence of a **`NULL`** often has meaningful implications.

What is your company's best practice or policy for handling **`NULLs`**? If your company doesn't have one, what do you think you should do?

NULLS AND MATH

It can be tricky working with `NULLs` and zeros if the analysis requires addition/subtraction or division.

- No dividing by zero.
- Can't add or subtract a `NULL` .

Various SQL tools can solve either situation. For example:

- Using a `CASE` statement, you can change zeros to `NULLs`.
- `NULLIF` can substitute a `NULL` for a zero value, allowing division equations to execute without an error condition.

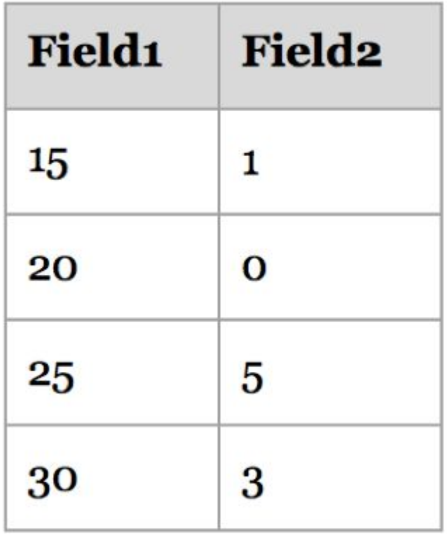
EXAMPLE: NULLIF

`NULLIF(field,testing_value)`

- Returns NULL if expressions are equal.
- Otherwise returns the first expression.

✓ NULLIF can test for zero values.

Example: Using the sample table on the right, divide Field 1 by Field 2. You must ensure there are no zeros in Field 2:



Field1	Field2
15	1
20	0
25	5
30	3

WORKING WITH NULLS

`IFNULL` is the opposite of `NULLIF`. This function takes a `NULL` value and turns it into a zero or another appropriate value.

When adding and subtracting values, SQL will not allow you to add or subtract `NULLs`, but will allow you to add and subtract numbers.

You can use this function to fill in averages where there are `NULLs`.

- For example, `IFNULL(Field1, AVG(Field2))`.

Pro Tip: PostgreSQL does not have `IFNULL`. Instead, use `COALESCE` or `CASE`.

WORKING WITH NULLS

`COALESCE` returns the first of its arguments that is **not null**. This is implemented within PostgreSQL to provide capabilities similar to `IFNULL`.

Example syntax:

```
    SELECT COALESCE(description, short_description, '(none)’)
    SELECT COALESCE(field2,alternate_value, 0)
```

DATA AGGREGATION IN SQL

GUIDED PRACTICE: NULLS AND JOINS

NULLS AND JOINS

You can find **NULL** data using the **WHERE** clause.

Run:

```
SELECT vendor_name, item_description FROM products WHERE
upc = ‘NULL’;
```

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

NULLS AND JOINS

To find `NULL` values, we use the SQL function “`IS NULL`.”

Run:

```
SELECT vendor_name, item_description, upc
FROM products WHERE upc IS NULL;
```

This will return all of the rows where the UPC field is unknown.

NULLS AND JOINS

We can also find non-`NULL` values by using `IS NOT NULL` – the opposite of `IS NULL`.

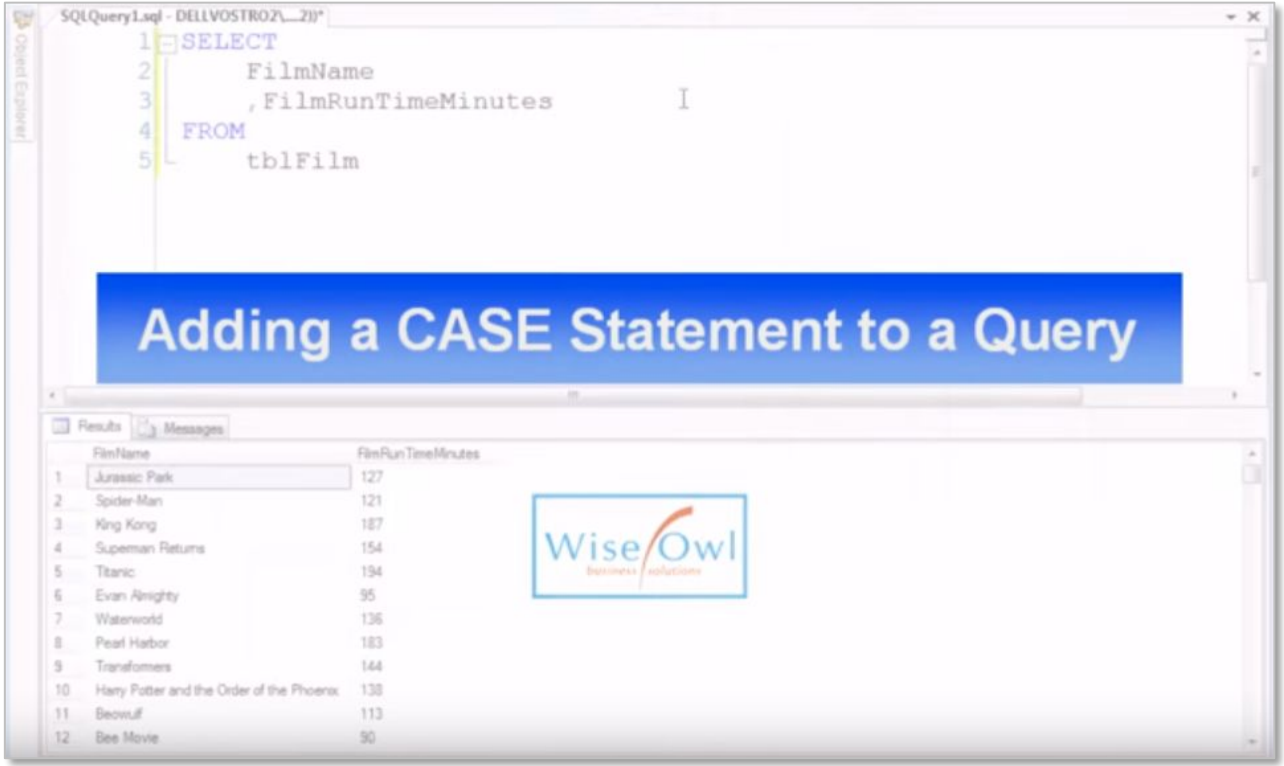
Run:

```
SELECT vendor_name, item_description, upc
FROM products WHERE upc IS NOT NULL;
```

DATA AGGREGATION IN SQL

INTRODUCTION: CASE STATEMENTS

CASE STATEMENTS



```
SELECT
     FilmName
     ,FilmRunTimeMinutes
FROM
     tblFilm
```

Adding a CASE Statement to a Query

	FilmName	FilmRunTimeMinutes
1	Jurassic Park	127
2	Spider-Man	121
3	King Kong	187
4	Superman Returns	154
5	Titanic	194
6	Evan Almighty	95
7	Waterworld	136
8	Pearl Harbor	183
9	Transformers	144
10	Harry Potter and the Order of the Phoenix	138
11	Beowulf	113
12	Bee Movie	90

CASE STATEMENTS

`CASE` statements group data into **categories** or **classifications**.

In SQL, `CASE` is part of the columns list in the `SELECT` statement.

CASE STATEMENTS

CASE syntax looks like this:

```
SELECT columns,
 CASE
    WHEN condition THEN result
    WHEN condition THEN result
    ELSE result
END AS output_name
FROM table;
```

DATA AGGREGATION IN SQL

GUIDED PRACTICE: CASE STATEMENTS

CASE STATEMENTS

Let’s say we want to classify Iowa’s counties as either:

- Small (less than 100,000 people).
- Medium (100,000-to-400,000 people).
- Large (more than 400,000 people).

How would we go about this?

CASE STATEMENTS

```
SELECT county, population,
   CASE
   WHEN population >= 400000 THEN 'large'
   WHEN population >= 100000 AND population < 400000
THEN 'medium'
   WHEN population < 100000 THEN 'small'
   END AS county_size
FROM  counties;
```

CASE STATEMENTS

Note that we define each size category. SQL will only return values that meet these conditions.

We can also add an "other" category if we want to include an `ELSE ‘other’` before the `END AS county_size` line. This will capture any missing data.

Pro Tip: while the use of indentation is helpful, it's not necessary in SQL.

CASE STATEMENTS

Next we’ll look at an example of **CASE** being used within a **SELECT** statement to generate an **aggregate.**

Calculate the percentage of items in the liquor product offerings that are whiskey products.

CASE STATEMENTS

```sql
SELECT AVG(
    CASE
    WHEN category_name LIKE '%WHISK%' THEN 1
    ELSE 0
    END)
    AS AverageWhisky
    FROM products;
```

CASE STATEMENTS

If we want a checksum for this formula, we can use:

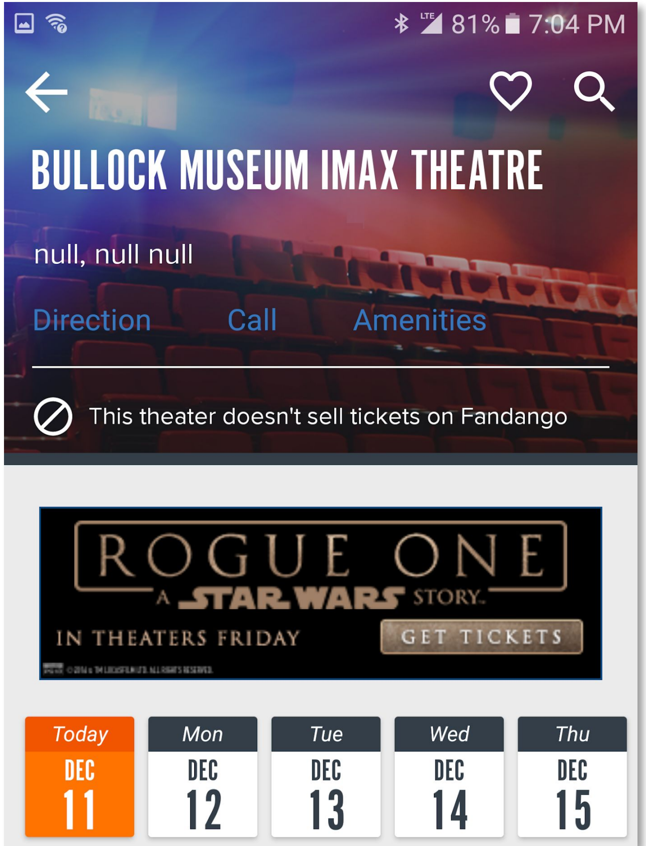
```
select sum(case when category_name LIKE '%WHISK%' THEN 1
ELSE 0 end) as whiskey_product
, count(1) as total
, 1.00*(sum(case WHEN category_name LIKE '%WHISK%' THEN
1 ELSE 0 end))/count(1) as pct_whiskey

from products
```

REAL-WORLD NULLS

What happens when we don’t deal with `Nulls` effectively?

What could they have done differently?



81% 7:04 PM

BULLOCK MUSEUM IMAX THEATRE

null, null null

This theater doesn't sell tickets on Fandango

INDEPENDENT PRACTICE: PUTTING IT ALL TOGETHER

ACTIVITY: PUTTING IT ALL TOGETHER

EXERCISE-1

DIRECTIONS

Create one query that:

1. Identifies the items that were sold (by item number) that don’t have matching reference information in the Products table (based on item_no NULLs).
    a. In the output, include a count of how many distinct stores sold these items.

Create another query that:

2. Lists the distinct store numbers with recorded sales but no listing in the Stores table.
    b. Use a CASE and COALESCE combination to add a column that labels these records as either a liquor store or convenience store.

SAMPLE SOLUTION

1. Identify the items that were sold (by item number) that do not have matching reference information in the Products table (based on item_no `NULLs`). In your output, create a count of how many distinct stores sold these items.

Solution: 88 rows.

```
SELECT a.item, COUNT(DISTINCT(a.store)) AS number_of_stores
FROM sales a
LEFT OUTER JOIN products b
ON a.item = b.item_no
WHERE b.item_no IS NULL
GROUP BY a.item
ORDER BY 1
```

SAMPLE SOLUTION

2. Create a list of the distinct store numbers with recorded sales but no listing in the Stores table. Practice using a **CASE** and **COALESCE** combination to add a column that labels them as either a liquor store or convenience store.

Solution: 31 rows.

```
SELECT DISTINCT ON(store) store, CASE
WHEN a.convenience_store ilike 'Y' THEN 'Convenience'
ELSE COALESCE(a.convenience_store, 'Liquor store')
END AS Store_Type FROM sales a LEFT JOIN stores b
USING(store) WHERE b.store IS NULL GROUP BY store,
a.convenience_store;
```

ACTIVITY: PUTTING IT ALL TOGETHER

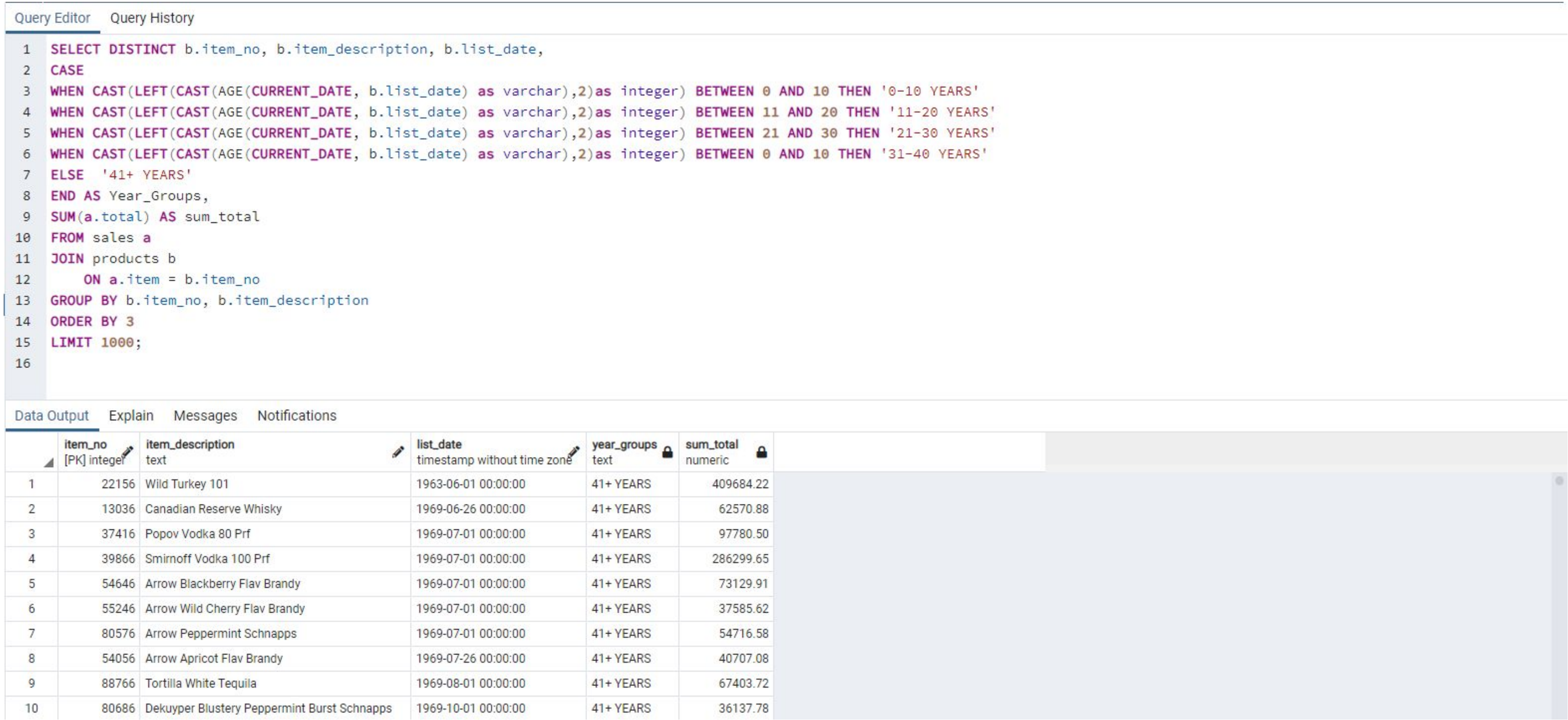
EXERCISE-2

DIRECTIONS

Let’s apply our SQL skills to this problem:

- Categorize all of the items by age:
  - Based on list date.
  - Ranges of zero–10 years, 11–20 years, 21–30 years, 31–40 years, and 41+ years.
- Then bring in the sum of total sales.

PUTTING IT ALL TOGETHER



```sql
SELECT DISTINCT b.item_no, b.item_description, b.list_date,
CASE
WHEN CAST(LEFT(CAST(AGE(CURRENT_DATE, b.list_date) as varchar),2)as integer) BETWEEN 0 AND 10 THEN '0-10 YEARS'
WHEN CAST(LEFT(CAST(AGE(CURRENT_DATE, b.list_date) as varchar),2)as integer) BETWEEN 11 AND 20 THEN '11-20 YEARS'
WHEN CAST(LEFT(CAST(AGE(CURRENT_DATE, b.list_date) as varchar),2)as integer) BETWEEN 21 AND 30 THEN '21-30 YEARS'
WHEN CAST(LEFT(CAST(AGE(CURRENT_DATE, b.list_date) as varchar),2)as integer) BETWEEN 0 AND 10 THEN '31-40 YEARS'
ELSE  '41+ YEARS'
END AS Year_Groups,
SUM(a.total) AS sum_total
FROM sales a
JOIN products b
    ON a.item = b.item_no
GROUP BY b.item_no, b.item_description
ORDER BY 3
LIMIT 1000;
```

	item_no [PK] integer	item_description text	list_date timestamp without time zone	year_groups text	sum_total numeric
1	22156	Wild Turkey 101	1963-06-01 00:00:00	41+ YEARS	409684.22
2	13036	Canadian Reserve Whisky	1969-06-26 00:00:00	41+ YEARS	62570.88
3	37416	Popov Vodka 80 Prf	1969-07-01 00:00:00	41+ YEARS	97780.50
4	39866	Smirnoff Vodka 100 Prf	1969-07-01 00:00:00	41+ YEARS	286299.65
5	54646	Arrow Blackberry Flav Brandy	1969-07-01 00:00:00	41+ YEARS	73129.91
6	55246	Arrow Wild Cherry Flav Brandy	1969-07-01 00:00:00	41+ YEARS	37585.62
7	80576	Arrow Peppermint Schnapps	1969-07-01 00:00:00	41+ YEARS	54716.58
8	54056	Arrow Apricot Flav Brandy	1969-07-26 00:00:00	41+ YEARS	40707.08
9	88766	Tortilla White Tequila	1969-08-01 00:00:00	41+ YEARS	67403.72
10	80686	Dekuyper Blustery Peppermint Burst Schnapps	1969-10-01 00:00:00	41+ YEARS	36137.78

ACTIVITY: PUTTING IT ALL TOGETHER

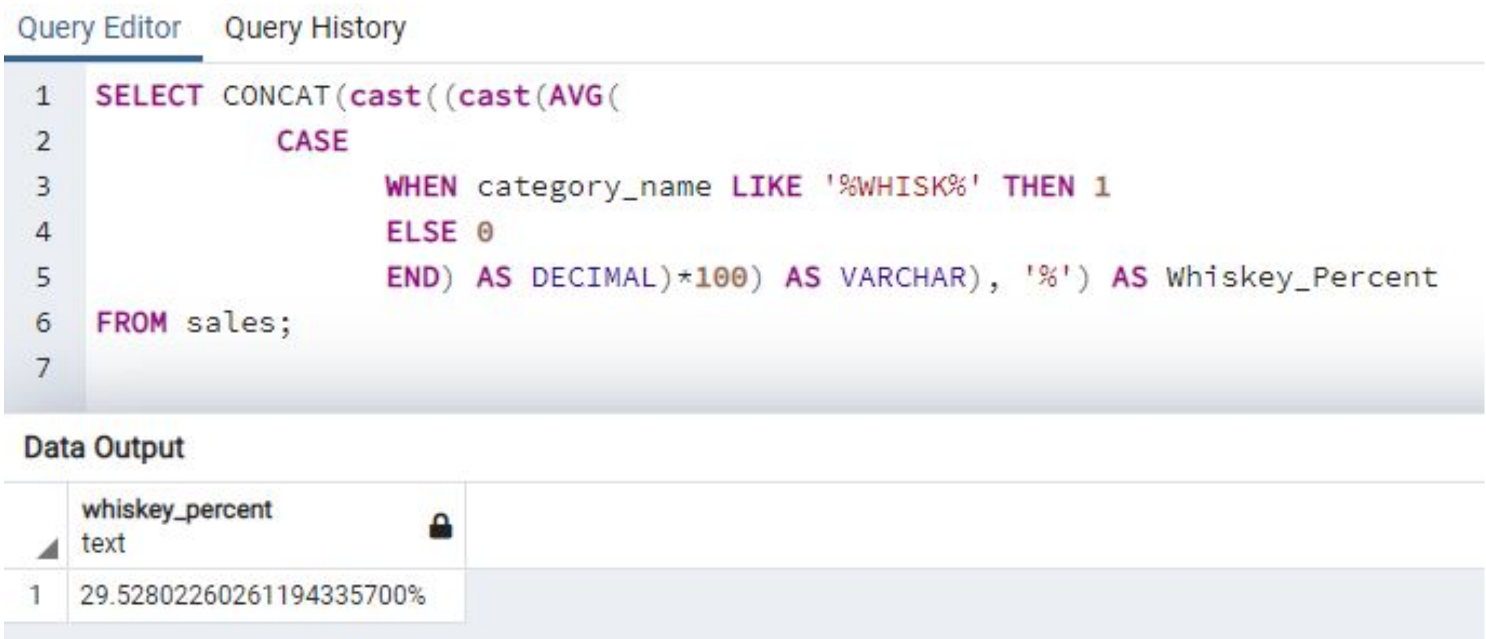
EXERCISE-3

DIRECTIONS

Combine your query tools (`CONCAT`, `CASE`, and other `SQL` formatting functions) to answer the following question from Iowa's liquor licensing board. Create a query with an output properly formatted as a percent with two decimal places and a percent notation.

What percentage of all purchases are whisky sales?

PUTTING IT ALL TOGETHER



```sql
SELECT CONCAT(cast((cast(AVG(
          CASE
                WHEN category_name LIKE '%WHISK%' THEN 1
                ELSE 0
                END) AS DECIMAL)*100) AS VARCHAR), '%') AS Whiskey_Percent
FROM sales;

```

	whiskey_percent text
1	29.52802260261194335700%

CONCLUSION

REVIEW: DATA AGGREGATION IN SQL

In this lesson, we:

1. Explored methods of dealing with **`NULLs`** in tables, including: **`NULLIF`**, **`IS NULL`**, **`IS NOT NULL`**, and **`COALESCE`** .
2. Reviewed **`CASE`** statements for adding categories and aggregates, using Boolean logic structures.
3. Practiced evaluating and interpreting the presence of **`NULLs`** that occur as a result of joining tables together.

Q&A

RESOURCES

RESOURCES

- “Strategies for Approaching `NULL` Values with SQL Server:” https://goo.gl/wALy62
- “Handling Null Values,” Microsoft SQL: https://goo.gl/4frfgz
- `CASE` Statement YouTube Video From WiseOwl: https://youtu.be/zlgrhj2D63E
- TechOnTheNet.com for SQL Server `NULLIF` Reference: https://goo.gl/AFeKuV