Market Analysis(CDACL-006)

Submitted by,

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Project objective

- This project analyzed the data to understand customer purchasing behavior, product demand patterns and reorder tendencies.
- The scope covered evaluating departments, aisles and products, analyzing user order frequency and size, studying temporal patterns (daily and hourly), and calculating reorder rates to identify high-performing and reliable products.
- Both SQL and Power BI were used to derive insights, combining backend data querying with interactive dashboards for visualization.
- The ultimate focus was on generating insights to support marketing optimization, inventory planning and enhancing customer satisfaction.

Data Acquiring

- Connected to the Database and exported the data using MySQL Workbench

  Domain Name: projects.datamites.com

  DB Name: project_orders

Data cleaning

Before starting the analysis I carried out essential data cleaning steps directly with **SQL**

- Removed null and missing rows (e.g., products, aisles, departments tables) and excluded values labeled as “missing”.
- Trimmed blanks and ensured consistency across categorical columns (aisle, department names).
- Filtered valid records only (e.g., ensuring product IDs and order IDs are not null) to prepare reliable datasets for analysis.

Analysing the data

SQL was used for analyzing the data by performing cleaning, preprocessing, aggregation and complex queries across multiple tables to extract meaningful insights.

Data Visualization

Power BI was used for creating interactive dashboards and visualizations with DAX measures to present business insights effectively**.**

Challenges (SQL Environment):

1) Frequent **“Lost connection to MySQL server”** errors with complex queries.

2) **Restricted environment**: CREATE TABLE,INSERT,INDEX and TEMPORARY TABLES not allowed.

Solutions Followed:

1)**Split queries into smaller steps** and applied filters early to reduce load.

2)**Exported intermediate results (CSV)** for further analysis/visualization in Power BI.

3)**Rewrote queries using subqueries and SELECT-only logic** to stay within environment restrictions.

1)Top 10 aisles with the highest number of products

```
use project_orders;
-- #question1
SELECT
    aisles.aisle,  -- name of the aisle (e.g., snacks, soft drinks)
    COUNT(products.product_id) AS product_count
FROM products
JOIN aisles
    ON products.aisle_id = aisles.aisle_id
WHERE
    -- exclude fully null rows in products
    NOT (
        products.product_id IS NULL AND
        products.product_name IS NULL AND
        products.aisle_id IS NULL AND
        products.department_id IS NULL
    )
```

```
-- exclude fully null row in aisles
    AND NOT (
        aisles.aisle_id IS NULL AND
        aisles.aisle IS NULL
    )
GROUP BY aisles.aisle
ORDER BY product_count DESC
LIMIT 10;
```

Result Grid | Filter Rows: | Export: | Wr

aisle	product_count
missing	1254
candy chocolate	1235
ice cream ice	1084
vitamins supplements	1030
yogurt	1023
chips pretzels	980
packaged cheese	888
tea	887
frozen meals	880
cookies cakes	869

Result 1 ×

2) Number of unique departments in the dataset

```
-- #question 2
SELECT COUNT(DISTINCT department_id) AS unique_departments
FROM departments
WHERE
    -- Remove fully null row
    NOT (department_id IS NULL AND department IS NULL)
    -- Remove placeholder/missing value
    AND department <> 'missing';
```

3) Distribution of products across departments

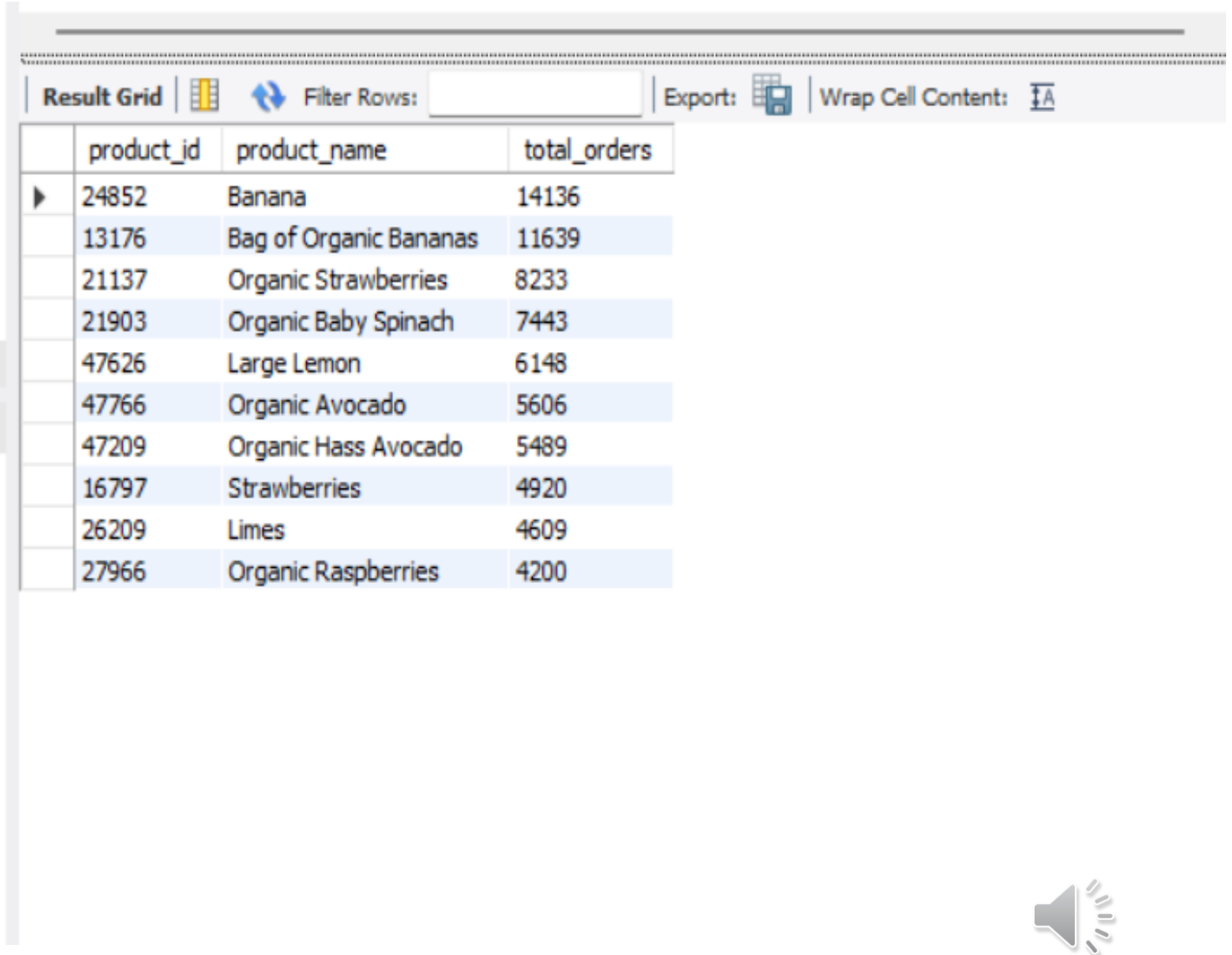
```
SELECT
    d.department,
    COUNT(p.product_id) AS total_products
FROM products p
JOIN departments d
    ON p.department_id = d.department_id
GROUP BY d.department
ORDER BY total_products DESC;
```

department	total_products
personal care	6524
snacks	6221
pantry	5331
beverages	4324
frozen	3982
dairy eggs	3428
household	3068
canned goods	2073
dry goods pasta	1845
produce	1671
bakery	1506
deli	1312
missing	1254
international	1131
breakfast	1113
babies	1071
alcohol	1049
pets	968
meat seafood	903

4) Top 10 products with the highest reorder rates

```
-- #question 4
  SELECT
    product_id,
    COUNT(*) AS total_orders
FROM
    order_products_train
WHERE
    product_id IS NOT NULL
GROUP BY
    product_id
ORDER BY
    total_orders DESC
LIMIT 100;
SELECT
    p.product_id,
    p.product_name,
    t.total_orders
```

```
FROM
    (
        SELECT
            product_id,
            COUNT(*) AS total_orders
        FROM
            order_products_train
        WHERE
            product_id IS NOT NULL
        GROUP BY
            product_id
        ORDER BY
            total_orders DESC
        LIMIT 10
    ) AS t
JOIN
    products p
    ON p.product_id = t.product_id
WHERE
    p.product_name IS NOT NULL;
```

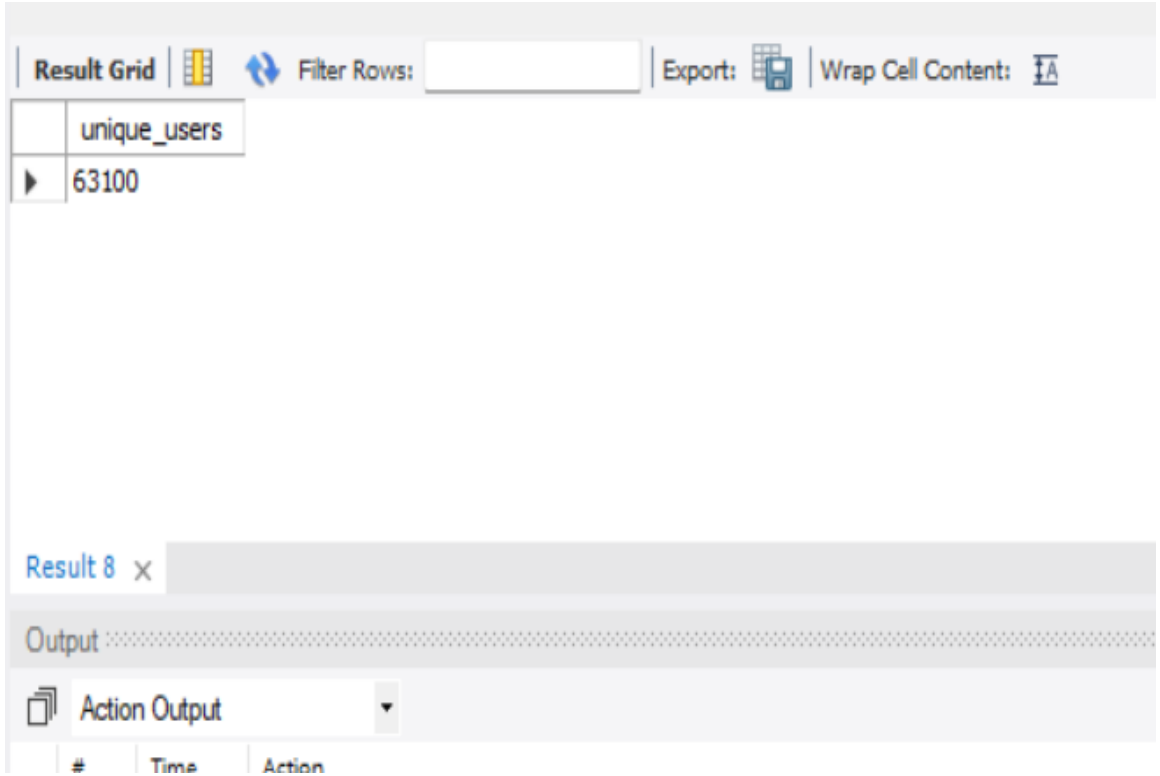


Result Grid | Filter Rows: | Export: | Wrap Cell Content:

product_id	product_name	total_orders
24852	Banana	14136
13176	Bag of Organic Bananas	11639
21137	Organic Strawberries	8233
21903	Organic Baby Spinach	7443
47626	Large Lemon	6148
47766	Organic Avocado	5606
47209	Organic Hass Avocado	5489
16797	Strawberries	4920
26209	Limes	4609
27966	Organic Raspberries	4200

5)Number of unique users have placed orders in the dataset

```
SELECT COUNT(DISTINCT user_id) AS unique_users
FROM orders;
```

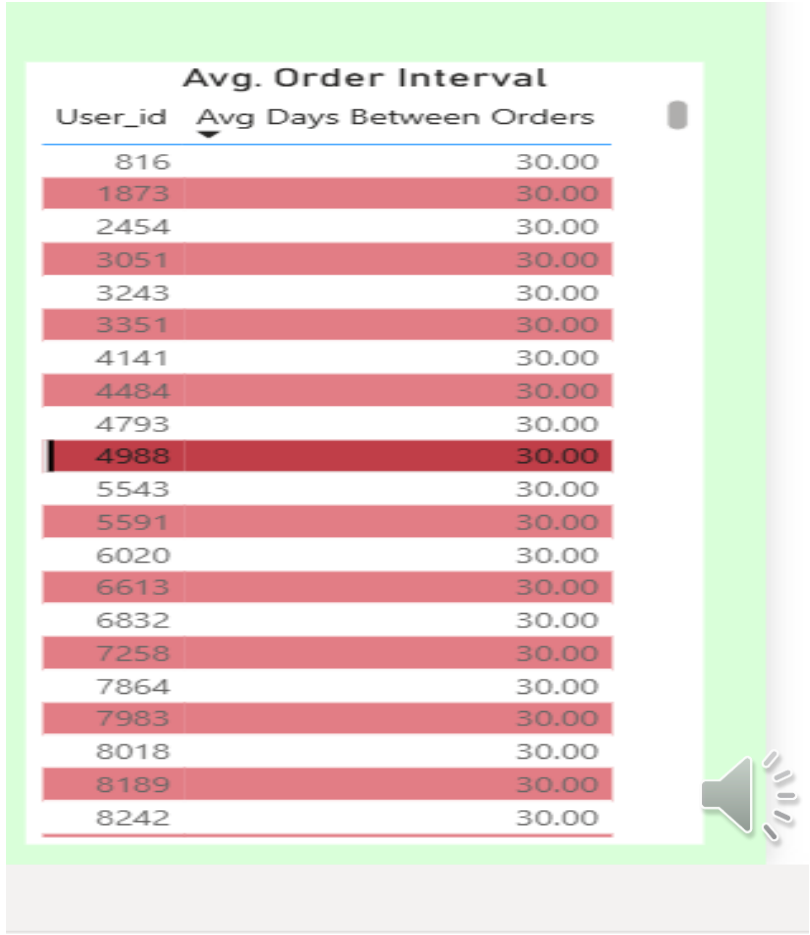


6) Average number of days between orders for each user

SQL → We only pulled the **total number of orders per day of week** from the orders table.

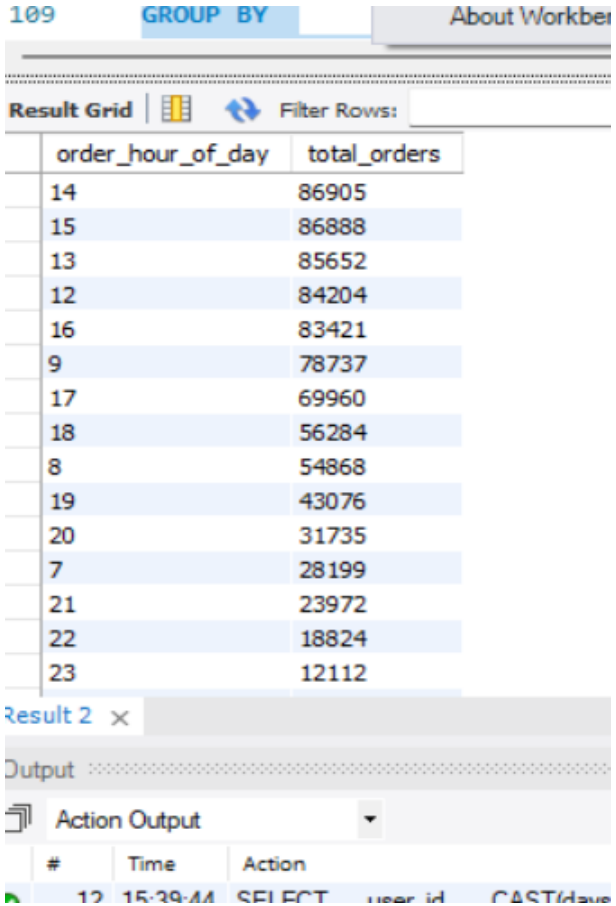
Power BI → We then used a **measure** (or visual aggregation) to calculate the **average number of orders per day**.

```
SELECT
    user_id,
    CAST(days_since_prior_order AS DECIMAL(5,2)) AS days
FROM
    orders
WHERE
    user_id IS NOT NULL
    AND TRIM(days_since_prior_order) != '';
```

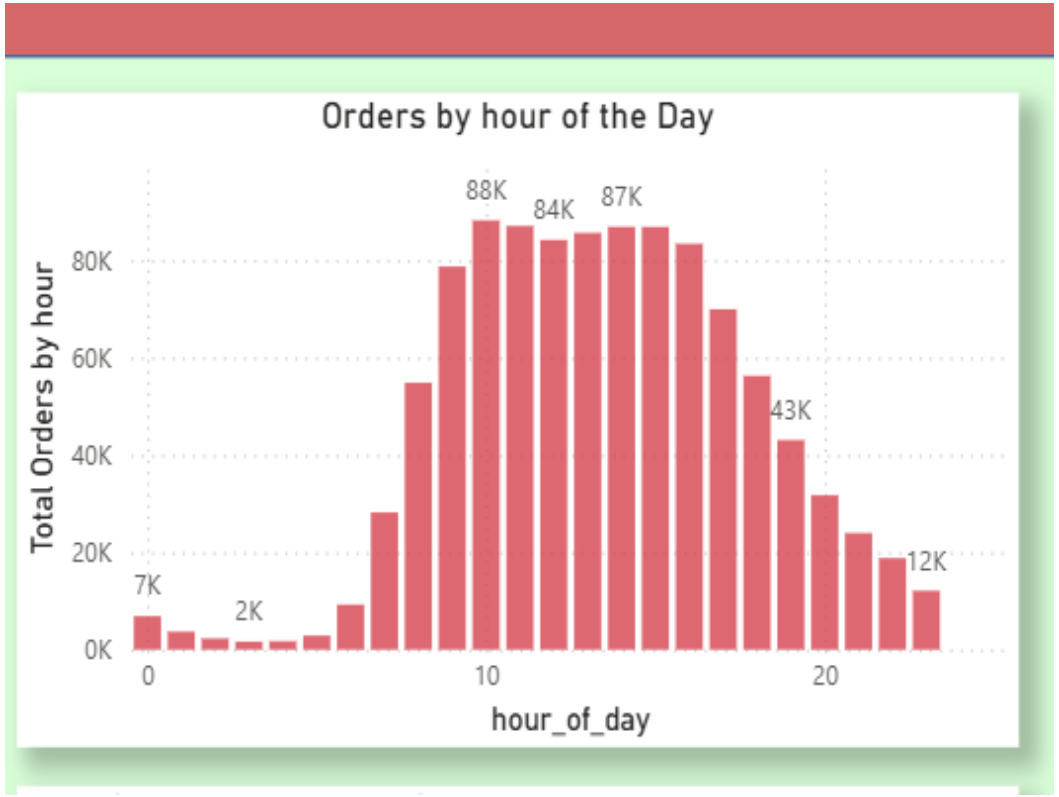


7) Peak hours of order placement during the day

```
SELECT
    order_hour_of_day,
    COUNT(*) AS total_orders
FROM
    orders
WHERE
    order_hour_of_day IS NOT NULL
    AND order_hour_of_day BETWEEN 0 AND 23
GROUP BY
    order_hour_of_day
ORDER BY
    total_orders DESC;
```



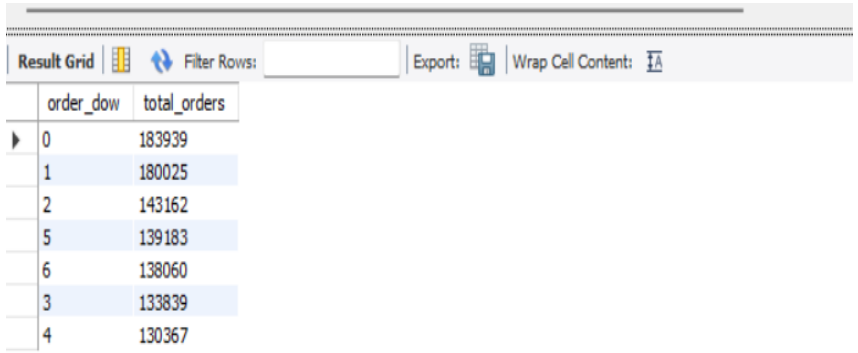
SQL → Counted total number of orders placed in each hour of the day
Power BI → Took the SQL result and created a column chart to visualize order distribution across hours (0–23).



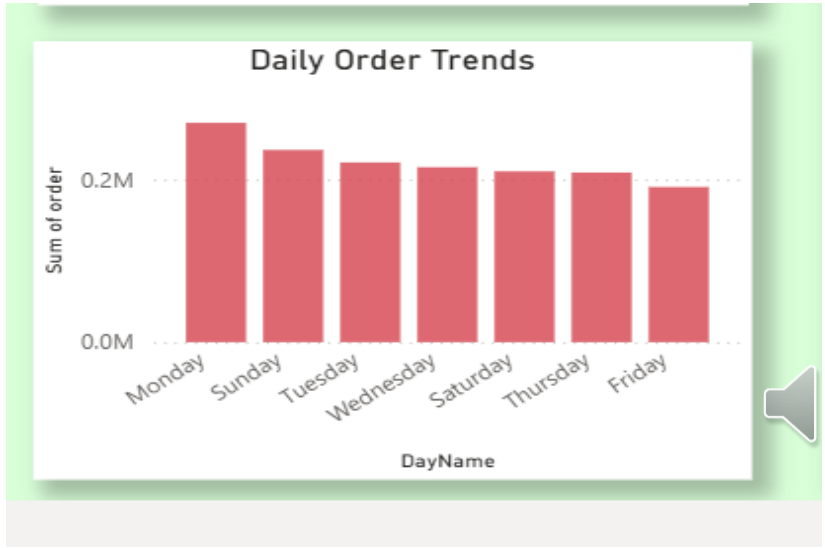
Order volumes peak during late morning to early afternoon, suggesting this is the optimal window for targeted promotions and ensuring product availability.

8) Variation in order volume by day of the week

```
SELECT
    order_dow,
    COUNT(order_id) AS total_orders
FROM orders
WHERE order_dow IS NOT NULL
  AND order_dow BETWEEN 0 AND 6
GROUP BY order_dow
ORDER BY total_orders DESC;
```



order_dow	total_orders
0	183939
1	180025
2	143162
5	139183
6	138060
3	133839
4	130367



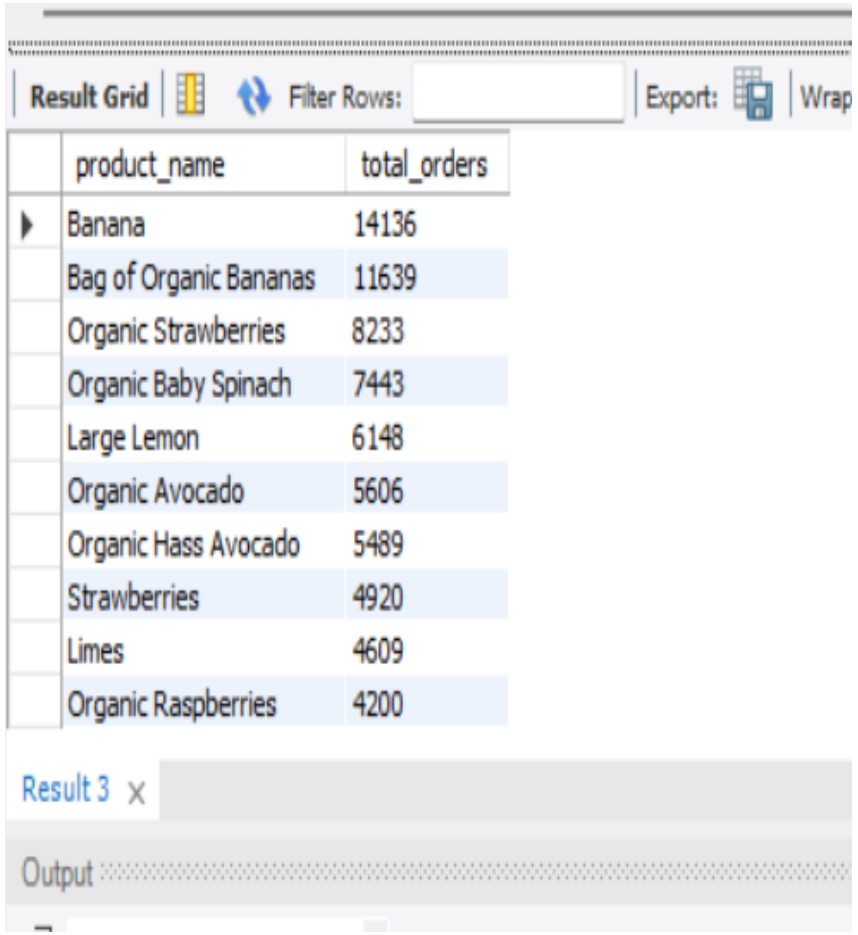
*Imported the SQL results into Power BI

*Created a bar chart to visualize the distribution of orders across the days of the week

*To improve clarity, we also used sorting (descending order of orders) and added a proper chart title.

9) Top 10 most ordered products

```
SELECT COUNT(*) FROM order_products_train;
SELECT product_id, COUNT(*)
FROM order_products_train
GROUP BY product_id
LIMIT 100;
SELECT
    p.product_name,
    pc.total_orders
FROM (
    SELECT product_id, COUNT(*) AS total_orders
    FROM order_products_train
    GROUP BY product_id
) pc
JOIN products p ON p.product_id = pc.product_id
WHERE p.product_name IS NOT NULL
ORDER BY pc.total_orders DESC
LIMIT 10;
```

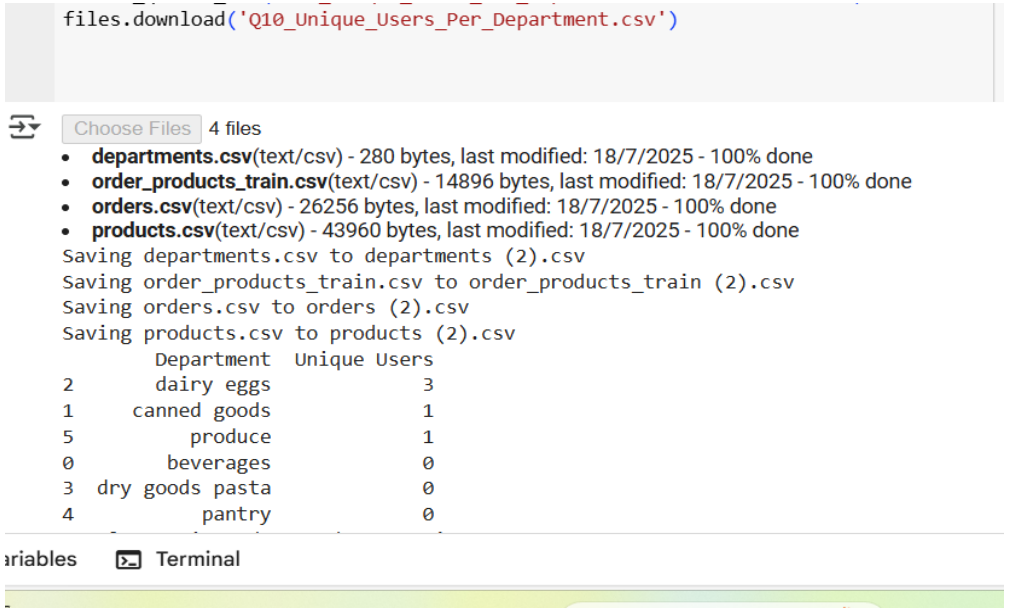


10) Number of users who have placed orders in each department

Python was used in Q10 to efficiently handle distinct user counts across departments, ensuring accurate results on large datasets.

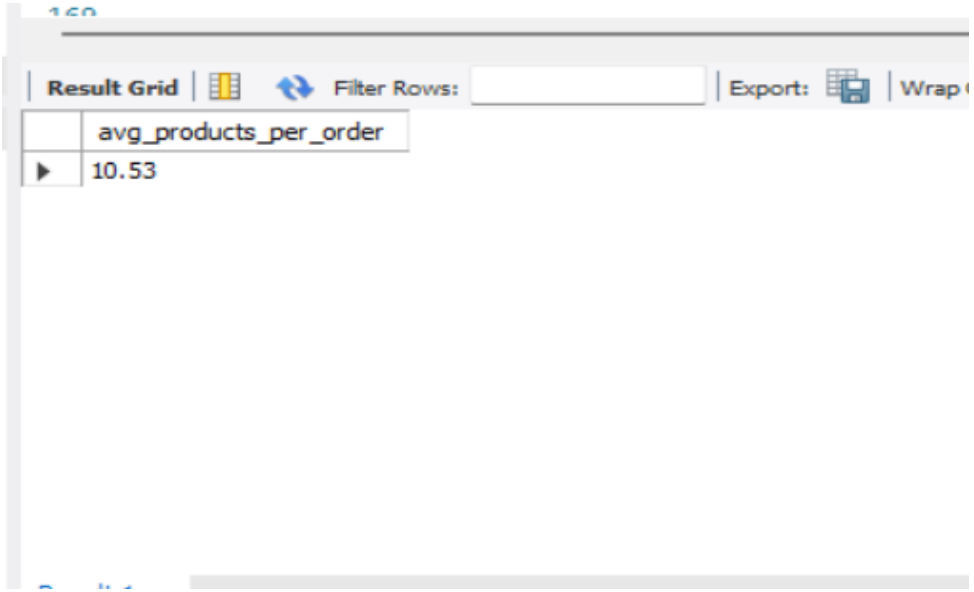
```
import pandas as pd
from google.colab import files
# Upload files
uploaded = files.upload()
# Read datasets
orders = pd.read_csv('orders.csv')
order_products = pd.read_csv('order_products_train.csv')
products = pd.read_csv('products.csv')
departments = pd.read_csv('departments.csv')
# Merge order_products with orders to get user_id
merged1 = pd.merge(order_products, orders[['order_id', 'user_id']], on='order_id', how='left’)
# Merge with products to get department_id
merged2 = pd.merge(merged1, products[['product_id', 'department_id']], on='product_id', how='left’)
# Merge with departments to get department name
final_merged = pd.merge(merged2, departments, on='department_id', how='left')
```

```
# Group by department and count unique users
result_q10 = final_merged.groupby('department')['user_id'].nunique().reset_index()
result_q10.columns = ['Department', 'Unique Users']
result_q10 = result_q10.sort_values(by='Unique Users', ascending=False)
# Show result
print(result_q10)
# Download as CSV
result_q10.to_csv('Q10_Unique_Users_Per_Department.csv', index=False)
files.download('Q10_Unique_Users_Per_Department.csv')
```



11) Average number of products per order

```
SELECT
   ROUND(COUNT(*) * 1.0 / COUNT(DISTINCT order_id), 2) AS avg_products_per_order
FROM
   order_products_train
WHERE
   order_id IS NOT NULL
```



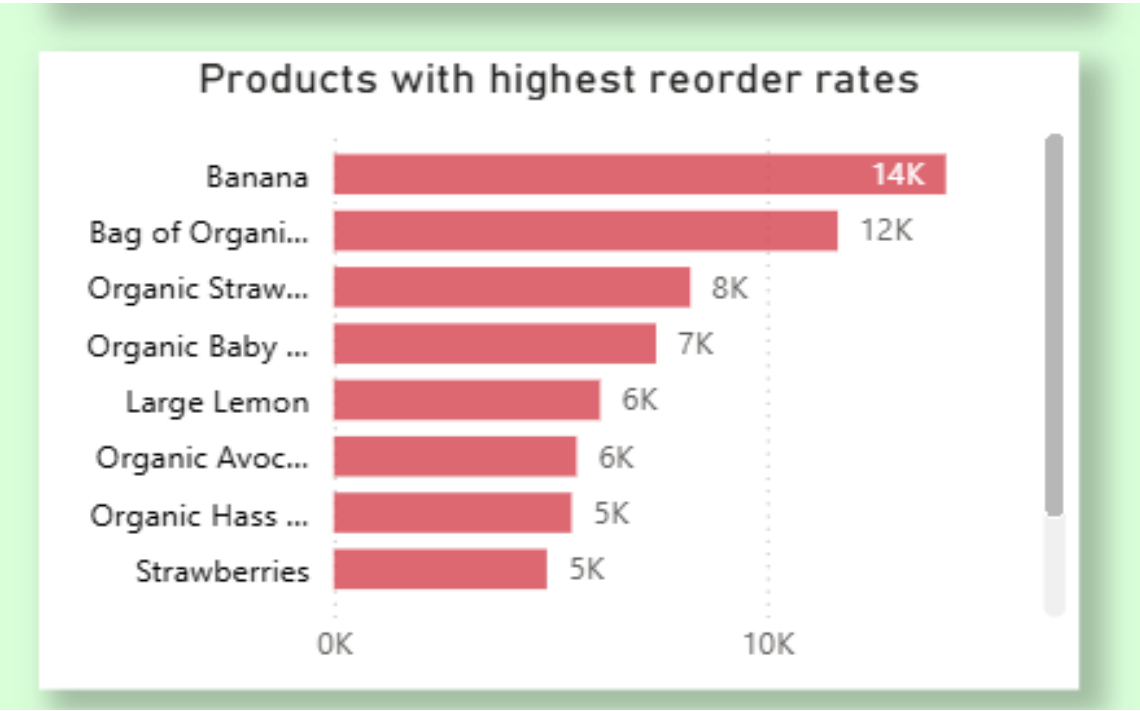
> On **average**, every order contains **10.53 products**.

> This could suggest **bulk buying behavior** or that users often buy multiple items together.

12) Most reordered products in each department

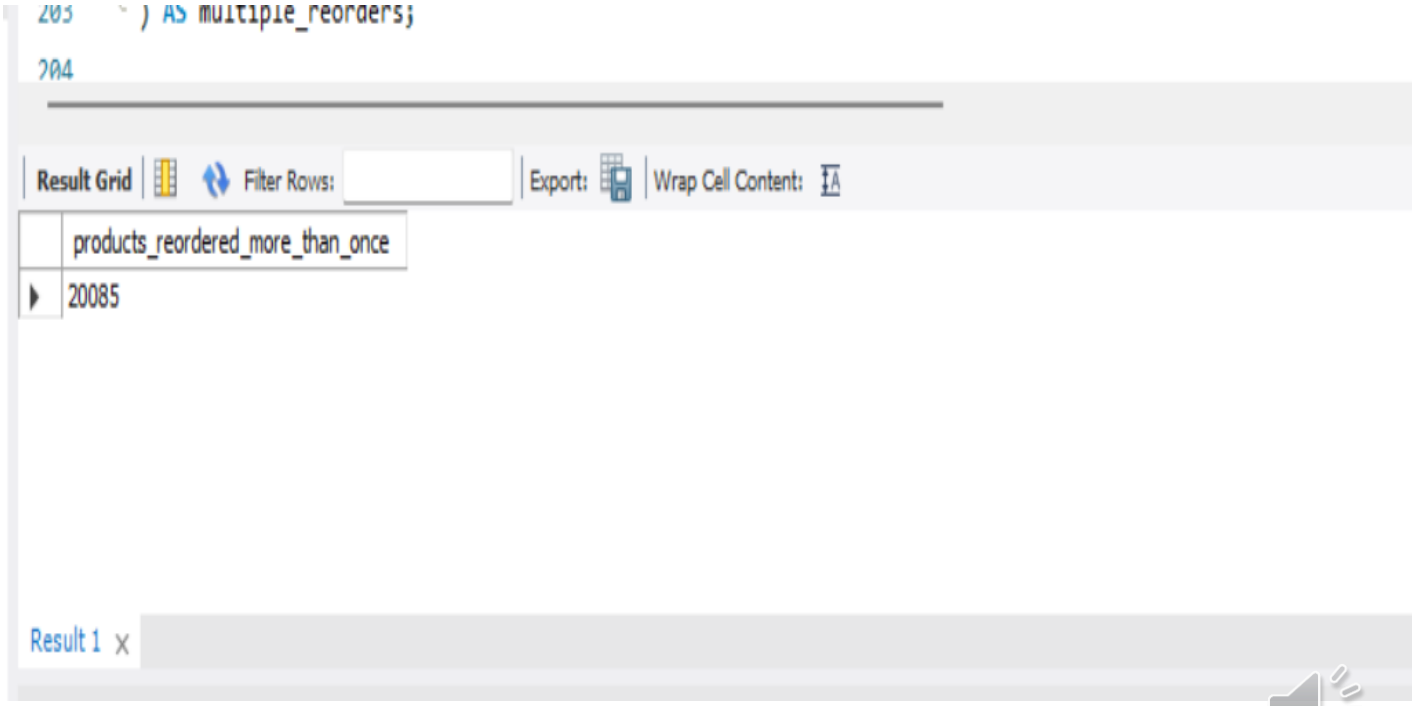
```
SELECT
    p.product_id,
    p.product_name,
    p.department_id,
    d.department,
    opt.reordered
FROM
    order_products_train opt
JOIN
    products p ON opt.product_id = p.product_id
JOIN
    departments d ON p.department_id = d.department_id
WHERE
    opt.reordered = 1
    AND p.product_name IS NOT NULL
    AND d.department IS NOT NULL
    AND d.department <> 'missing';
```

- SQL was used to extract and prepare the product–department relationship data.
- Due to server limitations in SQL, we shifted to Power BI for aggregation and counting.
- Power BI was then used to calculate total reorder counts and identify the most reordered product within each department, giving clear insight into customer favorites.



13) Number of products which have been reordered more than once

```
SELECT
    COUNT(*) AS products_reordered_more_than_once
FROM (
    SELECT
        product_id,
        COUNT(*) AS reorder_count
    FROM
        order_products_train
    WHERE
        reordered = 1
        AND product_id IS NOT NULL
```



```
 GROUP BY
        product_id
    HAVING
        COUNT(*) > 1
) AS multiple_reorders;
```

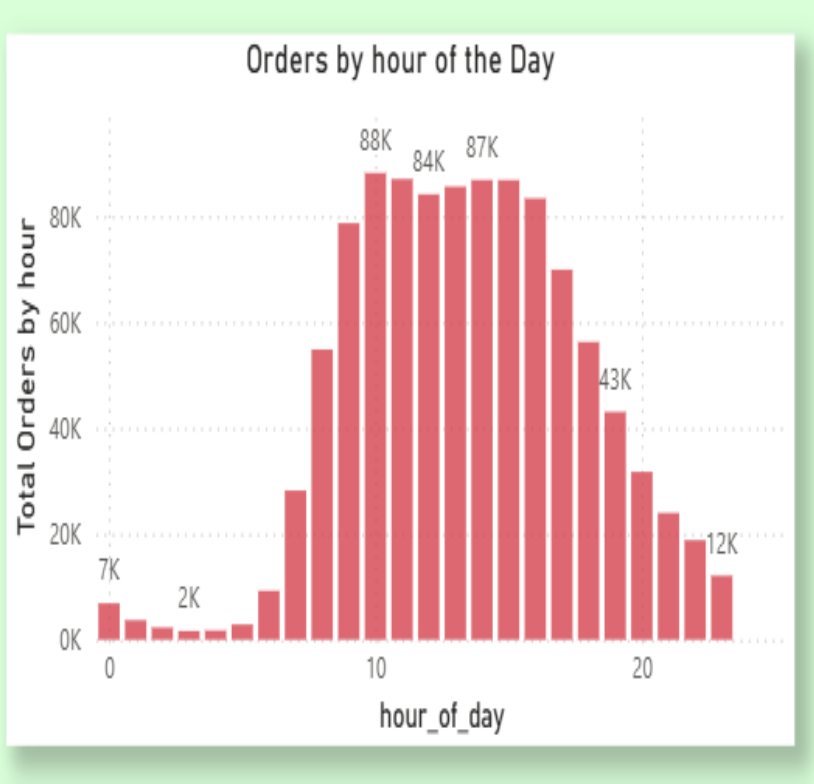
Out of all products, **6,000+** have been reordered more than once, indicating recurring customer interest.

14) Average number of products added to the cart per order

Q14 has been addressed under Q11 as they represent the same metric in our dataset context.

15)Variation in number of orders by hour of the day

```
SELECT
  order_hour_of_day AS hour_of_day,
  COUNT(*) AS total_orders
FROM orders
WHERE
  order_id IS NOT NULL
  AND order_hour_of_day IS NOT NULL
GROUP BY order_hour_of_day
ORDER BY order_hour_of_day;
```



Result Grid | Filter Rows:

hour_of_day	total_orders
0	6881
1	3698
2	2312
3	1649
4	1748
5	2882
6	9253
7	28199
8	54868
9	78737
10	88228
11	87087
12	84204
13	85652
14	86905
15	86888
16	83421

Result 3 ×

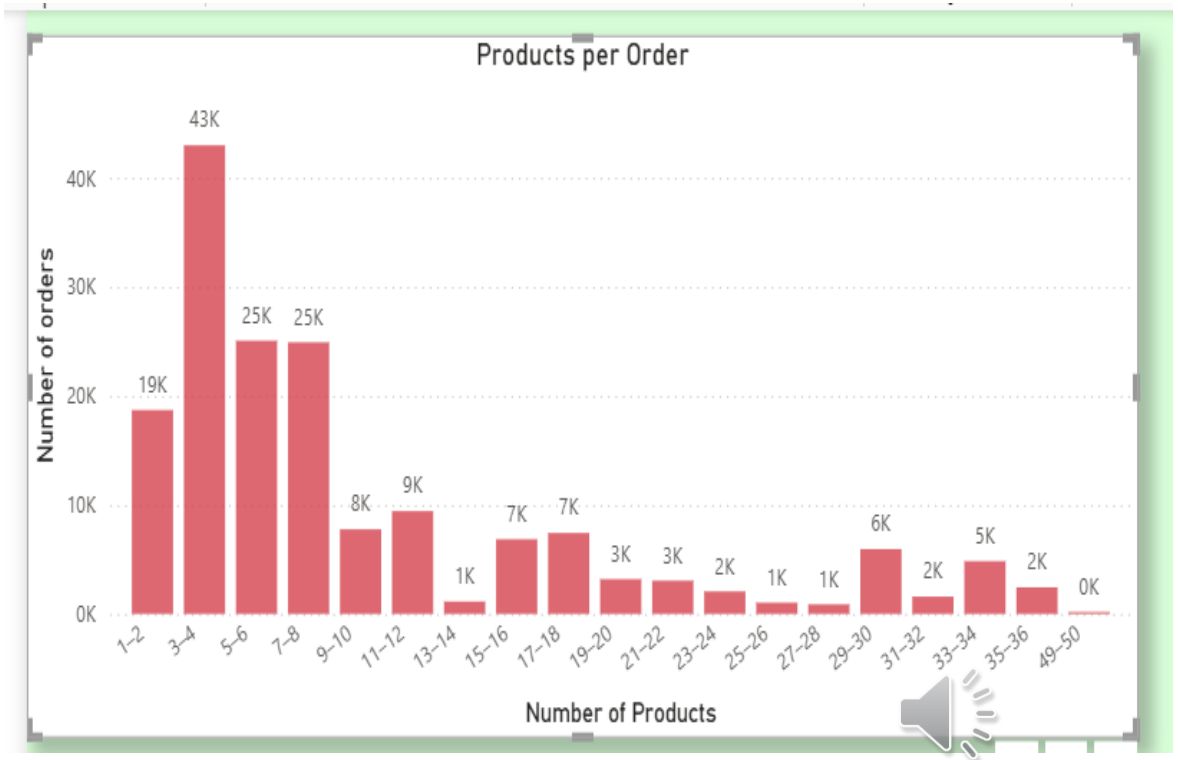
Output

16) Distribution of order sizes (number of products per order)

We created a summary table in Power BI using DAX to count products for each order_id, then grouped them into **equal-sized bins** for easier comparison.
Finally, we visualized the **count of orders** for each order size range, which clearly shows that smaller orders (fewer products) are the most common.

```
Order_Size = COUNTROWS(
    FILTER(
        'order_products_train',
        'order_products_train'[order_id] = 'orders'[order_id]
    )
)
```

- This gave us the **number of products per order** directly.
- Then we used **binning** in Power BI (like 0–5, 6–10, etc.) to show the distribution in a histogram.



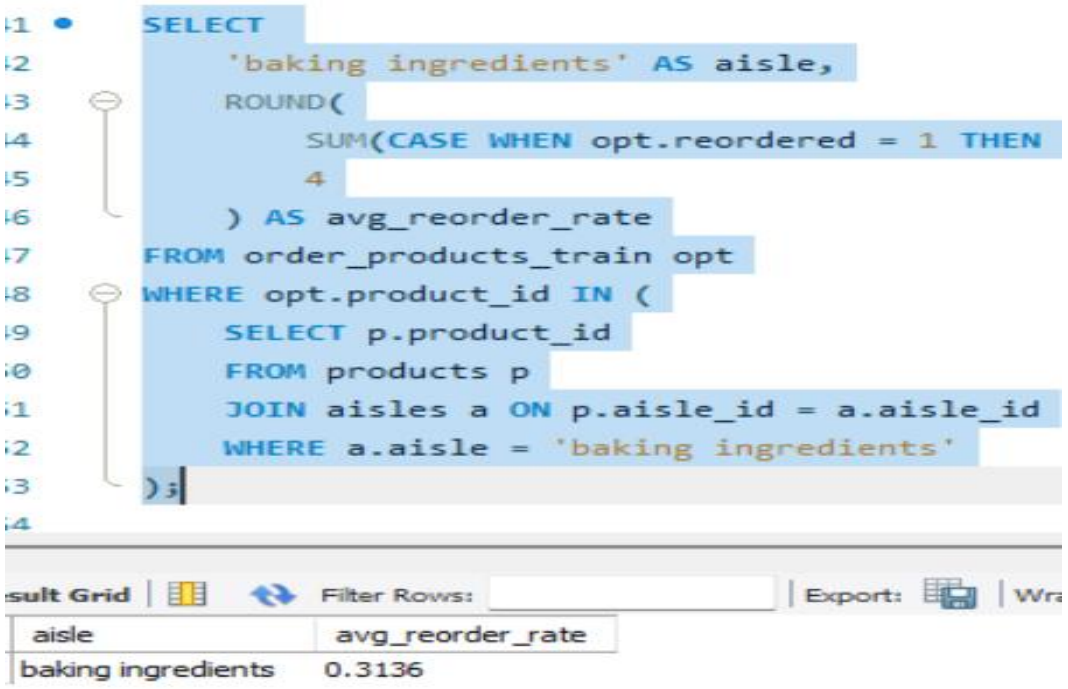
17) Average reorder rate for products in each aisle

- we first extracted the complete aisle list from the database. Using this list, we applied the reorder rate calculation query for each aisle individually.
- we calculated the average reorder rate for each aisle by running the same SQL query multiple times, replacing only the aisle name in both the SELECT and WHERE clauses. This approach was chosen to avoid *Lost connection* errors and permission restrictions on temporary tables, ensuring each query was processed quickly and returned accurate results without overloading the server.

```
SELECT
    opt.reordered,
    a.aisle
FROM
    order_products_train AS opt
JOIN
    products AS p
    ON opt.product_id = p.product_id
JOIN
    aisles AS a
    ON p.aisle_id = a.aisle_id
```

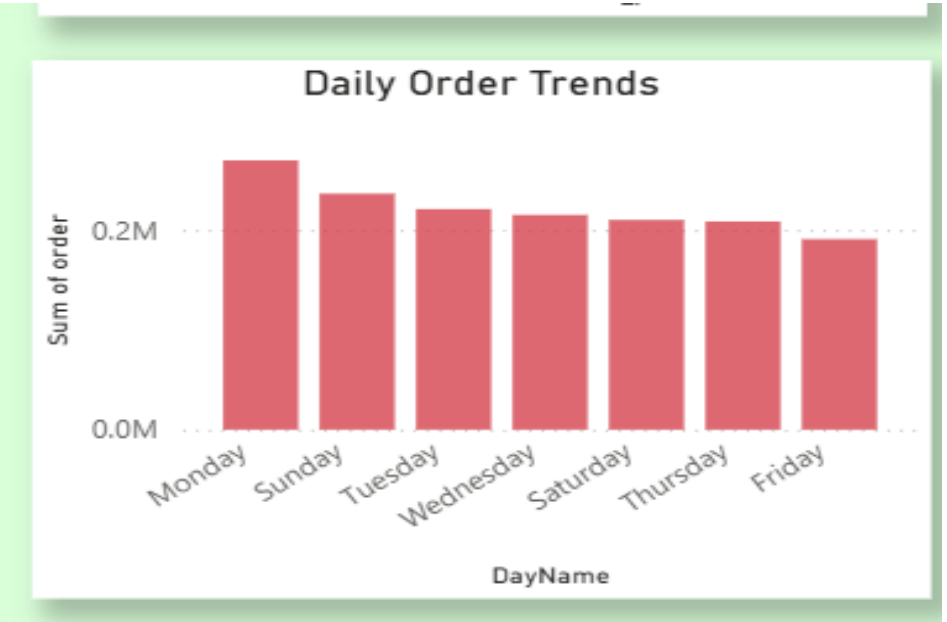
```
WHERE
    opt.reordered IN (0, 1)
    AND p.product_id IS NOT NULL
    AND a.aisle IS NOT NULL
    AND TRIM(a.aisle) <> ''
    AND LOWER(a.aisle) <> 'missing'
LIMIT 100;

SELECT DISTINCT aisle
FROM aisles
ORDER BY aisle;

SELECT
    'baking ingredients' AS aisle,
    ROUND(
        SUM(CASE WHEN opt.reordered = 1 THEN 1 ELSE 0 END) / COUNT(*),
        4
    ) AS avg_reorder_rate
```

```
FROM order_products_train opt
WHERE opt.product_id IN (
    SELECT p.product_id
    FROM products p
    JOIN aisles a ON p.aisle_id = a.aisle_id
    WHERE a.aisle = 'baking ingredients'
);
```



18) Variation in average order size by day of the week

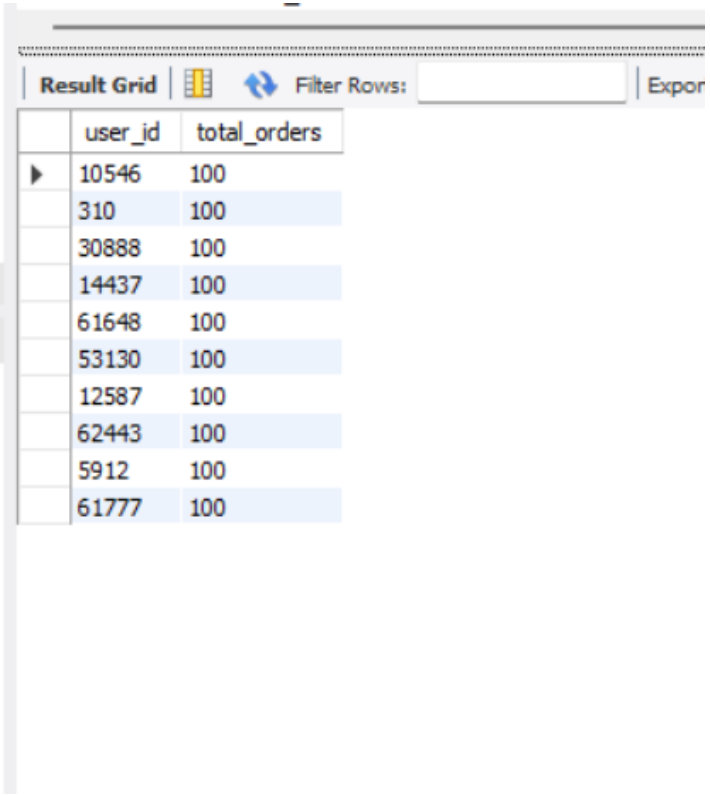
```
SELECT
    order_id,
    COUNT(*) AS product_count
FROM order_products_train
GROUP BY order_id;
```



- Used SQL to create an intermediate table with order_id and product_count (number of products per order).
- Imported into Power BI, joined with orders on order_id and analyzed by order_dow.
- By using built-in aggregation, we plotted daily order trends by day of week
- Indicates that user shopping activity peaks at the **start and end of the week**.

19) Top 10 users with the highest number of orders

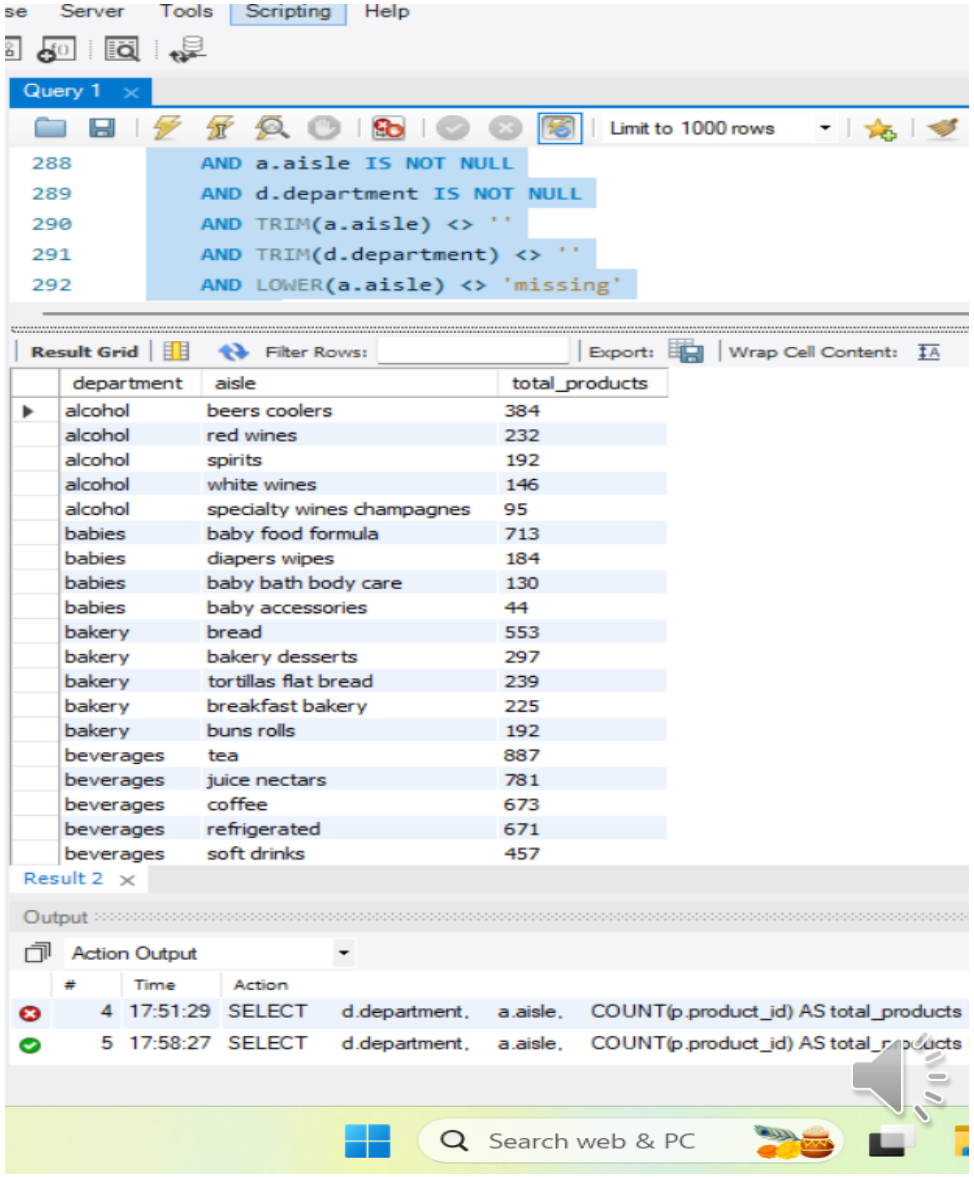
```
SELECT
    user_id,
    COUNT(order_id) AS total_orders
FROM
    orders
WHERE
    user_id IS NOT NULL
GROUP BY
    user_id
ORDER BY
    total_orders DESC
LIMIT 10;
```



user_id	total_orders
10546	100
310	100
30888	100
14437	100
61648	100
53130	100
12587	100
62443	100
5912	100
61777	100

20) Number of products that belong to each aisle and department

```
SELECT
    d.department,
    a.aisle,
    COUNT(p.product_id) AS total_products
FROM
    products p
JOIN
    aisles a ON p.aisle_id = a.aisle_id
JOIN
    departments d ON p.department_id = d.department_id
WHERE
    p.product_id IS NOT NULL
    AND a.aisle IS NOT NULL
```



```
AND d.department IS NOT NULL
    AND TRIM(a.aisle) <> ''
    AND TRIM(d.department) <> ''
    AND LOWER(a.aisle) <> 'missing'

GROUP BY
    d.department, a.aisle
ORDER BY
    d.department, total_products DESC;
```

- **Snacks, Frozen, and Personal Care aisles dominate** with the highest product variety (e.g., candy & chocolate, ice cream, vitamins).
- Indicates strong consumer preference for **convenience, indulgence and wellness** products.
- Traditional staples (bread, cereal, soups) remain important but rank below these top categories.

Key insights after analysis

- Snacks, Frozen, and Personal Care aisles dominate product variety.
- Dairy & Eggs and Produce attract the most unique users.
- Average order size is 10 products, showing bulk shopping habits.
- Order peaks: late mornings (10 AM – 2 PM), with Sundays and Mondays highest.
- Reorders are common → strong customer loyalty.
- Power users drive a significant share of total activity.

Overall: Customers favor convenience & indulgence, shop most on weekends/start of week, and show strong repeat-purchase behavior.

Visualisation using Power BI:

- Built **KPI cards** for quick data overview (departments, products, peak order hour, top department).
- Created a **navigation system (Home/Next buttons)** for easy movement between pages.
- Added **high-level visuals** like *Top Aisles, Top Departments, Daily Order Trends, Reorder Leaders and Order Intervals*, giving a holistic view of user behavior and product dynamics.

client_proj • Last saved: 9/17/2025 at 7:04 PM

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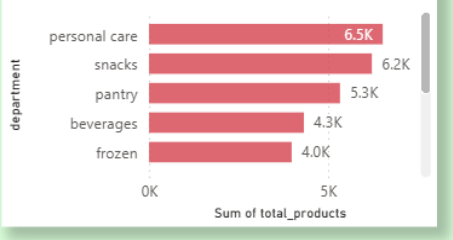
Market Analysis

Unique Departments	Unique Products	Peak order hour(day)	Top Product Department
20	49K	10	Personal Care

Top 10 Aisles with the Highest Number of Products

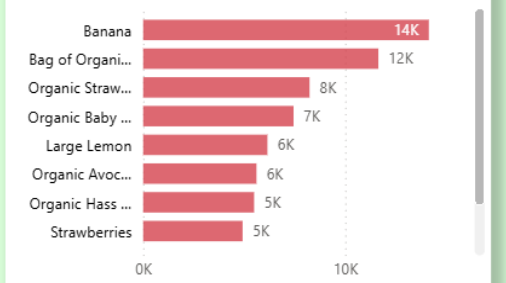
Top 10 Departments with Most Products



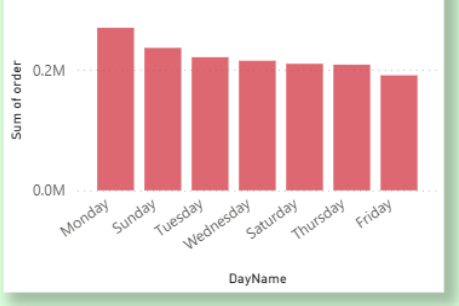
Avg. Order Interval

User_id	Avg Days Between Orders
4730	0.00
6118	0.00
6482	0.00
6696	0.00
11334	0.00
16567	0.00
18632	0.00
22274	0.00
25388	0.00
30564	0.00
33867	0.00
37701	0.00
37913	0.00
37949	0.00
39509	0.00
42206	0.00
46454	0.00
48465	0.00
49186	0.00

Products with highest reorder rates



Daily Order Trends



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Visualizations

Build visual

Values

Add data fields here

Drill through

Cross-report Off

Keep all filters On

Add drill-through fields here

Data

Search

- cleaned_orders
- department+total_pro...
- departments
- dummy
- Max_ReorderCount
- order_hours_of_day
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- top_aisles
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- top_products
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- unique_products
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client_proj • Last saved: 9/17/2025 at 7:04 PM

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Transform data Refresh — Queries

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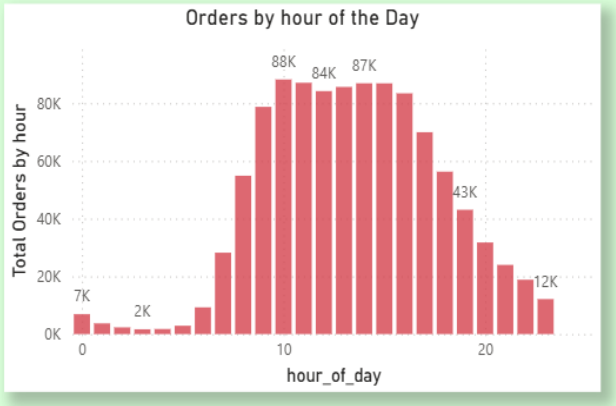

Most re-ordered products in each department

Department	product_name
bakery	100% Whole Wheat Bread
snacks	Almonds
babies	Baby Wipes
produce	Banana
household	Bathroom Tissue, 1â€'Ply, 1000 Sheet Rolls
meat seafood	Boneless Skinless Chicken Breast
alcohol	Chardonnay Wine
frozen	Cheese Pizza Snacks
snacks	Chocolate Chip Cookies
pets	Chopped Blends With Lamb Brown Rice Carrots Tomatoes & Spinach Dog

Visualizations

Build visual

Values

Add data fields here

Drill through

Cross-report Off

Keep all filters On

Add drill-through fields here

Data

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