# New Wheels Project

## Introduction to SQL

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## Problem Statement

### Business Context

A lot of people in the world share a common desire: to own a vehicle. A car or an automobile is seen as an object that gives the freedom of mobility. Many now prefer pre-owned vehicles because they come at an affordable cost, but at the same time, they are also concerned about whether the after-sales service provided by the resale vendors is as good as the care you may get from the actual manufacturers.

New-Wheels, a vehicle resale company, has launched an app with an end-to-end service from listing the vehicle on the platform to shipping it to the customer's location. This app also captures the overall after-sales feedback given by the customer.

### Objective

New-Wheels sales have been dipping steadily in the past year, and due to the critical customer feedback and ratings online, there has been a drop in new customers every quarter, which is concerning to the business. The CEO of the company now wants a quarterly report with all the key metrics sent to him so he can assess the health of the business and make the necessary decisions.

As a data analyst, you see that there is an array of questions that are being asked at the leadership level that need to be answered using data. Import the dump file that contains various tables that are present in the database. Use the data to answer the questions posed and create a quarterly business report for the CEO.

# Business Questions

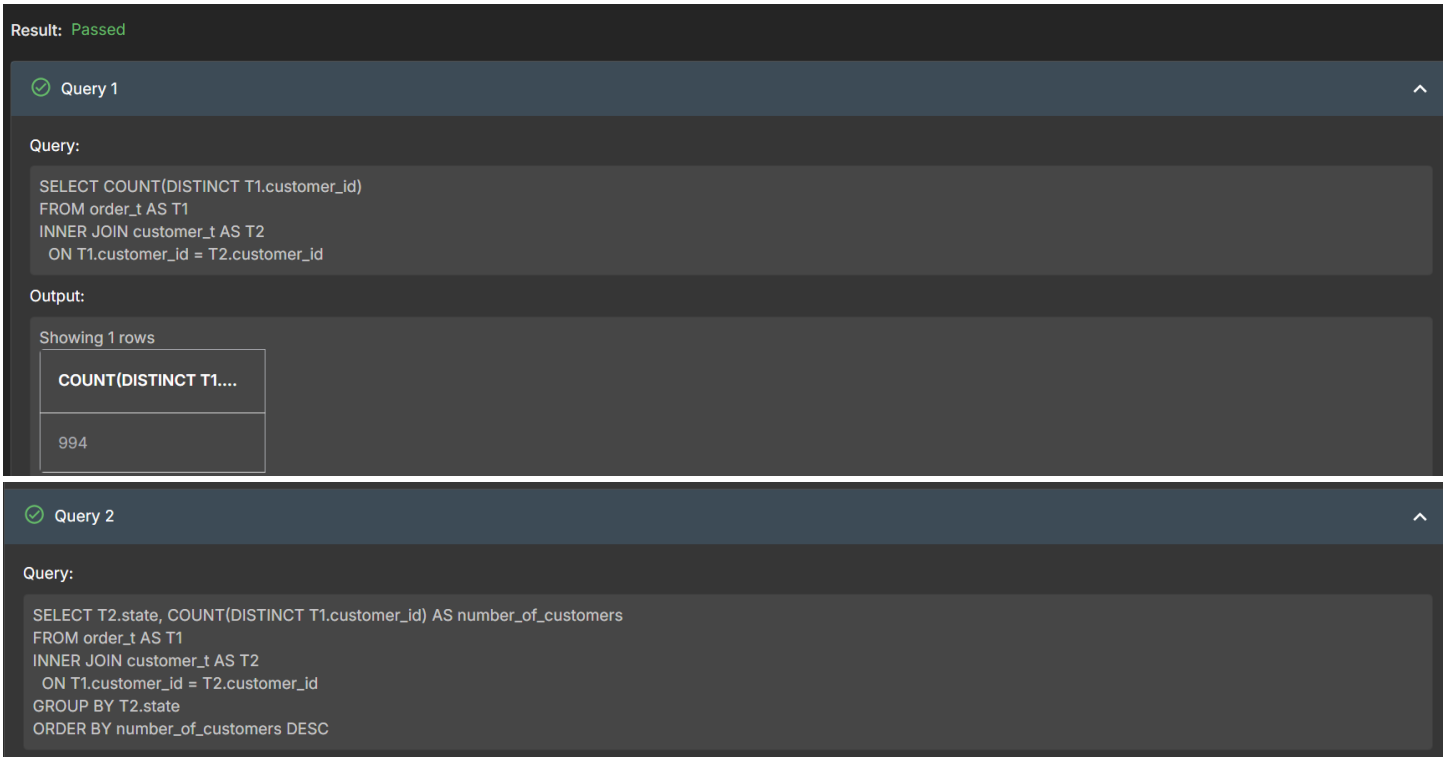
## Question 1: Find the total number of customers who have placed orders. What is the distribution of the customers across states?

**Solution Query:**

```
SELECT COUNT(DISTINCT T1.customer_id)
FROM order_t AS T1
INNER JOIN customer_t AS T2
  ON T1.customer_id = T2.customer_id;


SELECT T2.state, COUNT(DISTINCT T1.customer_id) AS number_of_customers
FROM order_t AS T1
INNER JOIN customer_t AS T2
  ON T1.customer_id = T2.customer_id
GROUP BY T2.state
ORDER BY number_of_customers DESC;
```

**Output:**



Output:

Showing first 10 rows out of 49 rows

| state | number_of_customers |
|---|---|
| Texas | 97 |
| California | 97 |
| Florida | 86 |
| New York | 69 |
| District of Columbia | 35 |
| Ohio | 33 |
| Colorado | 33 |
| Alabama | 29 |
| Washington | 28 |
| Arizona | 26 |

**Observations:**

- The total number of customers who have placed an order is 994.
- The top four states that account for a significant portion of the total customer base are Texas and California leading with 97 customers followed by Florida with 86 customers and New York with a notable presence of 69 customers.
  Areas with few customers are; Colorado, Alabama, Ohio, District of Columbia, Washington and Arizona.

**Key Insights and Recommendations:**

- **Market Concentration:** New Wheels has a strong presence in a few key states like Texas, California, Florida, New York. The company could focus on strengthening its presence in these areas through targeted marketing or enhanced services.

- **Growth Opportunities:** States with a smaller customer count represent potential growth areas. New Wheels could investigate why customer numbers are lower in these states and develop strategies to expand its market share there. This might involve competitive pricing, localized advertising, or partnerships with local service centers.

- **Service and Logistics Optimization:** The high concentration of customers in states like Texas and California could be leveraged to optimize logistics and after-sales service. For example, setting up

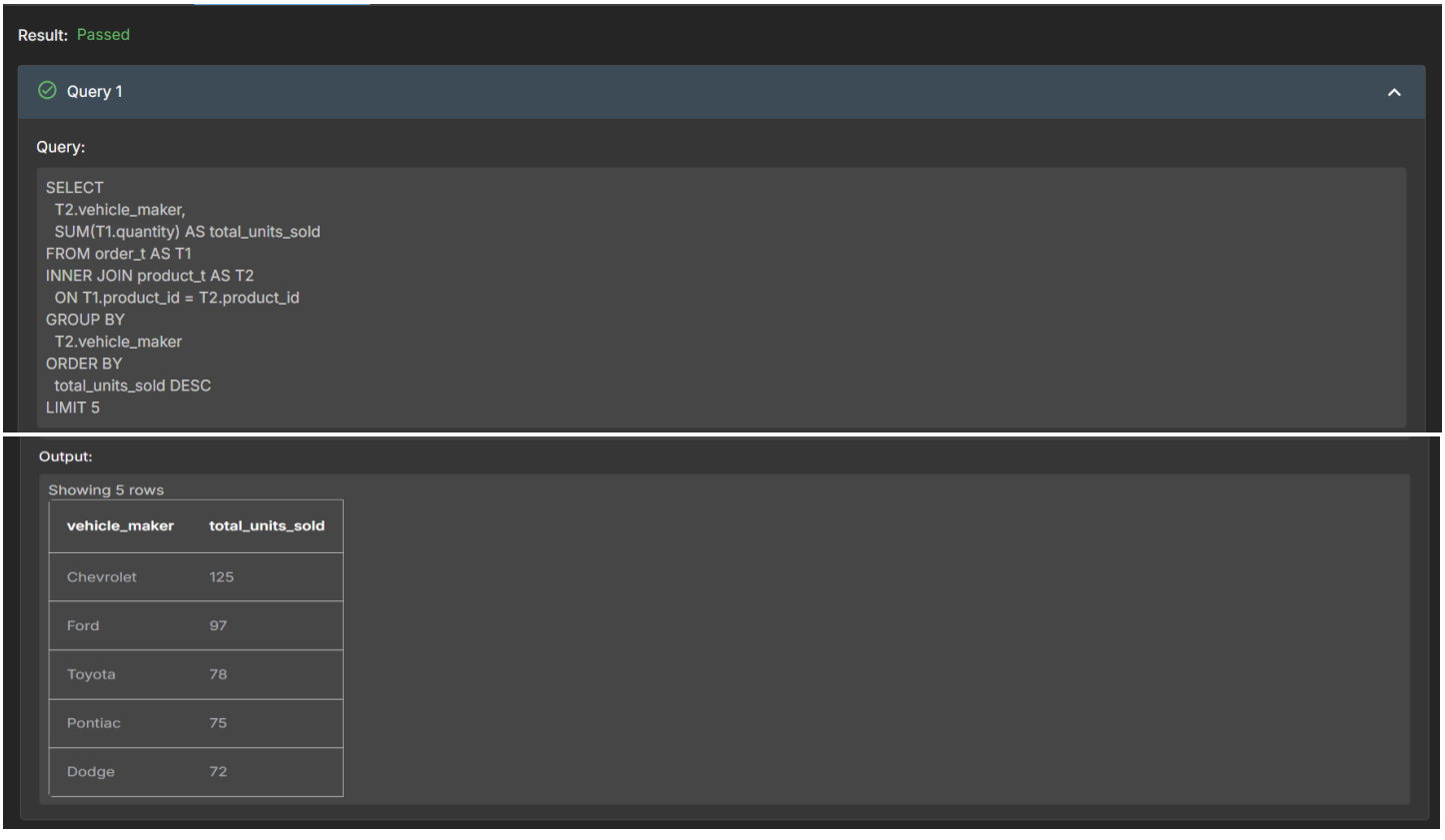
regional hubs in these states might improve shipping times and customer satisfaction, directly addressing the business's concern about after-sales feedback.

## Question 2: Which are the top 5 vehicle makers preferred by the customers?

**Solution Query:**

```
SELECT
  T2.vehicle_maker,
  SUM(T1.quantity) AS total_units_sold
FROM order_t AS T1
INNER JOIN product_t AS T2
  ON T1.product_id = T2.product_id
GROUP BY
  T2.vehicle_maker
ORDER BY
  total_units_sold DESC
LIMIT 5;
```

**Output:**



**Observations:**

The data shows the top five vehicle makers by total units sold.

- **Chevrolet** is the clear leader with **125** units sold.
- **Ford** is the second most popular with **97** units sold.
- **Toyota** follows with **78** units sold.
- **Pontiac** and **Dodge** round out the top five with **75** and **72** units sold, respectively.

**Key Insights and Recommendations:**

- The top selling brands, particularly Chevrolet and Ford, are likely driving a significant portion of New Wheels' sales volume.
- To capitalize on this, New-Wheels could:
    - Prioritize inventory of vehicles from these popular makers to meet customer demand.
    - Analyze the specific models from these makers that are selling best to further refine their purchasing strategy.
    - Develop targeted marketing campaigns highlighting the availability of these high-demand brands.

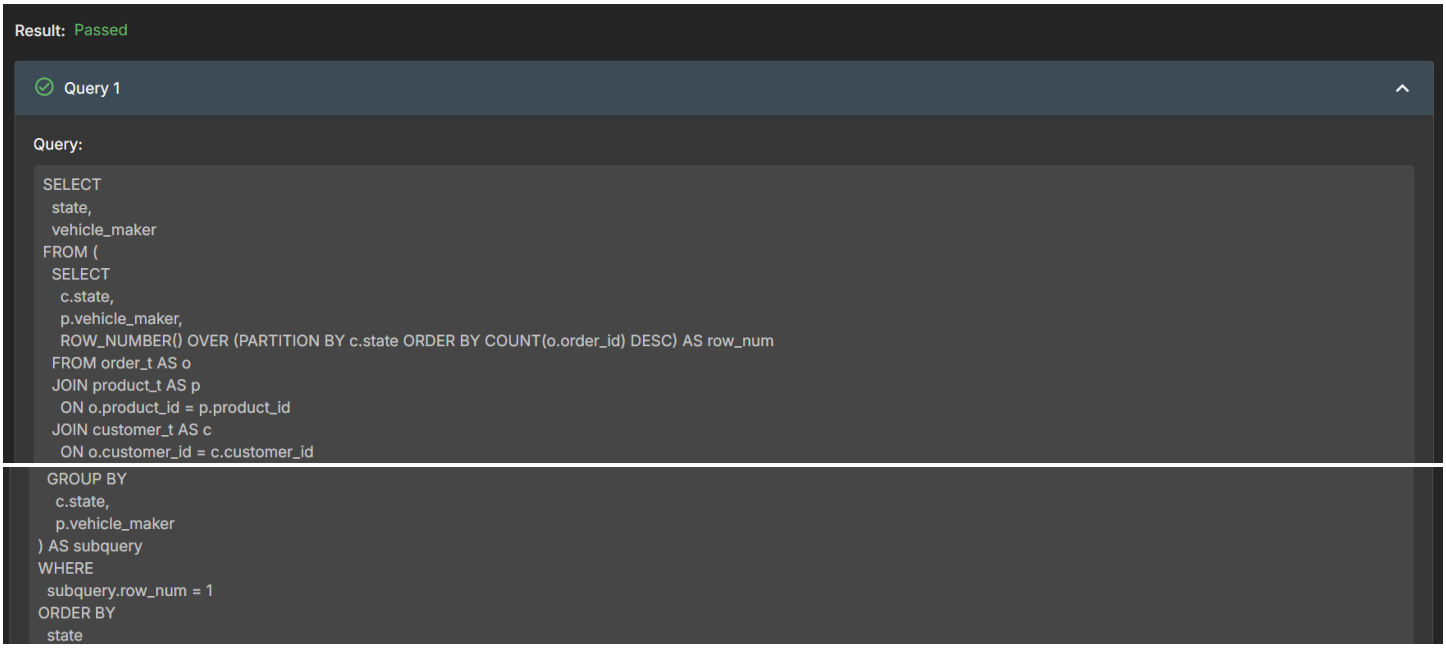
## Question 3: Which is the most preferred vehicle maker in each state?

**Solution Query:**

```
SELECT
  state,
  vehicle_maker
FROM (
  SELECT
    c.state,
    p.vehicle_maker,
    ROW_NUMBER() OVER (PARTITION BY c.state ORDER BY COUNT(o.order_id) DESC) AS row_num
  FROM order_t AS o
  JOIN product_t AS p
```

```
    ON o.product_id = p.product_id
  JOIN customer_t AS c
    ON o.customer_id = c.customer_id
  GROUP BY
    c.state,
    p.vehicle_maker
) AS subquery
WHERE
  subquery.row_num = 1
ORDER BY
  state;
```

**Output:**



Output:

Showing first 10 rows out of 49 rows

| state | vehicle_maker |
|---|---|
| Alabama | Dodge |
| Alaska | Chevrolet |
| Arizona | Pontiac |
| Arkansas | Volkswagen |
| California | Nissan |
| Colorado | Chevrolet |
| Connecticut | Volvo |
| Delaware | Mitsubishi |
| District of Columbia | Chevrolet |
| Florida | Toyota |

**Observations:**

- The output shows a diverse range of preferred vehicle makers in each state:
  - Dodge is the most preferred in Alabama.
  - Chevrolet leads in Alaska, Colorado, and the District of Columbia.
  - Pontiac is the top choice in Arizona.
  - Volkswagen is the most preferred in Arkansas.
  - Nissan is the most preferred in California.
  - Volvo is the top choice in Connecticut.
  - Mitsubishi leads in Delaware.
  - Toyota is the top choice in Florida.

**Key Insights and Recommendations:**

This data is crucial for New Wheels to tailor its inventory and marketing strategies on a regional level. Instead of a one-size-fits-all approach, the company can:

- **Optimize inventory:** Ensure that the most popular vehicle makers in each state are well stocked. For example, New Wheels should prioritize stocking Nissan vehicles in California and Toyota in Florida.
- **Target marketing campaigns:** Create state-specific marketing campaigns that highlight the most popular brands in that area. A campaign in Alabama could focus on the affordability and reliability of Dodge, while one in Alaska could promote the ruggedness of Chevrolet.
- **Explore new markets**: For states where a particular brand is dominant, New Wheels could investigate why that brand is so popular. This could reveal local preferences or economic factors that could be used to identify and stock other similar vehicles, expanding the product offerings in that region.

## Question 4: Find the overall average rating given by the customers. What is the average rating in each quarter?

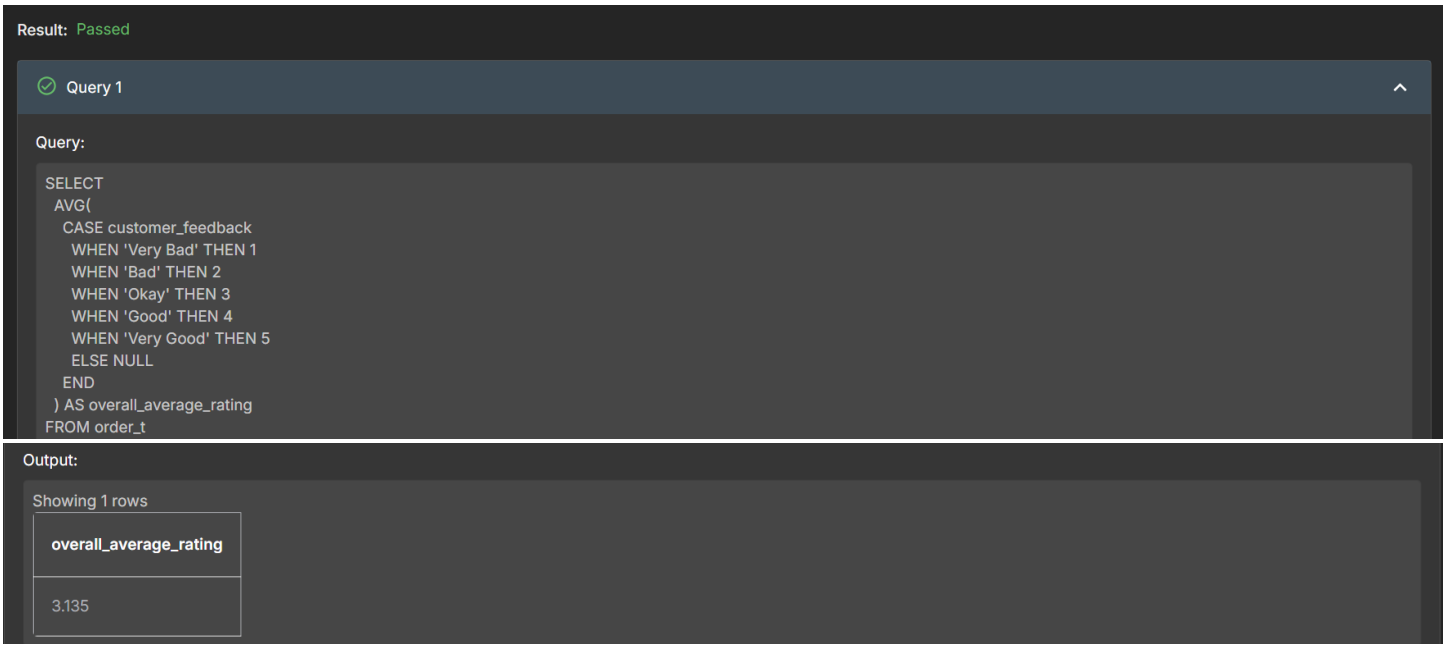
## Consider the following mapping for ratings: “Very Bad”: 1, “Bad”: 2, “Okay”: 3, “Good”: 4, “Very Good”: 5

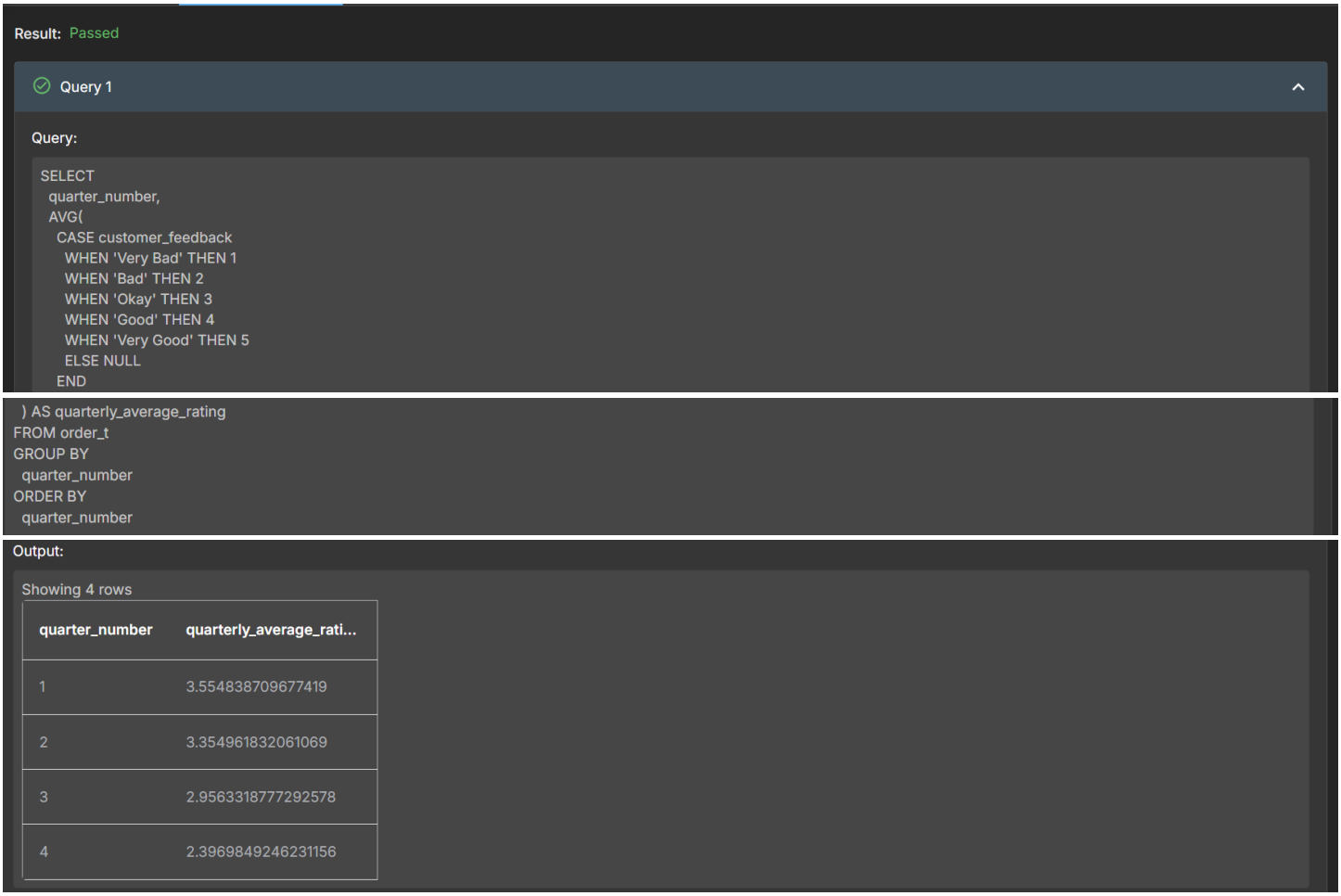
**Solution Query:**

```
SELECT
  AVG(
    CASE customer_feedback
      WHEN 'Very Bad' THEN 1
      WHEN 'Bad' THEN 2
      WHEN 'Okay' THEN 3
      WHEN 'Good' THEN 4
      WHEN 'Very Good' THEN 5
      ELSE NULL
    END
  ) AS overall_average_rating
FROM order_t;
```

```
SELECT
  quarter_number,
  AVG(
    CASE customer_feedback
      WHEN 'Very Bad' THEN 1
      WHEN 'Bad' THEN 2
      WHEN 'Okay' THEN 3
      WHEN 'Good' THEN 4
      WHEN 'Very Good' THEN 5
      ELSE NULL
    END
  ) AS quarterly_average_rating
FROM order_t
GROUP BY
  quarter_number
ORDER BY
  quarter_number;
```

**Output:**






**Observations:**

- The overall average customer rating of 3.135 is slightly above “Okay,” indicating moderate satisfaction but notable room for improvement toward “Good” or “Very Good.”
- The quarterly data reveals a concerning downward trend in customer satisfaction over the year:
  - **Quarter 1**: The average rating was 3.55.
  - **Quarter 2**: The average rating slightly decreased to 3.35.
  - **Quarter 3**: The rating dropped more significantly to 2.96, falling below the "Okay" mark.
  - **Quarter 4**: The average rating hit a low of 2.40.

**Key Insights and Recommendations:**

The data points to a clear and steady decline in customer satisfaction throughout the year, which is a major red flag for the business.

To address this, New Wheels should:

- Conduct a deeper analysis into what is causing the decline in satisfaction. This could involve examining specific customer feedback comments, looking at service times, delivery issues, or product quality problems in later quarters.
- Identify the root cause of the drop in Q3 and Q4. For example, whether the company implemented a new policy or a new service partner started in Q3. Understanding these causes is the first step to finding a solution.
- Prioritize after-sales service improvements. This could include a focus on faster response times, more efficient complaint resolution, and better quality control of shipped vehicles.

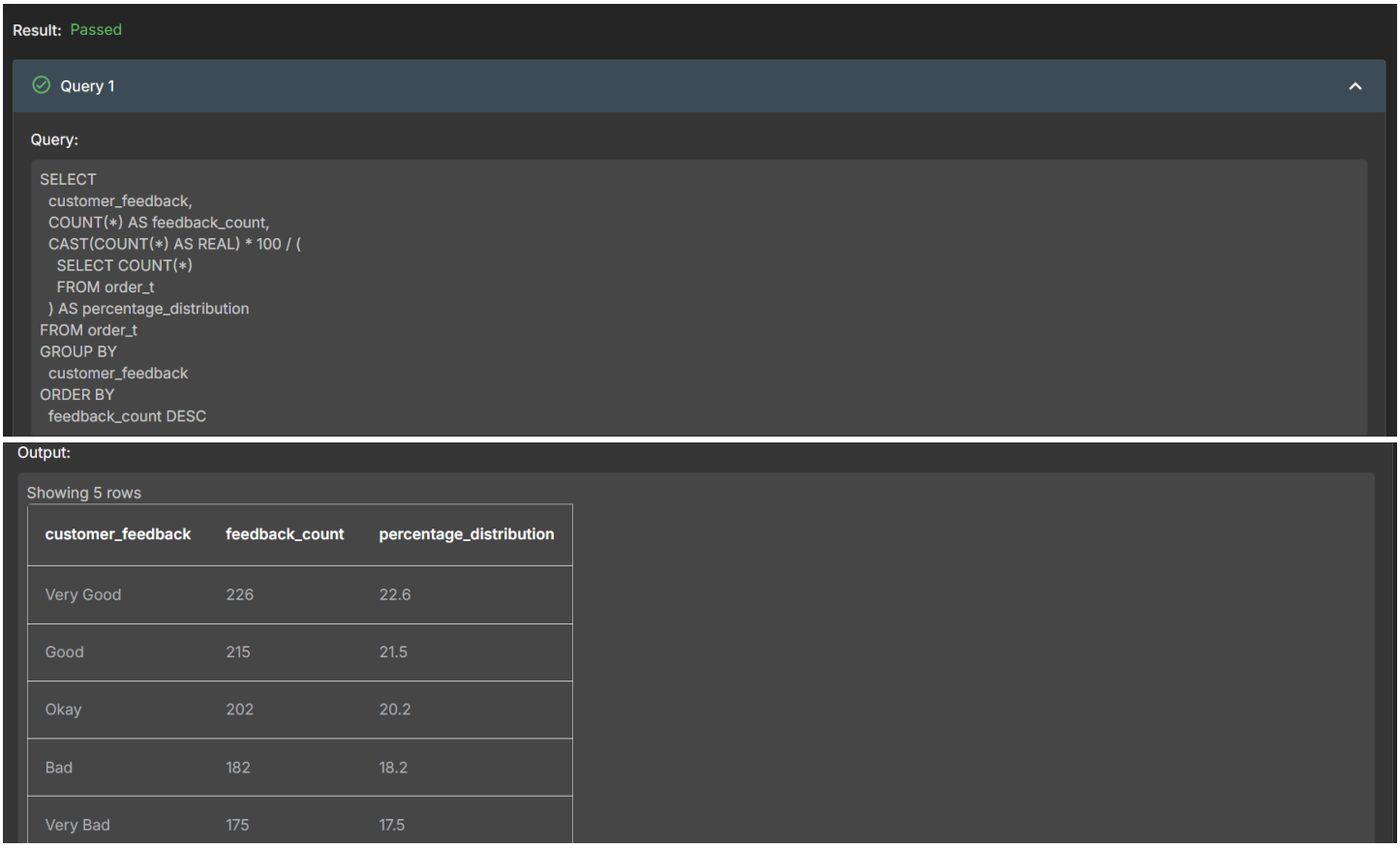
## Question 5: Find the percentage distribution of feedback from the customers. Are customers getting more dissatisfied over time?

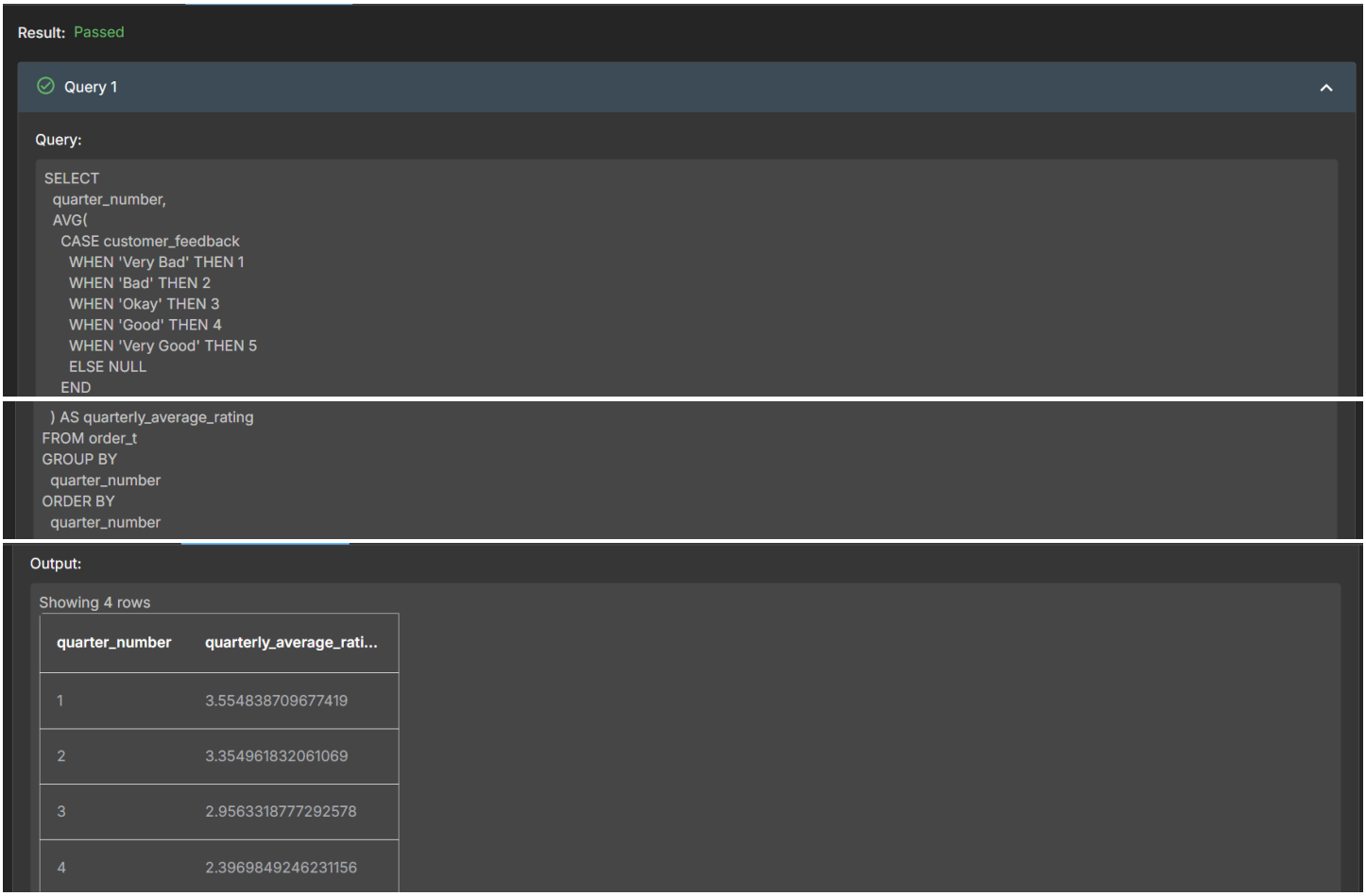
**Solution Query:**

```
 SELECT
  customer_feedback,
  COUNT(*) AS feedback_count,
  CAST(COUNT(*) AS REAL) * 100 / (
    SELECT COUNT(*)
    FROM order_t
  ) AS percentage_distribution
FROM order_t
GROUP BY
  customer_feedback
ORDER BY
  feedback_count DESC;
  SELECT
  quarter_number,
  AVG(
    CASE customer_feedback
```

```
      WHEN 'Very Bad' THEN 1
      WHEN 'Bad' THEN 2
      WHEN 'Okay' THEN 3
      WHEN 'Good' THEN 4
      WHEN 'Very Good' THEN 5
      ELSE NULL
    END
  ) AS quarterly_average_rating
FROM order_t
GROUP BY
  quarter_number
ORDER BY
  quarter_number;
```

**Output:**






**Observations:**

- The overall distribution of customer feedback indicates that "Very Good" forms the largest category. However, the combination of "Bad" and "Very Bad" feedback totals 35.7% of all responses. This is a significant portion of customers who are dissatisfied.
- The quarterly data still indicates a clear and concerning trend of increasing customer dissatisfaction
    - **Quarter 1:** The average rating was 3.55.
    - **Quarter 2:** The average rating slightly decreased to 3.35.
    - **Quarter 3:** The rating dropped more significantly to 2.96.
    - **Quarter 4:** The average rating hit a low of 2.40.

**Key Insights and Recommendations:**

The data shows a critical and accelerating decline in customer satisfaction throughout the year. Even with a more balanced overall feedback distribution, the quarterly trend is alarming.

To address this, New Wheels should:

- **Identify the root cause of the quarterly decline:** Investigate what changed in Q3 and Q4 that led to such a steep drop in customer ratings. This could be due to issues with after-sales service, as highlighted in the business context, or other factors like vehicle quality or delivery problems.
- **Focus on service recovery:** For the 35.7% of customers giving "Bad" or "Very Bad" feedback, New Wheels should implement a proactive service recovery strategy. This could include reaching out to these customers to understand their issues and offer solutions.
- **Improve the after-sales experience:** A key area of concern is after-sales service. The company should use this data to justify investment in improving customer support, service centers, and the overall post purchase experience.

## Question 6: What is the trend of the number of orders by quarter?

**Solution Query:**

```
SELECT
  quarter_number,
  COUNT(order_id) AS number_of_orders
FROM order_t
GROUP BY
  quarter_number
ORDER BY
  quarter_number;
```

**Output:**

Result: Passed

Query 1

Query:

```
SELECT
  quarter_number,
  COUNT(order_id) AS number_of_orders
FROM order_t
GROUP BY
  quarter_number
ORDER BY
  quarter_number
```

Output:

Showing 4 rows

| quarter_number | number_of_orders |
|---|---|
| 1 | 310 |
| 2 | 262 |
| 3 | 229 |
| 4 | 199 |

**Observations:**

- The results show a clear and consistent downward trend:
    - **Quarter 1:** 310 orders.
    - **Quarter 2:** 262 orders.
    - **Quarter 3:** 229 orders.
    - **Quarter 4:** 199 orders.

**Key Insights and Recommendations:**

The number of orders has steadily decreased from the first quarter to the fourth quarter. This decline is a major contributing factor to the company's "dipping sales" and "drop in new customers".

The drop in orders correlates with the decline in customer ratings. This suggests that as customers become more dissatisfied, the business is not only losing repeat business but also failing to attract new customers, leading to a shrinking order volume over time

To reverse this trend, New Wheels must:

- **Address the root causes of customer dissatisfaction:** As identified in previous analyses, the decline in ratings is a key issue. Improving after-sales service and addressing customer feedback directly are crucial steps.

- **Implement targeted marketing campaigns:** The company could strategically launch promotions or advertising campaigns in the later quarters to counteract the seasonal or year-end slump in sales.
- **Analyze the sales funnel:** A deeper dive into the data could help understand where potential customers are dropping off. Are they not completing orders? Is the website experience poor? Answering these questions can help optimize the sales process and increase conversion rates.

## Question 7: Calculate the net revenue generated by the company. What is the quarter-over-quarter % change in net revenue?

**Solution Query:**

```
SELECT
    ROUND(SUM(quantity * vehicle_price * (1 - discount)), 2) AS net_revenue
FROM order_t;


SELECT
    quarter_number,
    ROUND(SUM(quantity * p.vehicle_price * (1 - discount)), 2) AS net_revenue,
    ROUND(
        (
            (SUM(quantity * p.vehicle_price * (1 - discount))
             - LAG(SUM(quantity * p.vehicle_price * (1 - discount)))
               OVER (ORDER BY quarter_number)
            )
            / LAG(SUM(quantity * p.vehicle_price * (1 - discount)))
               OVER (ORDER BY quarter_number)
        ) * 100, 2
    ) AS qoq_percentage_change
FROM order_t o
JOIN product_t p
    ON o.product_id = p.product_id
```

```
GROUP BY quarter_number

ORDER BY quarter_number;
```

## Output:

Result: Passed

Query 1

Query:

```
SELECT
   ROUND(SUM(quantity * vehicle_price * (1 - discount)), 2) AS net_revenue
FROM order_t
```

Output:

Showing 1 rows

| net_revenue |
| --- |
| 48610993.78 |

Result: Passed

Query 1

Query:

```
SELECT
   quarter_number,
   ROUND(SUM(quantity * p.vehicle_price * (1 - discount)), 2) AS net_revenue,
   ROUND(
      (
         (SUM(quantity * p.vehicle_price * (1 - discount))
          - LAG(SUM(quantity * p.vehicle_price * (1 - discount)))
            OVER (ORDER BY quarter_number)
         )
         / LAG(SUM(quantity * p.vehicle_price * (1 - discount)))
            OVER (ORDER BY quarter_number)
      ) * 100, 2
   ) AS qoq_percentage_change
FROM order_t o
JOIN product_t p
   ON o.product_id = p.product_id
GROUP BY quarter_number
ORDER BY quarter_number
```

Output:

Showing 4 rows

| quarter_number | net_revenue | qoq_percentage_change |
| --- | --- | --- |
| 1 | 18032549.9 | |
| 2 | 13122995.78 | -27.23 |
| 3 | 8882298.84 | -32.32 |
| 4 | 8573149.24 | -3.48 |

**Observations:**

- The total net revenue for the year is **$48,610,993.78**
- The quarter-over-quarter percentage change in net revenue reveals a consistent and significant decline.

| Quarter | Net Revenue | % Quarter-Over Quarter Change |
|---|---|---|
| Q1 | $18,032,549.90 | N/A |
| Q2 | $13,122,995.78 | -27.23% |
| Q3 | $8,882,298.84 | -32.32% |
| Q4 | $8,573,149.24 | -3.48% |

**Key Insights and Recommendations:**

The data shows a troubling trend:

- **Consistent Revenue Decline**: The company has experienced a steady and significant decrease in net revenue across all quarters, from Q1 to Q4.
- **Sharp Initial Drop:** The most substantial decline occurred between Q1 and Q2, with net revenue plummeting by 27.23%. This indicates a significant loss of financial momentum early in the period.
- **Continued Erosion:** While the percentage drops in subsequent quarters (Q2 to Q3 at -32.32% and Q3 to Q4 at -3.48%) are varied, they still collectively demonstrate a troubling downward trajectory in revenue. The Q2 to Q3 drop is particularly alarming as it represents the largest percentage decline, suggesting an accelerating problem after the initial hit.
- **Implications for Business Health:** This sustained decline in net revenue is a critical indicator of underlying business challenges that require immediate attention.

To address this critical situation, New Wheels should:

- **Conduct Root Cause Analysis:** Urgently investigate the specific drivers behind the consistent revenue decline. This should include analyzing if the issue stems from a decrease in the number of orders, a reduction in the average vehicle price, increased discounts, or a combination of these factors.
- **Prioritize Customer Retention and Acquisition:** Given the evident revenue loss, it's crucial to evaluate customer acquisition strategies and, more importantly, customer retention efforts. Understanding why

customers are not making repeat purchases or why new customers aren't being attracted is paramount.

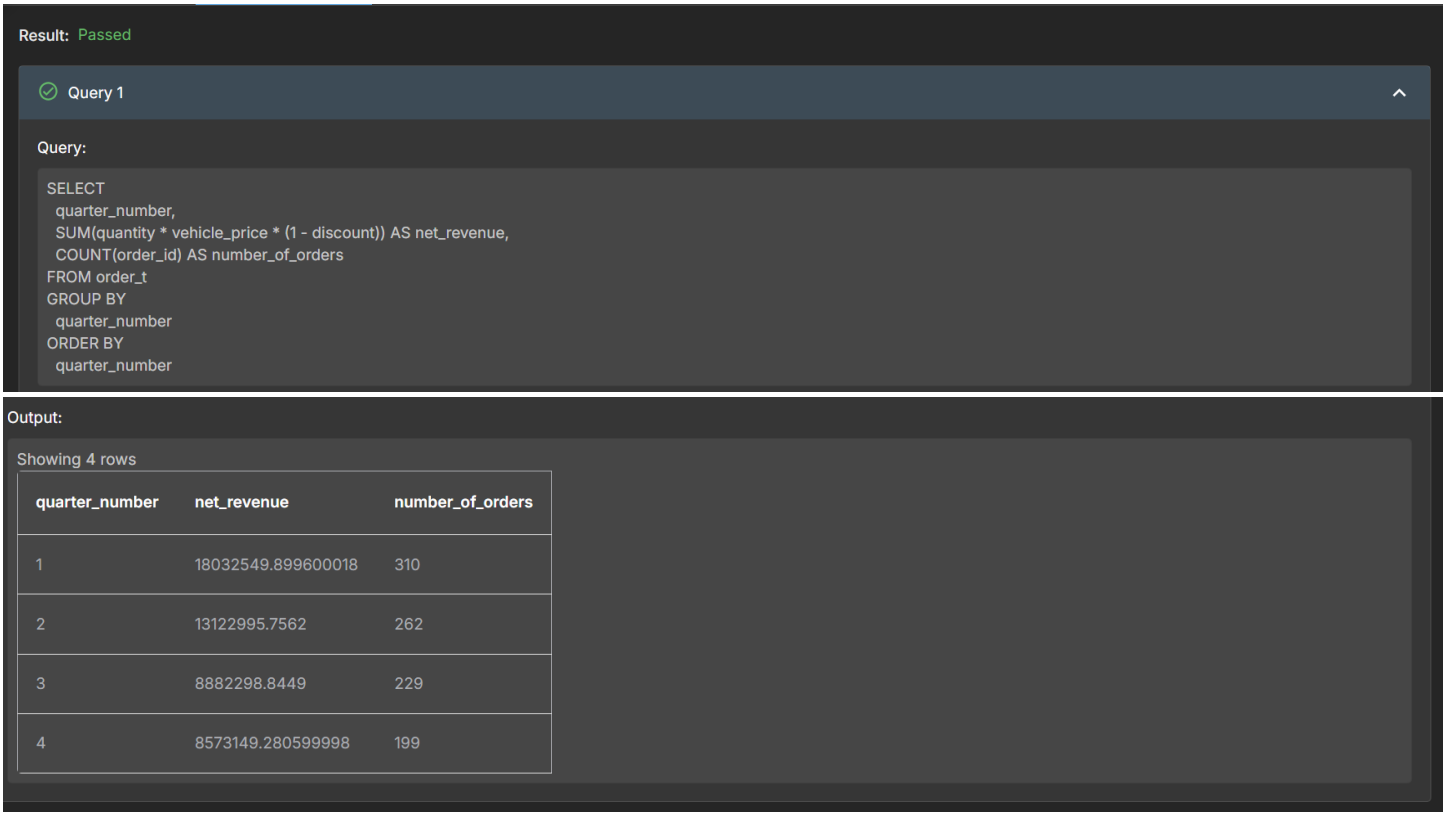
- **Evaluate Market and Operational Efficiencies:** Assess external market conditions that might be impacting sales, as well as internal operational efficiencies that could be contributing to revenue leakage. This might involve reviewing pricing strategies, marketing effectiveness, and sales processes.
- **Develop a Revenue Recovery Plan:** Based on the insights from the root cause analysis, formulate a comprehensive plan aimed at stabilizing and then growing net revenue. This plan should include concrete actions with measurable outcomes, such as targeted marketing campaigns, adjustments to product offerings, or improvements in customer service to rebuild trust and drive sales.

## Question 8: What is the trend of net revenue and orders by quarters?

**Solution Query:**

```
 SELECT
  quarter_number,
  SUM(quantity * vehicle_price * (1 - discount)) AS net_revenue,
  COUNT(order_id) AS number_of_orders
FROM order_t
GROUP BY
  quarter_number
ORDER BY
  quarter_number;
```

**Output:**



**Observations:**

- **Net Revenue:** Net revenue has declined each quarter, with a very significant drop from Q1 to Q2, and then a more gradual but still substantial decline through Q4. The total net revenue for the year has a clear downward trajectory
- **Number of Orders:** The number of orders also shows a steady decrease from quarter to quarter. The decline from 310 orders in Q1 to 199 in Q4 represents a substantial drop in sales volume over the year.

**Key Insights and Recommendations:**

- The company faces a core business issue, with declining revenue and orders signaling trouble in attracting and retaining customers, shrinking its market presence, and hurting finances.
- This financial performance is likely a direct result of the declining customer satisfaction, as evidenced by the quarterly average ratings (Q1: 3.55, Q2: 3.35, Q3: 2.96, Q4: 2.40).
- The dip in customer feedback and the subsequent decline in orders and revenue create a vicious cycle that is detrimental to the business's health.

To address this critical situation New Wheels should prioritize a comprehensive strategy focused on:

- **Customer Experience:** Immediately investigate and resolve the root causes of customer dissatisfaction. This is the most critical issue, as it is driving the decline in both orders and revenue.
- **Revenue Recovery:** Develop and implement strategies to reverse the negative revenue trend. This could include targeted promotions, improvements to the sales process, or a re-evaluation of pricing and discounts.
- **Market Analysis:** Use data on top-selling brands and popular states to optimize inventory and marketing efforts, ensuring resources are allocated to the most promising areas.

## Question 9: What is the average discount offered for different types of credit cards?

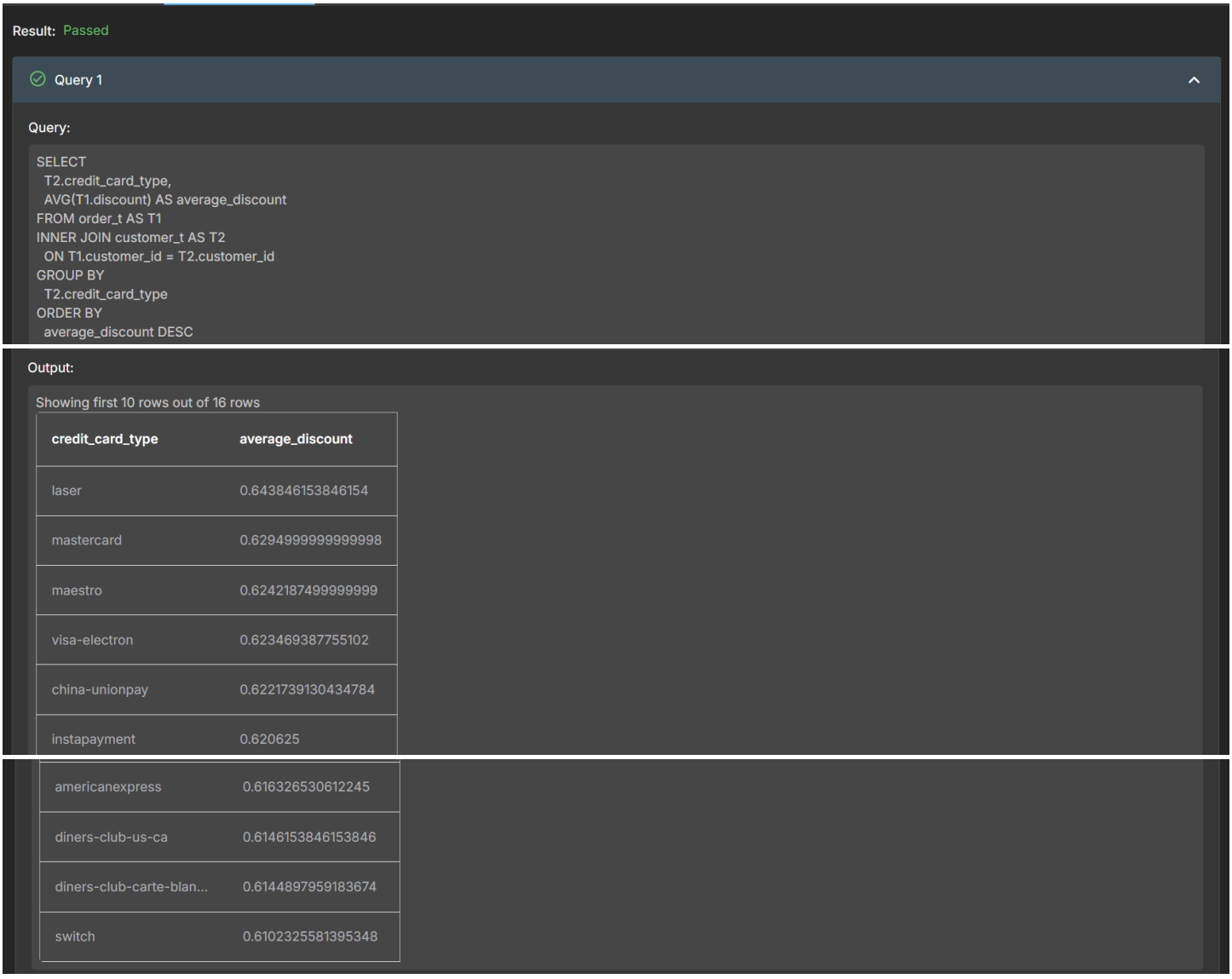
**Solution Query:**

```
  SELECT
  T2.credit_card_type,
  AVG(T1.discount) AS average_discount
FROM order_t AS T1
INNER JOIN customer_t AS T2
```

```
  ON T1.customer_id = T2.customer_id
GROUP BY
  T2.credit_card_type
ORDER BY
 average_discount DESC;
```

**Note**: The '`discount`' field in the '`order_t`' table is stored as a percentage, i.e. `0.6` represents a discount of `0.6%`, not `60%`.

**Output:**



**Observations:**

- The data shows that New Wheels offers very low average discounts, with a narrow range across all card types.

**Key Insights and Recommendations:**

- **Low Discounts:** The average discount offered across all credit card types is less than 1%. This is a very minimal discount and is unlikely to be a major factor in driving sales or customer loyalty.
- **Minimal Variation:** The discounts are very consistent, with the highest average at 0.64% and the lowest at 0.61%. This means there is no strategic discounting based on card type.
- **Conflicting Strategies**: The data reveals that New Wheels is not using significant discounts as a tool to attract customers.
- **Profitability vs. Customer Acquisition**: While a low discount strategy could protect profit margins, it may not be effective in a competitive market. The high customer dissatisfaction and declining sales suggest that the current pricing and value proposition are not working.

New-Wheels should re-evaluate its discounting strategy. They may need to consider offering more impactful discounts, especially in combination with a push to improve after-sales service, to attract and retain customers and ultimately reverse the negative trends in sales and revenue.

## Question 10: What is the average time taken to ship the placed orders for each quarter?

**Solution Query:**

```
SELECT
  quarter_number,
  AVG(julianday(ship_date) - julianday(order_date)) AS average_shipping_days
FROM order_t
GROUP BY
  quarter_number
ORDER BY
  quarter_number;
```

**Output:**

Result: Passed

Query 1

Query:

```
SELECT
  quarter_number,
  AVG(julianday(ship_date) - julianday(order_date)) AS average_shipping_days
FROM order_t
GROUP BY
  quarter_number
ORDER BY
  quarter_number
```

Output:

Showing 4 rows

| quarter_number | average_shipping_days |
|---|---|
| 1 | 57.16774193548387 |
| 2 | 71.11068702290076 |
| 3 | 117.75545851528385 |
| 4 | 174.09547738693468 |

**Observations:**

- The data shows the average number of days it took to ship an order for each of the four quarters. The trend is a significant and consistent increase in shipping time over the year.
    - **Quarter 1:** The average shipping time was 57.17 days.
    - **Quarter 2:** The average shipping time increased to 71.11 days.
    - **Quarter 3:** The average shipping time jumped to 117.75 day.
    - **Quarter 4:** The average shipping time continued to climb, reaching 174.09 days.

**Key Insights and Recommendations:**

- The dramatic increase in shipping time is a critical issue. The time it takes to deliver a vehicle nearly tripled from Q1 to Q4 (from approximately 57 days to 174 days).

This sharp decline in operational efficiency is likely a major contributor to the other negative trends observed in the data:

- **Decreasing Customer Ratings**: The escalating shipping delays directly correspond to the significant drop in customer ratings and satisfaction over the quarters. Long waits for a vehicle would understandably lead to negative feedback.

- **Falling Order Volume**: The extended delivery times could be a factor in the decline in new orders, as potential customers might be deterred by the long wait times.
- **Dipping Revenue:** The decline in orders and customer satisfaction, both linked to shipping delays, has a direct impact on the company's revenue.

The company must immediately address the shipping and logistics problems. The CEO needs to understand the root cause of these delays. Is it a problem with:

- The logistics providers?
- The company's internal processing and fulfillment procedures?
- An increase in order volume that the logistics system cannot handle?

By fixing the shipping delays, New Wheels can directly impact and improve customer satisfaction, which, in turn, may help to reverse the negative trends in order volume and revenue

## Business Metrics Overview

| Total Revenue | Total Orders | Total Customers | Average Rating |
|---|---|---|---|
| $48,551,093.76 | 1,000 | 994 | 3.135 |
| **Last Quarter Revenue** | **Last quarter Orders** | **Average Days to Ship** | **% Good Feedback** |
| $8,573,149.28 | 199 | 97.96 | 21.5% |

**Note**: These values must be derived using SQL queries. Some of them may have already been obtained while answering previous questions.

## Business Recommendations

- **Prioritize After-Sales Service and Logistics:** The top priority is fixing after-sales service by addressing shipping delays, which rose from 57 days in Q1 to 174 days in Q4, causing drops in customer satisfaction and orders.
- **Develop a Targeted Customer Retention Strategy:** To counter falling orders and ratings, focus on re-engaging past customers with exceptional service, targeted promotions, strong after-sales support, and proactive order updates to rebuild trust.

- **Rethink Pricing and Discounting:** With current discounts at only 0.6%, New Wheels should consider offering larger but profitable incentives or value-added services to boost sales, while balancing this against profit margins strained by high shipping costs.

- **Leverage Geographic and Brand-Specific Insights:** Use regional brand preferences to optimize inventory and marketing, stocking top-selling brands per state and running localized campaigns to boost sales across all markets.

- **Investigate and Reverse the Vicious Cycle:** Break the cycle of falling ratings, orders, and revenue by fixing operational issues like shipping delays and acting on customer feedback to drive lasting satisfaction and growth.