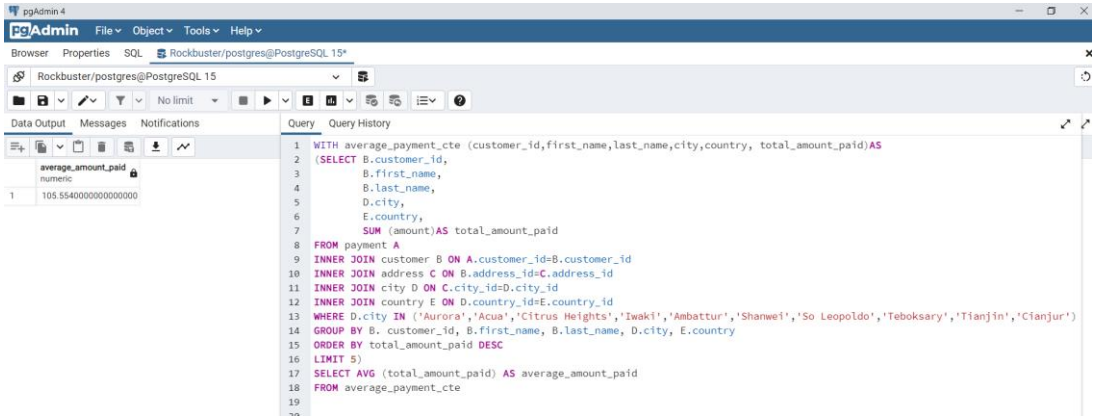
Task 9. Common Table Expressions

Answers 3.9

Step 1: Answer the business questions from step 1 and 2 of task 3.8 using CTEs

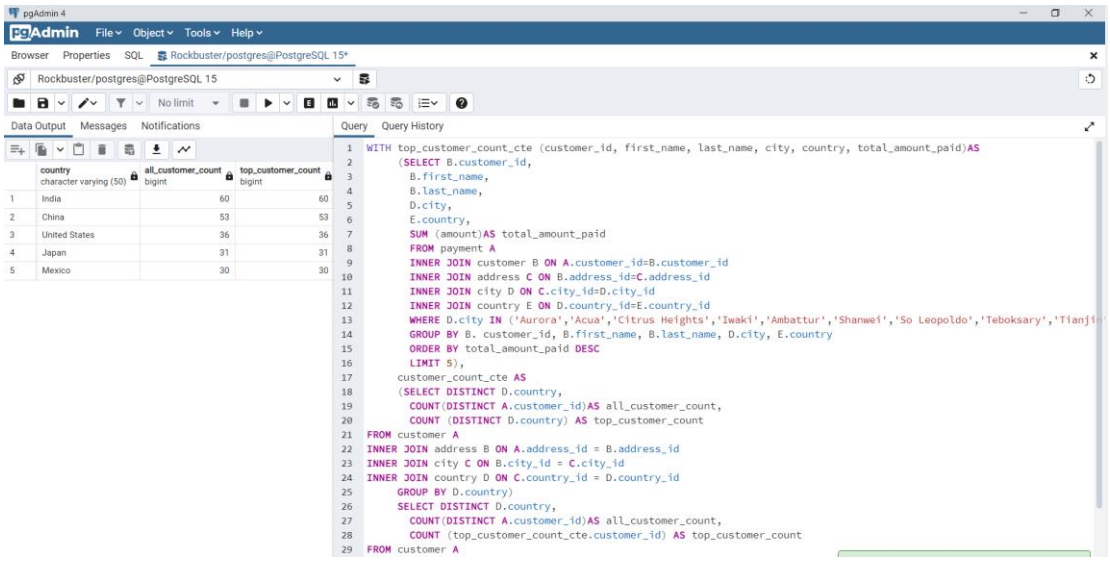
- CTE (converted from subquery on step 1): **Objective: find the average amount paid by the top 5 customers**

```
WITH average_payment_cte
(customer_id,first_name,last_name,city,country, total_amount_paid)AS
(SELECT B.customer_id,
        B.first_name,
        B.last_name,
        D.city,
        E.country,
        SUM (amount)AS total_amount_paid
FROM payment A
INNER JOIN customer B ON A.customer_id=B.customer_id
INNER JOIN address C ON B.address_id=C.address_id
INNER JOIN city D ON C.city_id=D.city_id
INNER JOIN country E ON D.country_id=E.country_id
WHERE D.city IN ('Aurora','Acua','Citrus
Heights','Iwaki','Ambattur','Shanwei','So
Leopoldo','Teboksary','Tianjin','Cianjur')
GROUP BY B. customer_id, B.first_name, B.last_name, D.city, E.country
ORDER BY total_amount_paid DESC
LIMIT 5)
SELECT AVG (total_amount_paid) AS average_amount_paid
FROM average_payment_cte
```



- CTE (converted from subquery on step 2): **Objective: Find out how many of the top 5 customers are based within each country.**

```
WITH top_customer_count_cte (customer_id, first_name, last_name, city, country, total_amount_paid)AS
    (SELECT B.customer_id,
      B.first_name,
            B.last_name,
            D.city,
            E.country,
            SUM (amount)AS total_amount_paid
      FROM payment A
      INNER JOIN customer B ON A.customer_id=B.customer_id
      INNER JOIN address C ON B.address_id=C.address_id
      INNER JOIN city D ON C.city_id=D.city_id
      INNER JOIN country E ON D.country_id=E.country_id
      WHERE D.city IN ('Aurora','Acua','Citrus Heights','Iwaki','Ambattur','Shanwei','So Leopoldo','Teboksary','Tianjin','Cianjur')
      GROUP BY B. customer_id, B.first_name, B.last_name, D.city, E.country
      ORDER BY total_amount_paid DESC
      LIMIT 5),
          customer_count_cte AS
          (SELECT DISTINCT D.country,
      COUNT(DISTINCT A.customer_id)AS all_customer_count,
            COUNT (DISTINCT D.country) AS top_customer_count
FROM customer A
INNER JOIN address B ON A.address_id = B.address_id
INNER JOIN city C ON B.city_id = C.city_id
INNER JOIN country D ON C.country_id = D.country_id
          GROUP BY D.country)
          SELECT DISTINCT D.country,
      COUNT(DISTINCT A.customer_id)AS all_customer_count,
            COUNT (top_customer_count_cte.customer_id) AS top_customer_count
FROM customer A
INNER JOIN address B ON A.address_id = B.address_id
INNER JOIN city C ON B.city_id = C.city_id
INNER JOIN country D ON C.country_id = D.country_id
LEFT JOIN top_customer_count_cte ON D.country=top_customer_count_cte.country
GROUP BY D.country
ORDER BY top_customer_count DESC
LIMIT 5
```



1. **Write 2 to 3 sentences explaining how you approached this step, for example, what you did first, second, and so on.**

The first query was relatively easy. I first copy pasted the query from step 1 and added a CTE syntax to it, using the previous sub-query as the CTE, then followed by the main statement.

The second query took me quite a long time to get to.

First, I copy pasted the subquery from step 2/task 3.8, then I identified the part that should go into my CTE, however, I realized I would need more than one CTE, to reflect the whole query. By doing some research online, I realized we can have two CTE after WITH (the first references the second), so I used two CTE.

Step 2: Compare the performance of your CTEs and subqueries.

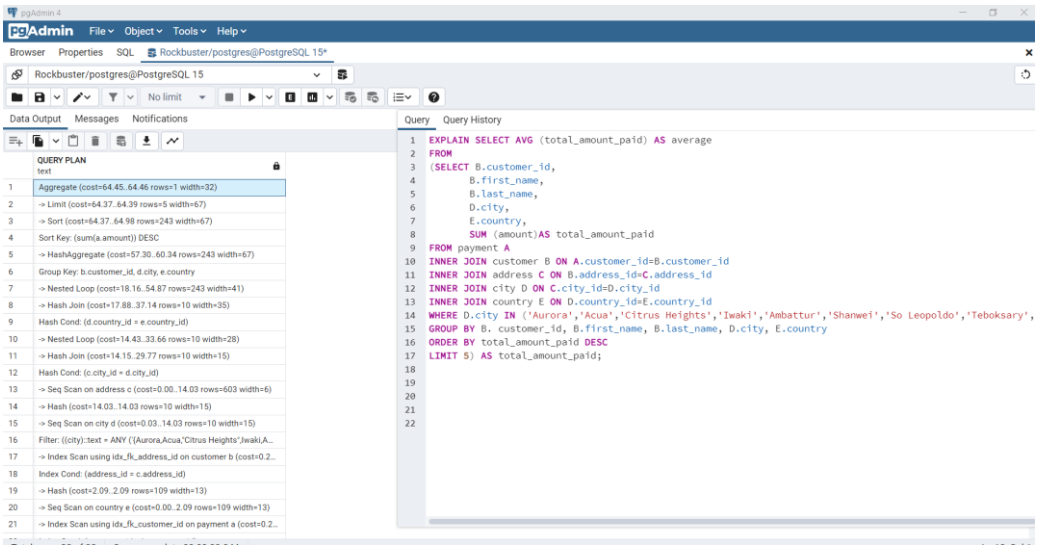
1. **Which approach do you think will perform better and why?**

Despite the challenges I'm facing with query two, I find the CTEs work better, particularly in the case of query two, because the code is easier to interpret.

2. **Compare the costs of all the queries by creating query plans for each one.**

3. **The EXPLAIN command gives you an *estimated* cost. To find out the actual speed of your queries, run them in pgAdmin 4. After each query has been run, a pop-up window will display its speed in milliseconds.**

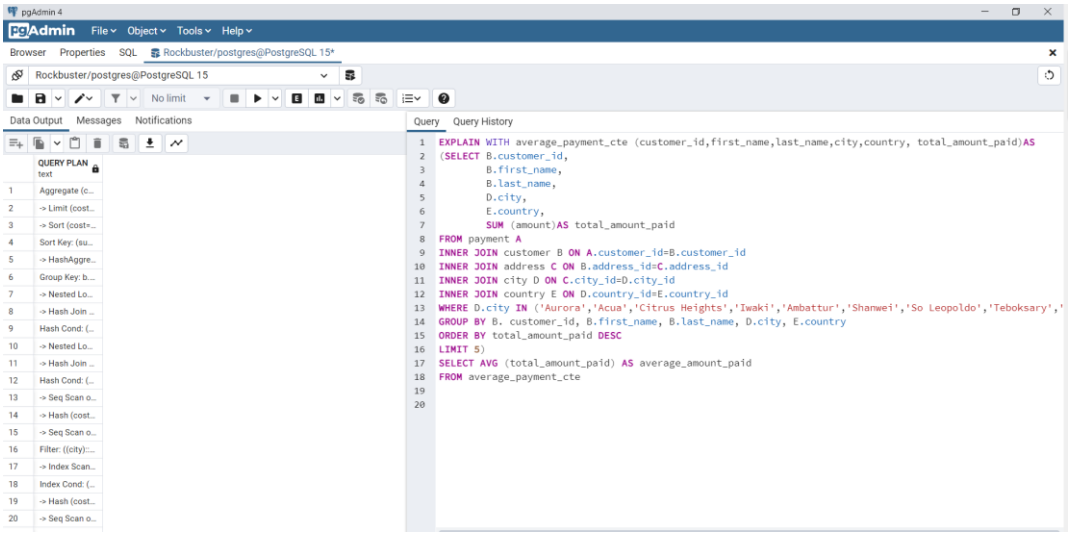
Explain Query 1/sub-query:



Cost: "Aggregate (cost=64.45..64.46 rows=1 width=32)"

The speed was 45 miliseconds

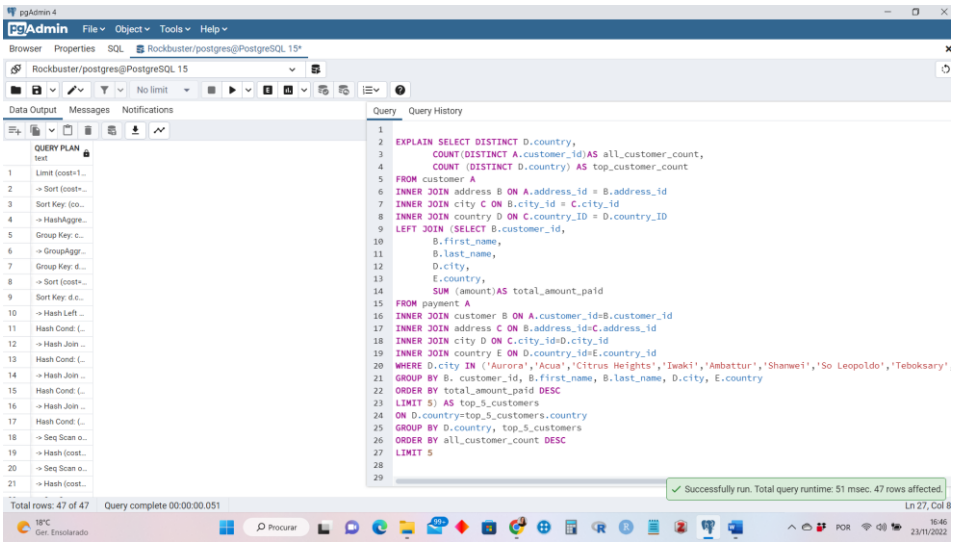
Explain Query 1/CTE:



Its speed was 55 miliseconds

Cost: "Aggregate (cost=64.45..64.46 rows=1 width=32)"

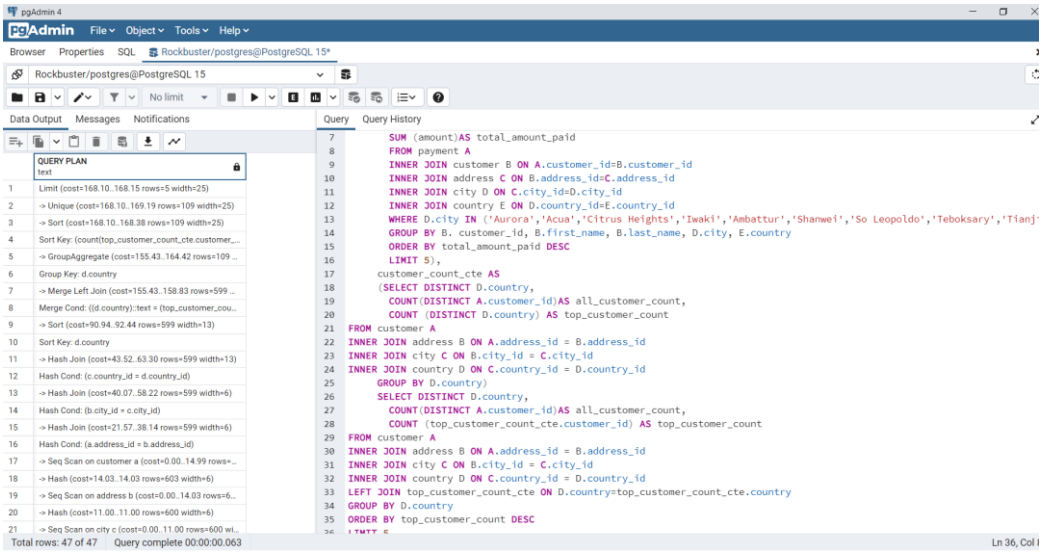
Explain Query 1/sub-query:



51 Miliseconds

Cost: "Limit (cost=189.48..189.49 rows=5 width=84)"

Explain Query 2/CTE:



Its speed was 56 milliseconds (less than query 1/CTE)

Cost: "Limit (cost=168.10..168.15 rows=5 width=25)"

4. **Did the results surprise you? Write a few sentences to explain your answer.**

Query 1 had a lower cost than Query 2, which is to be expected since the later is much more complex.

In Query 1, there are no major differences between using CTE or sub-queries in terms of cost, and there is a minor difference in the time use, which was longer in the case of the CTE query. Yet, for Query 2, using the CTE reduced the cost, while the time was almost the same as in the sub-query version. These results are not surprising and also show that the differences in time and cost will vary case by case.

Step 3: Write 1 to 2 paragraphs on the challenges you faced when replacing your subqueries with CTEs.

The main challenge I've faced, particularly with the second query was to identify the items that need to be included in the CTEs. It was also challenging to understand how to reference the CTE in the SELECT statement, when I realized I would need more than one CTE to account for the different aspects of the sub-query. The fact that the sub-query version of Query 2 was embedded as LEFT join, with FROM, made it really challenging to understand how it could be converted into a CTE. I think that this requires a lot of practice, and it is not something that can be learned easily. In short, the more complex the sub-query the more difficult it becomes to turn it into a CTE query. But I find the CTE much easier to use, and with a syntax that is more easily understandable.