3.9: Common Table Expressions

Directions
Create a new text document and call it "Answers 3.9." You'll save your queries, outputs, and written answers in this document.

Step 1: Answer the business questions from step 1 and 2 of task 3.8 using **CTEs**
(**Task 3.8 Step 1**: Find the average amount paid by the top 5 customers and Step 2: Find out how many of the top 5 customers are based within each country).

1. Rewrite your queries from steps 1 and 2 of task 3.8 as CTEs.
2. Copy-paste your CTEs and their outputs into your answers document.
3. Write 2 to 3 sentences explaining how you approached this step, for example, what you did first, second, and so on.

Query | Query History

```
1  WITH Average_total_paid_cte(customer_id, first_name, last_name, city,
2                              country, total_amount_paid) AS
3  (SELECT B.customer_id, B.first_name, B. last_name, D.city, E.country,
4  SUM (A. amount) AS total_amount_paid
5  FROM payment A
6  INNER JOIN customer B ON A.customer_id = B. customer_id
7  INNER JOIN address C ON B.address_id = C.address_id
8  INNER JOIN city D ON C.city_id = D.city_id
9  INNER JOIN country E ON D.country_ID = E. country_ID
10 WHERE city IN ('Aurora', 'Atlixco', 'Xintai', 'Adoni', 'Dhule (Duhlia)',
11                'Kursahiki', 'Pingxiang', 'Sivas', 'Celaya', 'So Leopoldo')
12 GROUP BY B.customer_id, B. first_name, B. last_name, D. City, E.country
13 ORDER BY total_amount_paid DESC
14 LIMIT 5)
15 SELECT AVG(total_amount_paid) AS avg_amount_paid
16 FROM average_total_paid_cte
```

Data Output | Messages | Notifications

	avg_amount_paid numeric
1	107.3540000000000000

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

1. Which approach do you think will perform better and why?
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.
4. Did the results surprise you? Write a few sentences to explain your answer.

Query | Query History

```
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(A.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 city IN('Aurora', 'Atlixco', 'Xintai', 'Adoni', 'Dhule (Duhlia)',
'Kursahiki', 'Pingxiang', 'Sivas', 'Celaya', 'So Leopoldo')
GROUP BY B.customer_id, B.first_name, B.last_name, D. City, E.country
ORDER BY total_amount_paid DESC
LIMIT 5),
all_customer_count_cte AS
(SELECT E.country,
COUNT (DISTINCT B.customer_id) AS all_customer_count,
COUNT (DISTINCT E.country) AS top_customer_count
FROM country E
INNER JOIN city D ON E.country_id = D.country_id
INNER JOIN address C ON D.city_id = C.city_id
INNER JOIN customer B ON C.address_id = B.address_id
GROUP BY E.country)
SELECT E.country,
COUNT (DISTINCT B.customer_id) AS all_customer_count,
COUNT (DISTINCT top_customer_count_cte.customer_id) AS top_customer_count
FROM country E
INNER JOIN city D ON E.country_id = D.country_id
INNER JOIN address C ON D.city_id = C.city_id
INNER JOIN customer B ON C.address_id = B.address_id
LEFT JOIN
top_customer_count_cte ON E.country = top_customer_count_cte.country
GROUP BY E.country
ORDER BY top_customer_count DESC
LIMIT 5
```

Data Output | Messages | Graph Visualiser | Notifications

	country character varying (50)	all_customer_count bigint	top_customer_count bigint
1	Mexico	30	2
2	United States	36	1
3	India	60	1
4	Turkey	15	1
5	American Samoa	1	0

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

Both subqueries and CTE performed similarly, what differed from them was the running time. Both had the same Limit cost of 169.6…169.62 rows =5 and width = 25. The CTE performed a little bit slower by having a time of 64 msec and the subquery 54 msec.

Step 4:
Save your “Answers 3.9” document as a PDF and upload it here for your tutor to review.