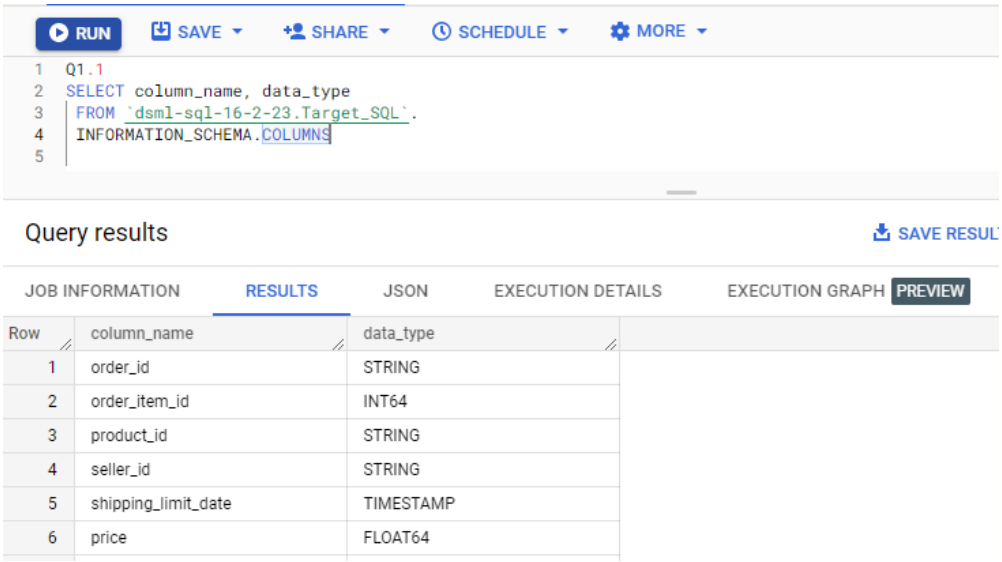
BUSINESS CASE STUDY – TARGET SQL

Q1. Initial exploration of dataset like checking the characteristics of data

---1) Data type of columns in a table

Query:

```
SELECT column_name, data_type
FROM `dsml-sql-16-2-23.Target_SQL`.
INFORMATION_SCHEMA.COLUMNS
```

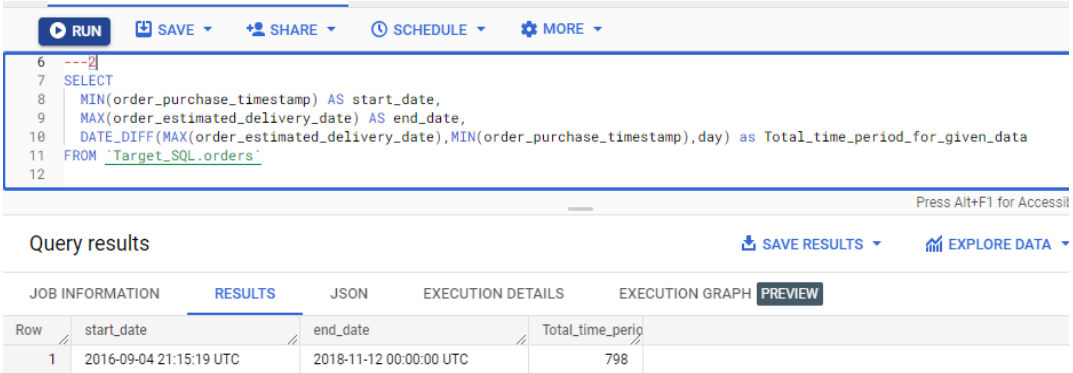


Row	column_name	data_type
1	order_id	STRING
2	order_item_id	INT64
3	product_id	STRING
4	seller_id	STRING
5	shipping_limit_date	TIMESTAMP
6	price	FLOAT64

---2) Time period for which the data is given

Query:

```
SELECT
  MIN(order_purchase_timestamp) AS start_date,
  MAX(order_estimated_delivery_date) AS end_date,
  DATE_DIFF(MAX(order_estimated_delivery_date),MIN(order_purchase_timestamp
),day) as Total_time_period_for_given_data
FROM `Target_SQL.orders`
```



Row	start_date	end_date	Total_time_perio
1	2016-09-04 21:15:19 UTC	2018-11-12 00:00:00 UTC	798

--3) Cities and States of customers ordered during the given period

Query:

```
SELECT
  o.order_id,
  c.customer_city,
  c.customer_state
FROM `Target_SQL.orders` as o
LEFT JOIN `Target_SQL.customers`as c
ON o.customer_id = c.customer_id
```

```
12
13  ----3
14  SELECT
15    o.order_id,
16    c.customer_city,
17    c.customer_state
18  FROM `Target_SQL.orders` as o
19  LEFT JOIN `Target_SQL.customers`as c
20  ON o.customer_id = c.customer_id
21
22  ----Q2.
```

Query results

SAVE RESULTS

JOB INFORMATION | RESULTS | JSON | EXECUTION DETAILS | EXECUTION GRAPH | PREVIEW

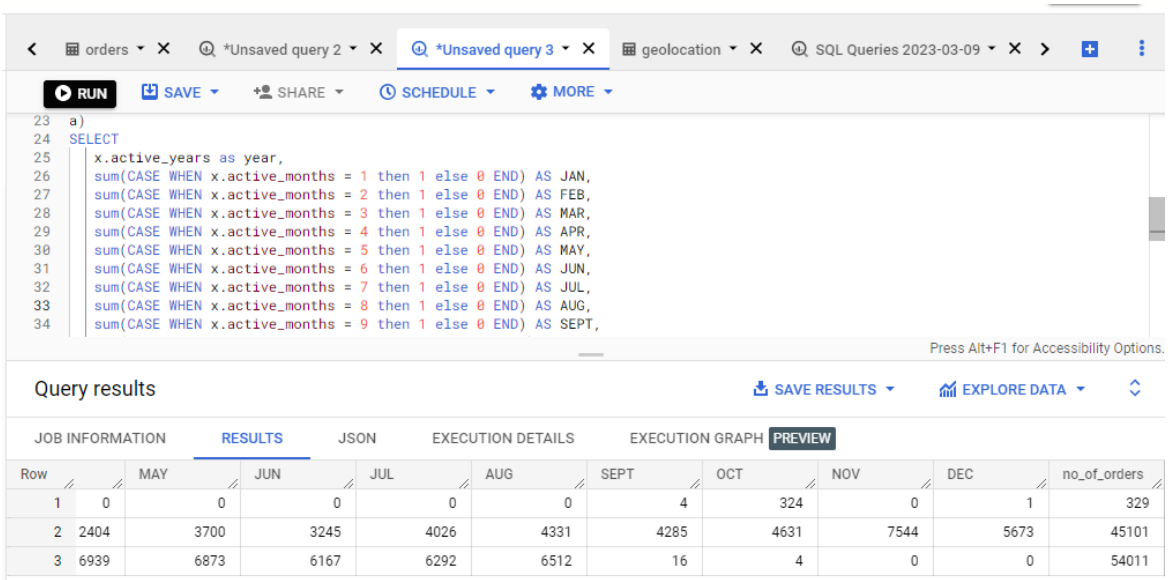
Row	order_id	customer_city	customer_state
1	6190a94657e1012983a274b8...	maceio	AL

Q2. In-depth Exploration

1) Is there a growing trend on e-commerce in Brazil? How can we describe a complete scenario? Can we see some seasonality with peaks at specific months?

QUERY :

```
SELECT
   x.active_years as year,
   sum(CASE WHEN x.active_months = 1 then 1 else 0 END) AS JAN,
   sum(CASE WHEN x.active_months = 2 then 1 else 0 END) AS FEB,
   sum(CASE WHEN x.active_months = 3 then 1 else 0 END) AS MAR,
   sum(CASE WHEN x.active_months = 4 then 1 else 0 END) AS APR,
   sum(CASE WHEN x.active_months = 5 then 1 else 0 END) AS MAY,
   sum(CASE WHEN x.active_months = 6 then 1 else 0 END) AS JUN,
   sum(CASE WHEN x.active_months = 7 then 1 else 0 END) AS JUL,
   sum(CASE WHEN x.active_months = 8 then 1 else 0 END) AS AUG,
   sum(CASE WHEN x.active_months = 9 then 1 else 0 END) AS SEPT,
   sum(CASE WHEN x.active_months = 10 then 1 else 0 END) AS OCT,
   sum(CASE WHEN x.active_months = 11 then 1 else 0 END) AS NOV,
   sum(CASE WHEN x.active_months = 12 then 1 else 0 END) AS DEC,
   COUNT(DISTINCT x.order_id) as no_of_orders
  FROM
  (SELECT
   order_id,
   order_purchase_timestamp,
   EXTRACT(YEAR from order_purchase_timestamp) AS active_years,
   EXTRACT(MONTH from order_purchase_timestamp) AS active_months
   FROM `Target_SQL.orders`
   ORDER BY order_purchase_timestamp) as x
GROUP BY year
order by year
```

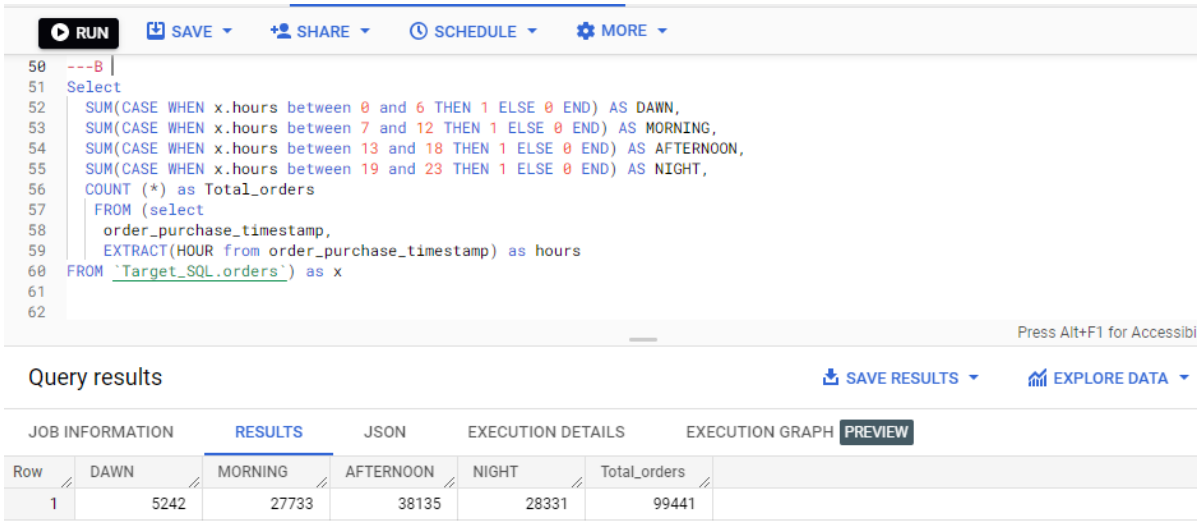


Row		MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	no_of_orders
1	0	0	0	0	0	4	324	0	1	329
2	2404	3700	3245	4026	4331	4285	4631	7544	5673	45101
3	6939	6873	6167	6292	6512	16	4	0	0	54011

--2) What time do Brazilian customers tend to buy (Dawn, Morning, Afternoon or Night)?

QUERY

```
Select
  SUM(CASE WHEN x.hours between 0 and 6 THEN 1 ELSE 0 END) AS DAWN,
  SUM(CASE WHEN x.hours between 7 and 12 THEN 1 ELSE 0 END) AS MORNING,
  SUM(CASE WHEN x.hours between 13 and 18 THEN 1 ELSE 0 END) AS AFTERNOON,
  SUM(CASE WHEN x.hours between 19 and 23 THEN 1 ELSE 0 END) AS NIGHT,
  COUNT (*) as Total_orders
   FROM (select
    order_purchase_timestamp,
    EXTRACT(HOUR from order_purchase_timestamp) as hours
FROM `Target_SQL.orders`) as x
```



Row	DAWN	MORNING	AFTERNOON	NIGHT	Total_orders
1	5242	27733	38135	28331	99441

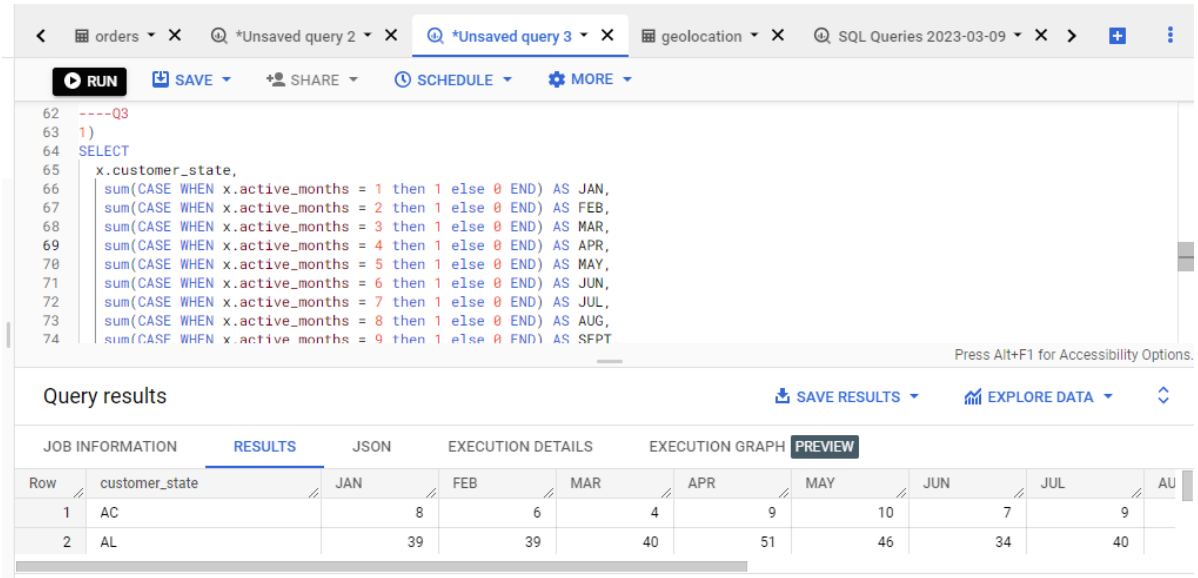
Inference –Brazilian people preferred to purchase more in Afternoon

Q3. Evolution of E-commerce orders in the Brazil region

1) Get month on month orders by states

QUERY:

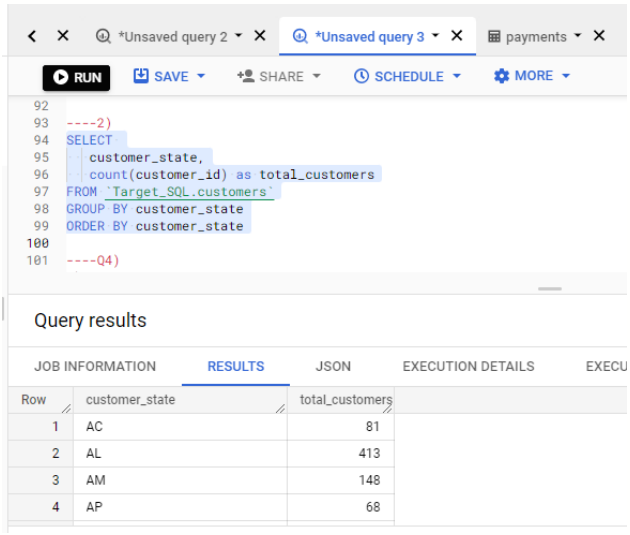
```
SELECT
  x.customer_state,
   sum(CASE WHEN x.active_months = 1 then 1 else 0 END) AS JAN,
   sum(CASE WHEN x.active_months = 2 then 1 else 0 END) AS FEB,
   sum(CASE WHEN x.active_months = 3 then 1 else 0 END) AS MAR,
   sum(CASE WHEN x.active_months = 4 then 1 else 0 END) AS APR,
   sum(CASE WHEN x.active_months = 5 then 1 else 0 END) AS MAY,
   sum(CASE WHEN x.active_months = 6 then 1 else 0 END) AS JUN,
   sum(CASE WHEN x.active_months = 7 then 1 else 0 END) AS JUL,
   sum(CASE WHEN x.active_months = 8 then 1 else 0 END) AS AUG,
   sum(CASE WHEN x.active_months = 9 then 1 else 0 END) AS SEPT,
   sum(CASE WHEN x.active_months = 10 then 1 else 0 END) AS OCT,
   sum(CASE WHEN x.active_months = 11 then 1 else 0 END) AS NOV,
   sum(CASE WHEN x.active_months = 12 then 1 else 0 END) AS DEC,
   COUNT(DISTINCT x.order_id) as no_of_orders
  FROM
  (SELECT
   o.order_id,
   c.customer_state,
   o.order_purchase_timestamp,
   EXTRACT(YEAR from order_purchase_timestamp) AS active_years,
   EXTRACT(MONTH from order_purchase_timestamp) AS active_months
   FROM `Target_SQL.orders` as o
   LEFT JOIN `Target_SQL.customers` as c
   ON o.customer_id = c.customer_id
   ORDER BY order_purchase_timestamp) as x
GROUP BY x.customer_state
order by x.customer_state
```



2) Distribution of customers across the states in Brazil

QUERY:

```
SELECT
   customer_state,
   count(customer_id) as total_customers
FROM `Target_SQL.customers`
GROUP BY customer_state
ORDER BY customer_state
```

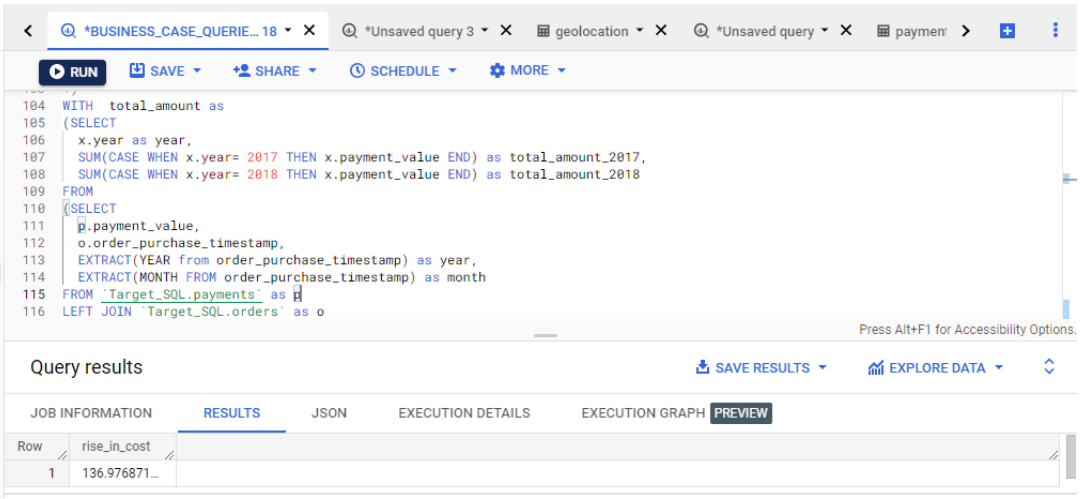


Q4. Impact on Economy: Analyze the money movement by e-commerce by looking at order prices, freight and others.

---1) Get % increase in cost of orders from 2017 to 2018 (include months between Jan to Aug only)

QUERY:

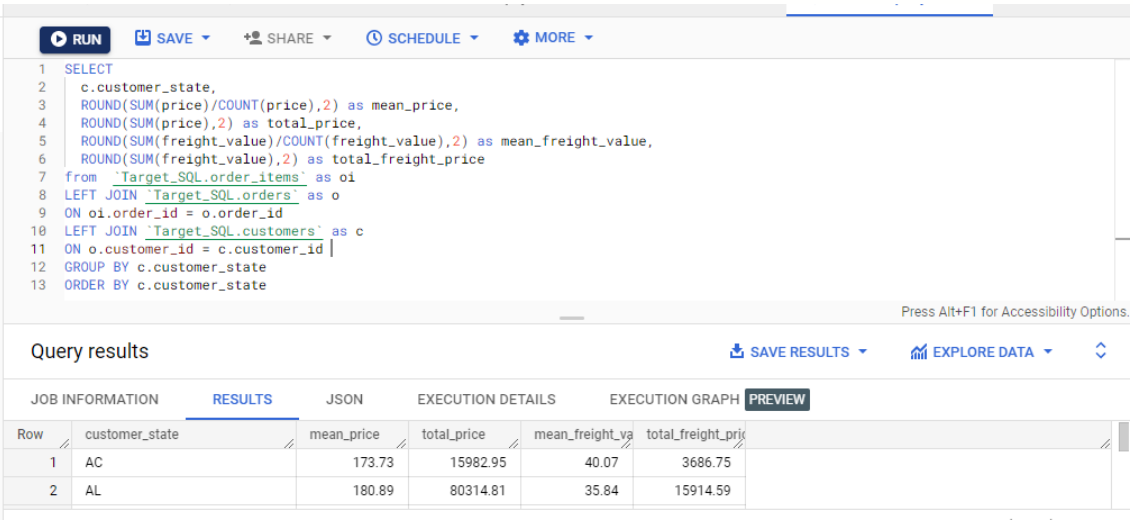
```
WITH  total_amount as
(SELECT
    x.year as year,
    SUM(CASE WHEN x.year= 2017 THEN x.payment_value END) as total_amount_2017,
    SUM(CASE WHEN x.year= 2018 THEN x.payment_value END) as total_amount_2018
FROM
  (SELECT
    p.payment_value,
    o.order_purchase_timestamp,
    EXTRACT(YEAR from order_purchase_timestamp) as year,
    EXTRACT(MONTH FROM order_purchase_timestamp) as month
  FROM `Target_SQL.payments` as p
  LEFT JOIN `Target_SQL.orders` as o
  on p.order_id = o.order_id
  WHERE EXTRACT(YEAR from order_purchase_timestamp) IN(2017,2018) AND EXTRACT
  (MONTH FROM order_purchase_timestamp) between 1 and 8 ) as x
  GROUP BY x.year)
SELECT (MAX(total_amount_2018)-MAX(total_amount_2017))/
        MAX(total_amount_2017)*100 as rise_in_cost
FROM total_amount
```



---2) Mean & Sum of price and freight value by customer state

QUERY:

```
SELECT
  c.customer_state,
  ROUND(SUM(price)/COUNT(price),2) as mean_price,
  ROUND(SUM(price),2) as total_price,
  ROUND(SUM(freight_value)/COUNT(freight_value),2) as mean_freight_value,
  ROUND(SUM(freight_value),2) as total_freight_price
from  `Target_SQL.order_items` as oi
LEFT JOIN `Target_SQL.orders` as o
ON oi.order_id = o.order_id
LEFT JOIN `Target_SQL.customers` as c
ON o.customer_id = c.customer_id
GROUP BY c.customer_state
ORDER BY c.customer_state
```

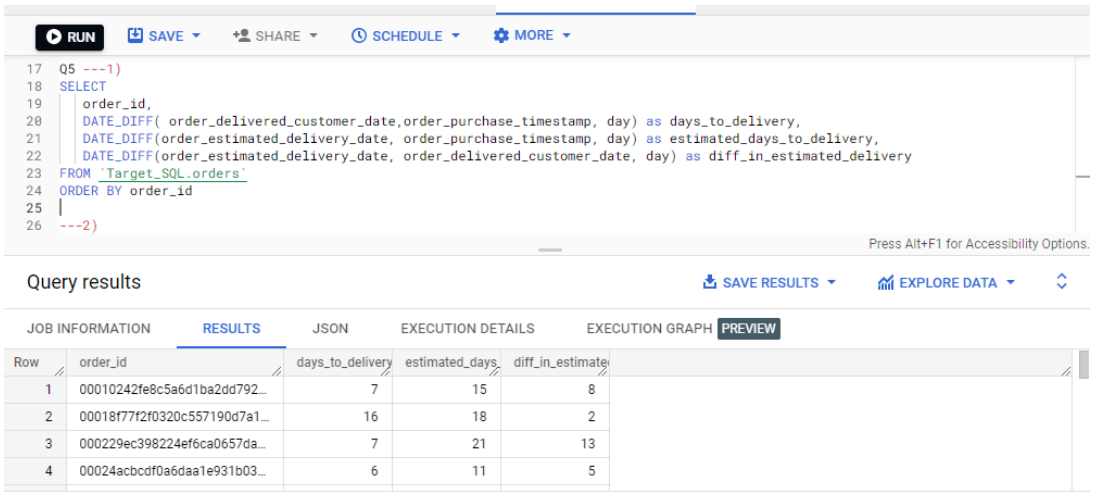


5. Analysis on sales, freight and delivery time

---1). Calculate days between purchasing, delivering and estimated delivery

QUERY

```
SELECT
   order_id,
   DATE_DIFF( order_delivered_customer_date,order_purchase_timestamp, day)
as days_to_delivery,
   DATE_DIFF(order_estimated_delivery_date, order_purchase_timestamp, day)
as estimated_days_to_delivery,
   DATE_DIFF(order_estimated_delivery_date, order_delivered_customer_date,
day) as diff_in_estimated_delivery
FROM `Target_SQL.orders`
ORDER BY order_id
```

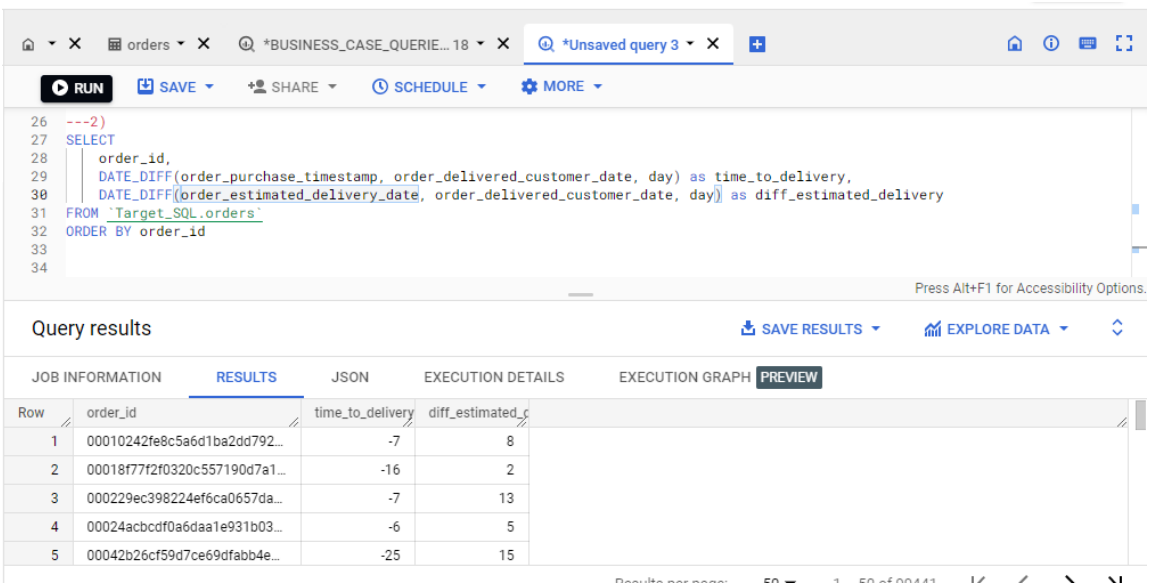


--2) Find time_to_delivery & diff_estimated_delivery. Formula for the same given below:

- time_to_delivery = order_purchase_timestamp-order_delivered_customer_date
- diff_estimated_delivery = order_estimated_delivery_date-order_delivered_customer_date

QUERY:

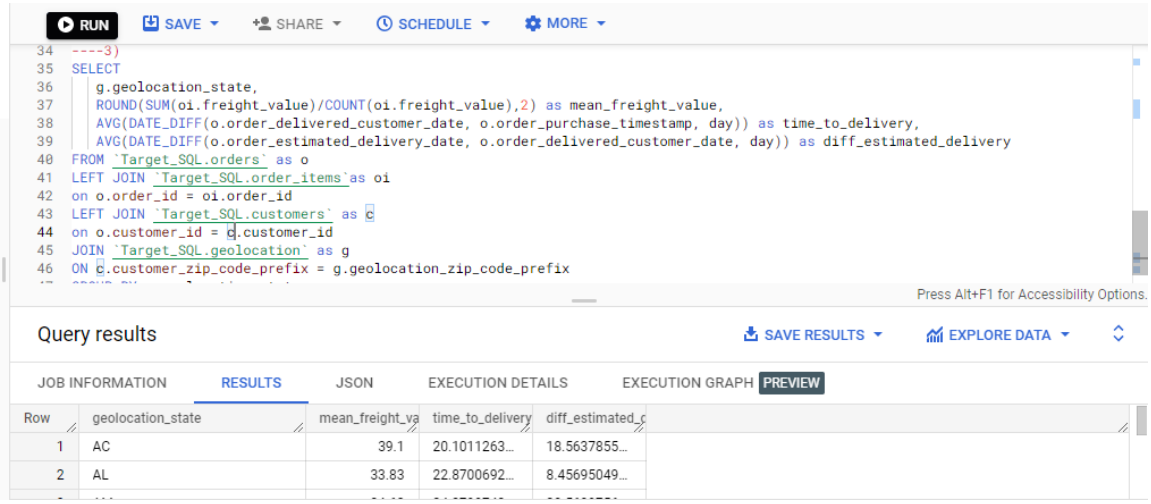
```
SELECT
    order_id,
    DATE_DIFF(order_purchase_timestamp, order_delivered_customer_date, day)
 as time_to_delivery,
    DATE_DIFF(order_estimated_delivery_date, order_delivered_customer_date,
 day) as diff_estimated_delivery
FROM `Target_SQL.orders`
ORDER BY order_id
```



--3) Group data by state, take mean of freight_value, time_to_delivery, diff_estimated_delivery

QUERY:

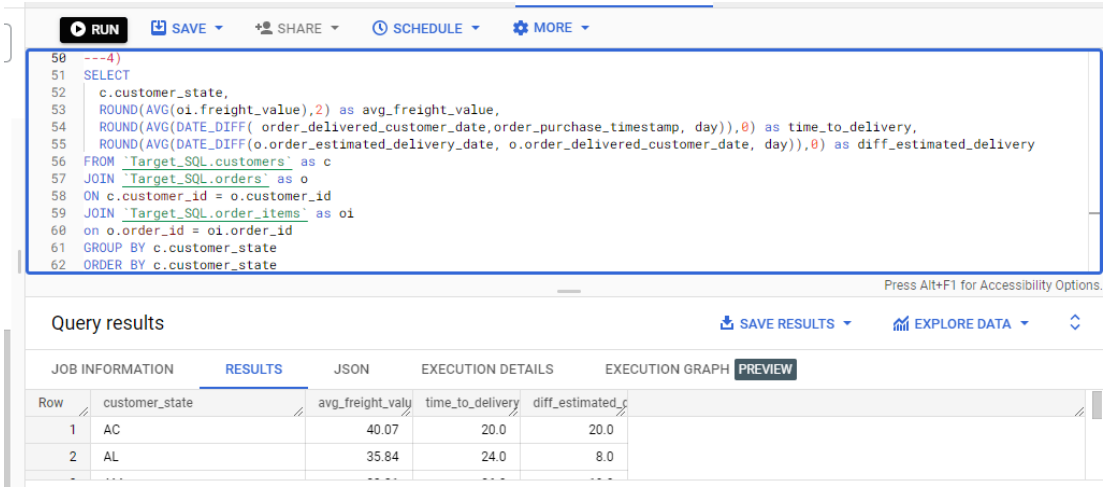
```
SELECT
  g.geolocation_state,
  ROUND(SUM(oi.freight_value)/COUNT(oi.freight_value),2) as mean_freight_value,
  AVG(DATE_DIFF(o.order_delivered_customer_date, o.order_purchase_timestamp, day))
 as time_to_delivery,
  AVG(DATE_DIFF(o.order_estimated_delivery_date, o.order_delivered_customer_date,
day)) as diff_estimated_delivery
FROM `Target_SQL.orders` as o
LEFT JOIN `Target_SQL.order_items`as oi
on o.order_id = oi.order_id
LEFT JOIN `Target_SQL.customers` as c
on o.customer_id = c.customer_id
JOIN `Target_SQL.geolocation` as g
ON c.customer_zip_code_prefix = g.geolocation_zip_code_prefix
GROUP BY g.geolocation_state
ORDER BY g.geolocation_state
```



--- 4) Sort the data to get the following:

QUERY:

```
SELECT
  c.customer_state,
  ROUND(AVG(oi.freight_value),2) as avg_freight_value,
  ROUND(AVG(DATE_DIFF( order_delivered_customer_date,order_purchase_timestamp, day
)),0) as time_to_delivery,
  ROUND(AVG(DATE_DIFF(o.order_estimated_delivery_date, o.order_delivered_customer_
date, day)),0) as diff_estimated_delivery
FROM `Target_SQL.customers` as c
JOIN `Target_SQL.orders` as o
ON c.customer_id = o.customer_id
JOIN `Target_SQL.order_items` as oi
on o.order_id = oi.order_id
GROUP BY c.customer_state
ORDER BY c.customer_state
```

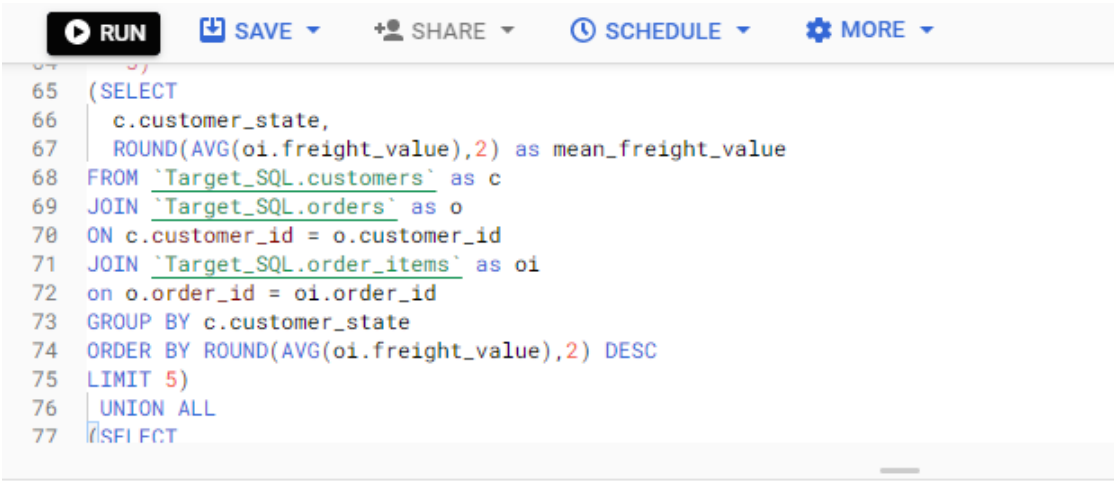


--- (5) - Top 5 states with highest/lowest average freight value - sort in desc/asc limit

QUERY:

```
(SELECT
  c.customer_state,
  ROUND(AVG(oi.freight_value),2) as mean_freight_value
FROM `Target_SQL.customers` as c
JOIN `Target_SQL.orders` as o
ON c.customer_id = o.customer_id
JOIN `Target_SQL.order_items` as oi
on o.order_id = oi.order_id
GROUP BY c.customer_state
ORDER BY ROUND(AVG(oi.freight_value),2) DESC
LIMIT 5)
 UNION ALL
(SELECT
  c.customer_state,
  ROUND(AVG(oi.freight_value),2) as mean_freight_value
FROM `Target_SQL.customers` as c
JOIN `Target_SQL.orders` as o
ON c.customer_id = o.customer_id
```

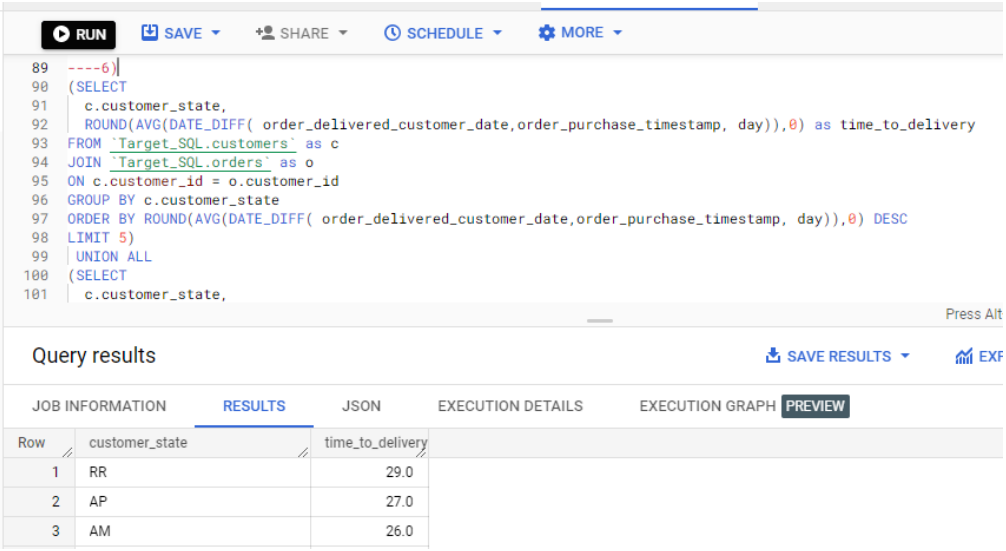
```
JOIN `Target_SQL.order_items` as oi
on o.order_id = oi.order_id
GROUP BY c.customer_state
ORDER BY ROUND(AVG(oi.freight_value),2) ASC
LIMIT 5)
```



---6) Top 5 states with highest/lowest average time to delivery

QUERY

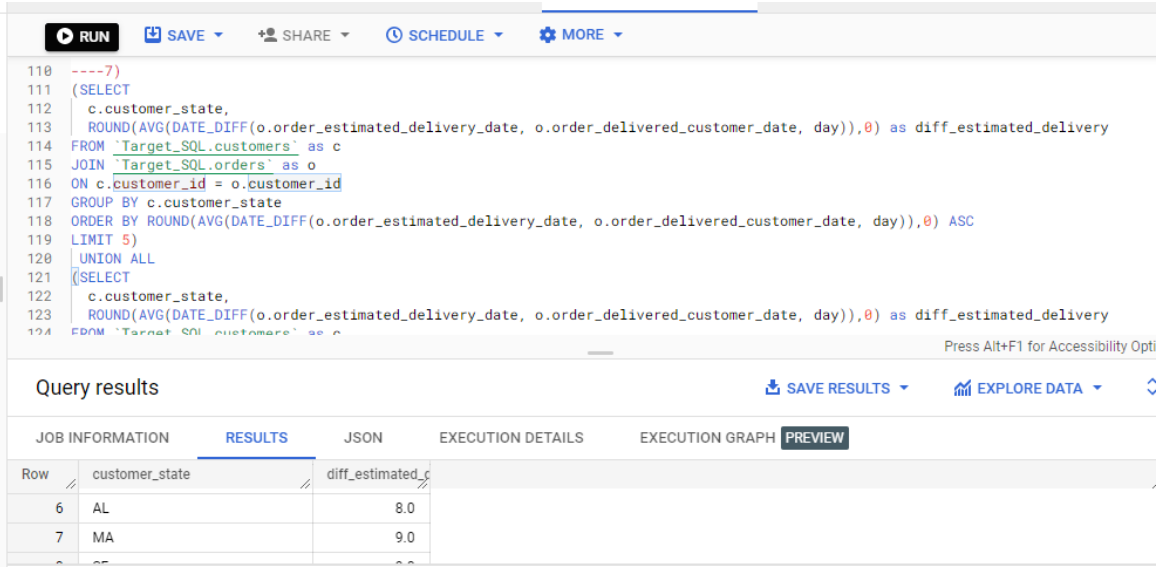
```
(SELECT
  c.customer_state,
  ROUND(AVG(DATE_DIFF( order_delivered_customer_date,order_purchase_timesta
mp, day  )),0) as time_to_delivery
FROM `Target_SQL.customers` as c
JOIN `Target_SQL.orders` as o
ON c.customer_id = o.customer_id
GROUP BY c.customer_state
ORDER BY ROUND(AVG(DATE_DIFF( order_delivered_customer_date,order_purchase_
timestamp, day)),0) DESC
LIMIT 5)
 UNION ALL
(SELECT
  c.customer_state,
  ROUND(AVG(DATE_DIFF( order_delivered_customer_date,order_purchase_timesta
mp, day)),0) as time_to_delivery
FROM `Target_SQL.customers` as c
JOIN `Target_SQL.orders` as o
ON c.customer_id = o.customer_id
GROUP BY c.customer_state
ORDER BY ROUND(AVG(DATE_DIFF( order_delivered_customer_date,order_purchase_
timestamp, day)),0) asc
LIMIT 5)
```



---7) Top 5 states where delivery is really fast/ not so fast compared to estimated date

QUERY:

```
(SELECT
  c.customer_state,
  ROUND(AVG(DATE_DIFF(o.order_estimated_delivery_date, o.order_delivered_cu
stomer_date, day)),0) as diff_estimated_delivery
FROM `Target_SQL.customers` as c
JOIN `Target_SQL.orders` as o
ON c.customer_id = o.customer_id
GROUP BY c.customer_state
ORDER BY ROUND(AVG(DATE_DIFF(o.order_estimated_delivery_date, o.order_deliv
ered_customer_date, day)),0) ASC
LIMIT 5)

 UNION ALL

(SELECT
  c.customer_state,
  ROUND(AVG(DATE_DIFF(o.order_estimated_delivery_date, o.order_delivered_cu
stomer_date, day)),0) as diff_estimated_delivery
FROM `Target_SQL.customers` as c
JOIN `Target_SQL.orders` as o
ON c.customer_id = o.customer_id
GROUP BY c.customer_state
ORDER BY ROUND(AVG(DATE_DIFF(o.order_estimated_delivery_date, o.order_deliv
ered_customer_date, day)),0) DESC
LIMIT 5)
```

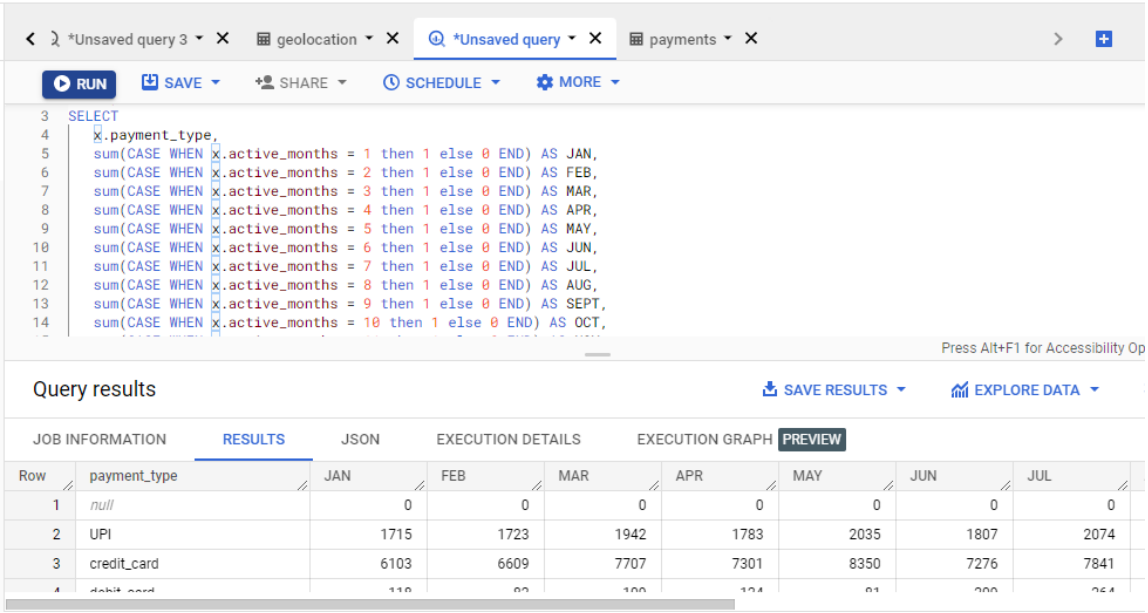


6) Payment type analysis:

1. Month over Month count of orders for different payment types

QUERY:

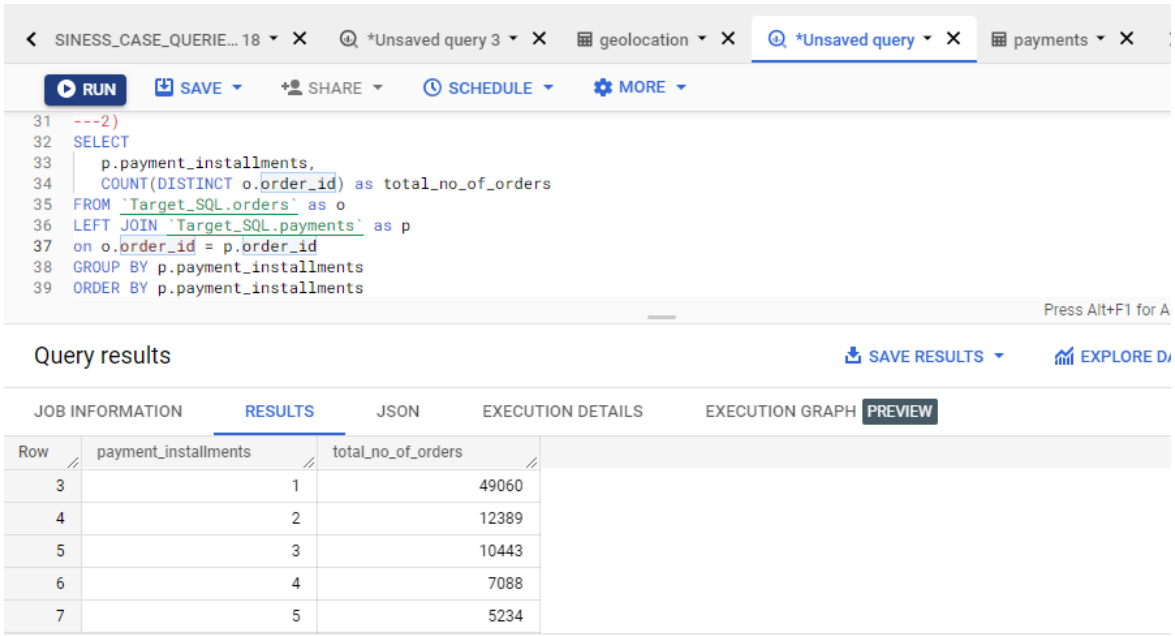
```
SELECT

   x.payment_type,
   sum(CASE WHEN x.active_months = 1 then 1 else 0 END) AS JAN,
   sum(CASE WHEN x.active_months = 2 then 1 else 0 END) AS FEB,
   sum(CASE WHEN x.active_months = 3 then 1 else 0 END) AS MAR,
   sum(CASE WHEN x.active_months = 4 then 1 else 0 END) AS APR,
   sum(CASE WHEN x.active_months = 5 then 1 else 0 END) AS MAY,
   sum(CASE WHEN x.active_months = 6 then 1 else 0 END) AS JUN,
   sum(CASE WHEN x.active_months = 7 then 1 else 0 END) AS JUL,
   sum(CASE WHEN x.active_months = 8 then 1 else 0 END) AS AUG,
   sum(CASE WHEN x.active_months = 9 then 1 else 0 END) AS SEPT,
   sum(CASE WHEN x.active_months = 10 then 1 else 0 END) AS OCT,
   sum(CASE WHEN x.active_months = 11 then 1 else 0 END) AS NOV,
   sum(CASE WHEN x.active_months = 12 then 1 else 0 END) AS DEC,
   COUNT(DISTINCT x.order_id) as no_of_orders
  FROM
  (SELECT
   p.payment_type,
   o.order_id,
   o.order_purchase_timestamp,
   EXTRACT(MONTH from order_purchase_timestamp) AS active_months
   FROM `Target_SQL.orders` as o
   LEFT JOIN `Target_SQL.payments` as p
   ON o.order_id = p.order_id
   ORDER BY order_purchase_timestamp) as x
GROUP BY x.payment_type
order by x.payment_type
```



----2) Count of orders based on the no. of payment instalments

QUERY:

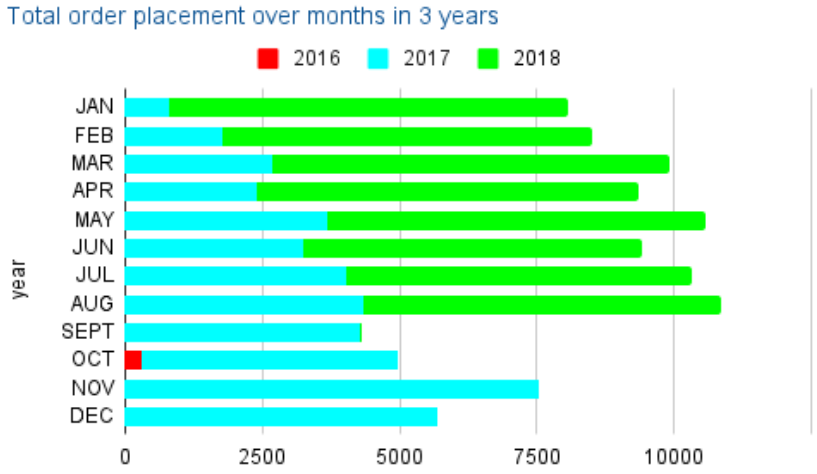
```
SELECT
   p.payment_installments,
   COUNT(DISTINCT o.order_id) as total_no_of_orders
FROM `Target_SQL.orders` as o
LEFT JOIN `Target_SQL.payments` as p
on o.order_id = p.order_id
GROUP BY p.payment_installments
ORDER BY p.payment_installments
```



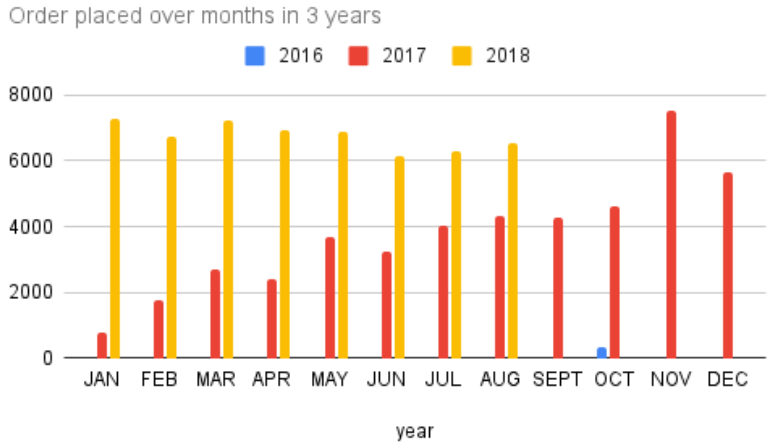
7) ACTIONABLE INSIGHTS

The given target orders data (oct,2016 to sept,2018) for the region Brazil, has some interesting insights coming away.

year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	no_of_orders
2016	0	0	0	0	0	0	0	0	4	324	0	1	329
2017	800	1780	2682	2404	3700	3245	4026	4331	4285	4631	7544	5673	45101
2018	7269	6728	7211	6939	6873	6167	6292	6512	16	4	0	0	54011

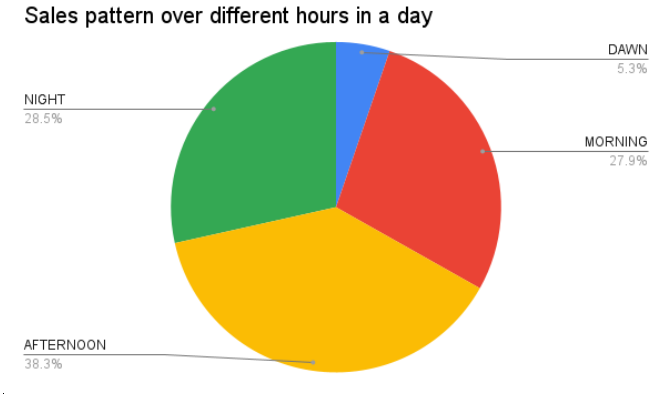


- In the above stacked bar chart, it can be seen that year 2018 shows proper growth in order counts when compared to the other two years (data derived out of Q2.1)

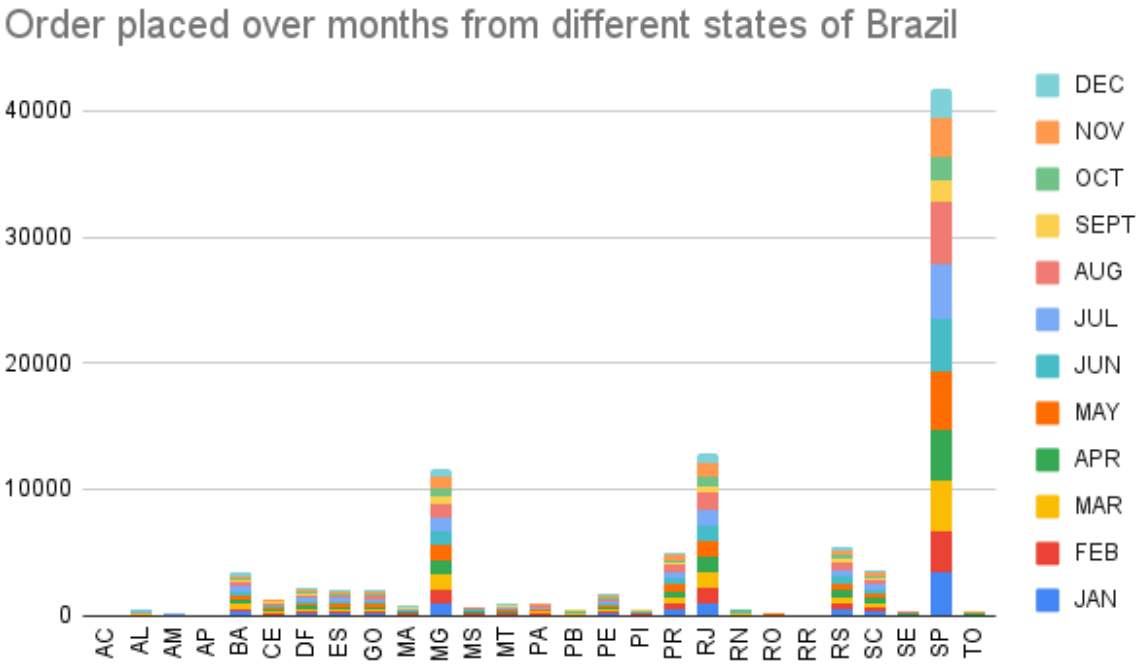


- The above given column chart briefly says that the highest ever order placement was observed during Nov, 2017 followed by Jan, 2018.
- The order counts for months Jan to Jun, 2017 are significantly dull compared to the year 2018 in the respective months (data derived out of Q2.1)

DAWN	MORNING	AFTERNOON	NIGHT	Total_orders
5242	27733	38135	28331	99441

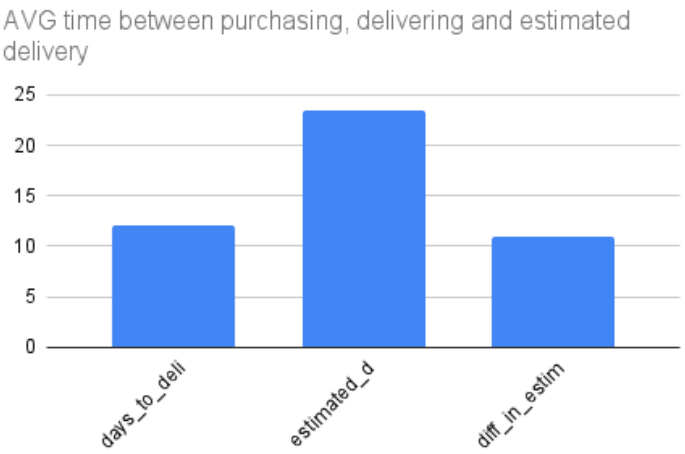


From this pie-chart, it can be observed that out of total orders, people of Brazil preferred afternoon (1 – 5 PM) hours for purchase and least at dawn(data derived from Q2.2)

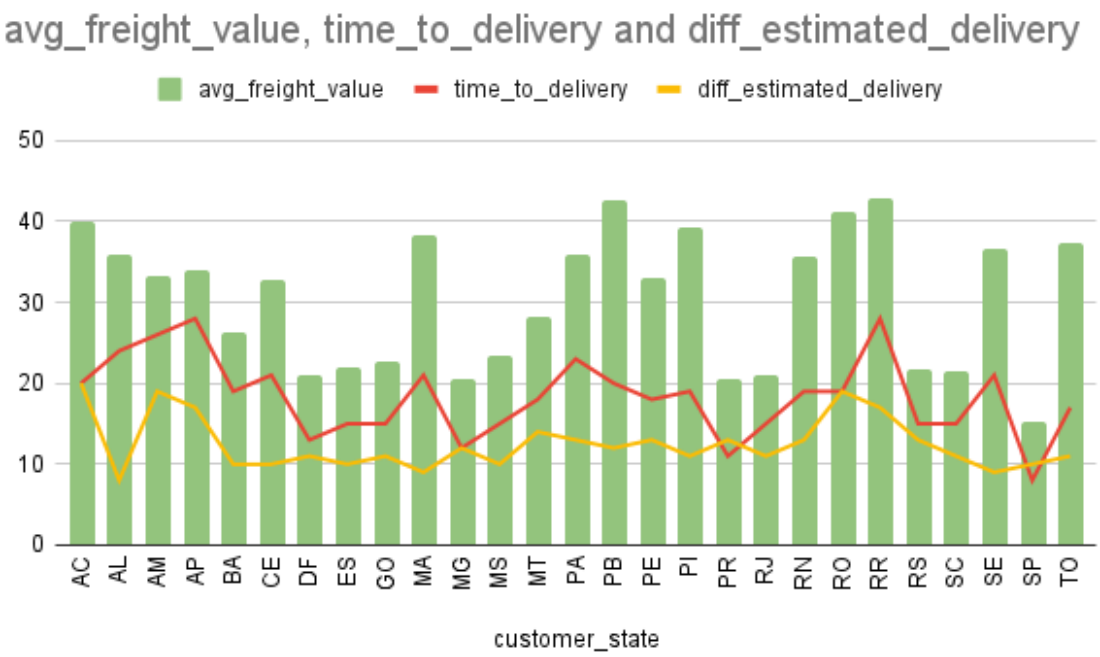


- In this stacked bar chart it can be observed that most orders were placed by state – "SP" which is almost half the number of total orders placed, especially in the month of July which signifies summer in Brazil.
- And when explored more into the customer counts(Q3.2), most number of customers were also found in SP(41,746), RJ(12,852) and MG(11,635)

In regard to insights from Q4, total sum of payment, 2018 (8694733.839) for the period of Jan to Aug is **136%** higher than the total sum of payment, 2017(Jan – Aug) is 3669022.11. So based on this and earlier observations sales and price both spiked in the year 2018 compared to 2017.



From this graph you can observe the time taken to actually deliver a product averages around 12 days, whereas the estimated time to deliver from the date of order averages around 23 days and finally the difference between actual delivered date and estimated date is around 11 days (data derived from Q5)



The above given combo graph signifies that average freight value(shipment cost) lies below 40 for most of the states, time taken to delivery is high in states – "AP" and "RR". And lowest in state – "SP".

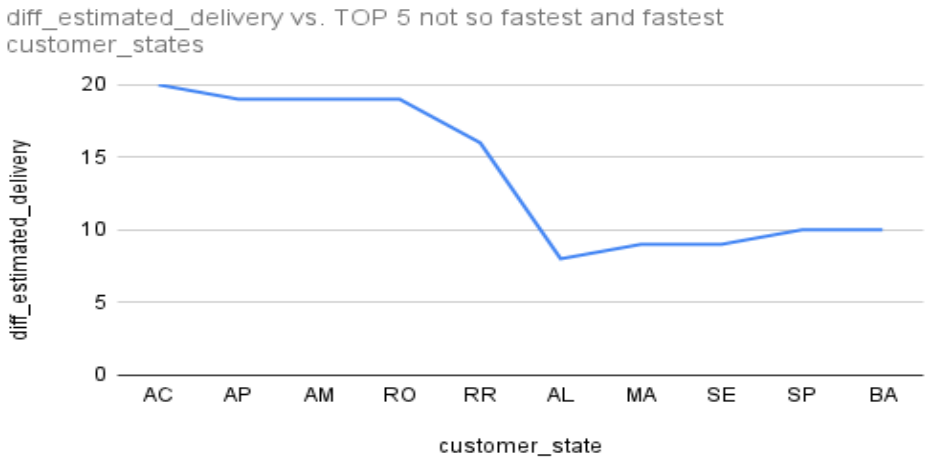
Top 5 states with lowest/highest average freight value

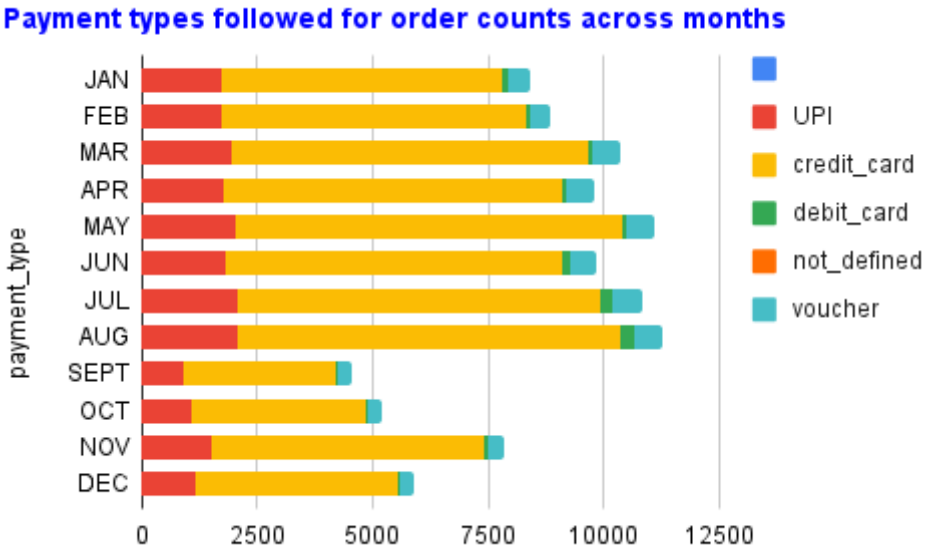
	customer_state	mean_freight_value
1	SP	15.15
2	PR	20.53
3	MG	20.63
4	RJ	20.96
5	DF	21.04
6	RR	42.98
7	PB	42.72
8	RO	41.07
9	AC	40.07
10	PI	39.15

States – SP, PR, MG, RJ, DF charges less freight values of which "SP" is the least of 15.15 amongst all the listed states.

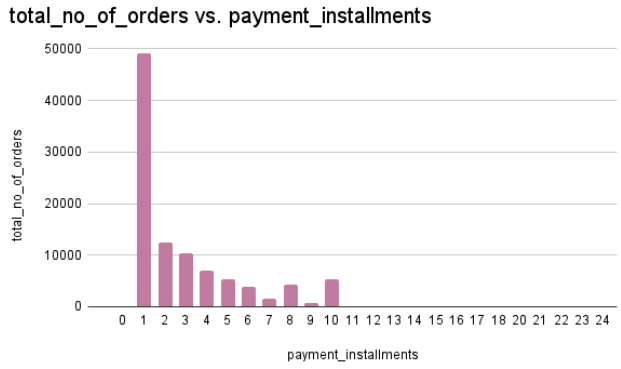
States – RR, PB, RO, AC, PI charges the highest freight values of which "RR" is charges the most of 42.9

Top 5 states where delivery is really fast/ not so fast compared to estimated date





From this above given stacked bar chart, its observed that credit-card payment is the most practised payment type followed by UPI payments. And maximum purchase is observed overs months of May, July and August.(data derived from Q6.1)



From the column chart on the left, it can be observed that most of the payment instalments for the given orders lasts for 1 month followed by 2 to 4 months. And sometimes for 8 or 10 months and rarely others(data derived from Q6.2)

Q8. Recommendations

From the data analysed, it seems that order counts are in increasing trends over the year. However a few things can be improvised from my point of view, which are listed below:

- Expansion of market across areas with more population will see a good impact in sales.
- From the given data alone, the state "SP" seems to have absurdly high number of orders, so similar strategy which is followed in the state "SP" can be followed in other places to boost the sale numbers in other areas.
- Time taken to deliver orders are is high in states – "AP" and "RR" and lowest in state – "SP" and "SP" is also the state with most orders, which can also be a reason why order counts are high in "SP". So, efforts should be taken to improve the delivery time where time taken to deliver is high, which might help in showing better counts in the future.

- Reason why Freight value is also less in state SP, an area with most no. of orders and lowest delivery time can also be because the warehouses are more in that area. So expanding warehouses across areas can be helpful for increasing order counts in other areas.
- In the given data, credit card and UPI were the most used payment types, so introducing more lucrative credit card offers in partnership with different banks can add more customers.
- From the data analyzation of payment instalments, it was understood that most order payments were completed in 1-5 months, so the products for which such kind of payment is done can be sorted out and increased in numbers across states and create more demand.