```python
import pandas as pd
import matplotlib.pyplot as plt
import numpy as np
import seaborn as sb
import mysql.connector as mysqlc

db = mysqlc.connect(host = "localhost",
                    username = "root",
                    password = "Root",
                    database = "ecomm")

cur = db.cursor()
# extracting data from the mysql database for further analysis
```

1. List all unique cities where customers are located.

```python
query = """SELECT DISTINCT upper(customer_city)
           FROM customers"""
cur.execute(query)
data = cur.fetchall()
import pandas as pd
df= pd.DataFrame(data,columns=["Cities"])
df
```

```
                     Cities
0                    FRANCA
1     SAO BERNARDO DO CAMPO
2                 SAO PAULO
3           MOGI DAS CRUZES
4                  CAMPINAS
...                     ...
4114                 SIRIJI
4115    NATIVIDADE DA SERRA
4116           MONTE BONITO
4117             SAO RAFAEL
4118      EUGENIO DE CASTRO

[4119 rows x 1 columns]
```

2. Count the number of orders placed in 2017.

```python
query = """SELECT COUNT(*) as total_order
        FROM orders
        WHERE year(order_purchase_timestamp) = 2017"""
cur.execute(query)
data = cur.fetchall()
data
"Total Orders Placed In 2017 are" ,data[0][0]

('Total Orders Placed In 2017 are', 45101)
```

3. Find the total sales per category.

```
query = """SELECT DISTINCT upper(products.product_category) as
Category,
          round(sum(payments.payment_value),2) as Sales
    FROM products
    JOIN order_items
    ON products.product_id = order_items.product_id
    JOIN payments
    ON payments.order_id = order_items.order_id
    GROUP BY Category"""
cur.execute(query)

data = cur.fetchall()

df = pd.DataFrame(data, columns=["Category", "Sales"])
df


                       Category       Sales
0                     PERFUMERY   506738.66
1          FURNITURE DECORATION  1430176.39
2                     TELEPHONY   486882.05
3                BED TABLE BATH  1712553.67
4                    AUTOMOTIVE   852294.33
..                          ...         ...
69               CDS MUSIC DVDS     1199.43
70                   LA CUISINE     2913.53
71  FASHION CHILDREN'S CLOTHING      785.67
72                     PC GAMER     2174.43
73       INSURANCE AND SERVICES      324.51

[74 rows x 2 columns]
```

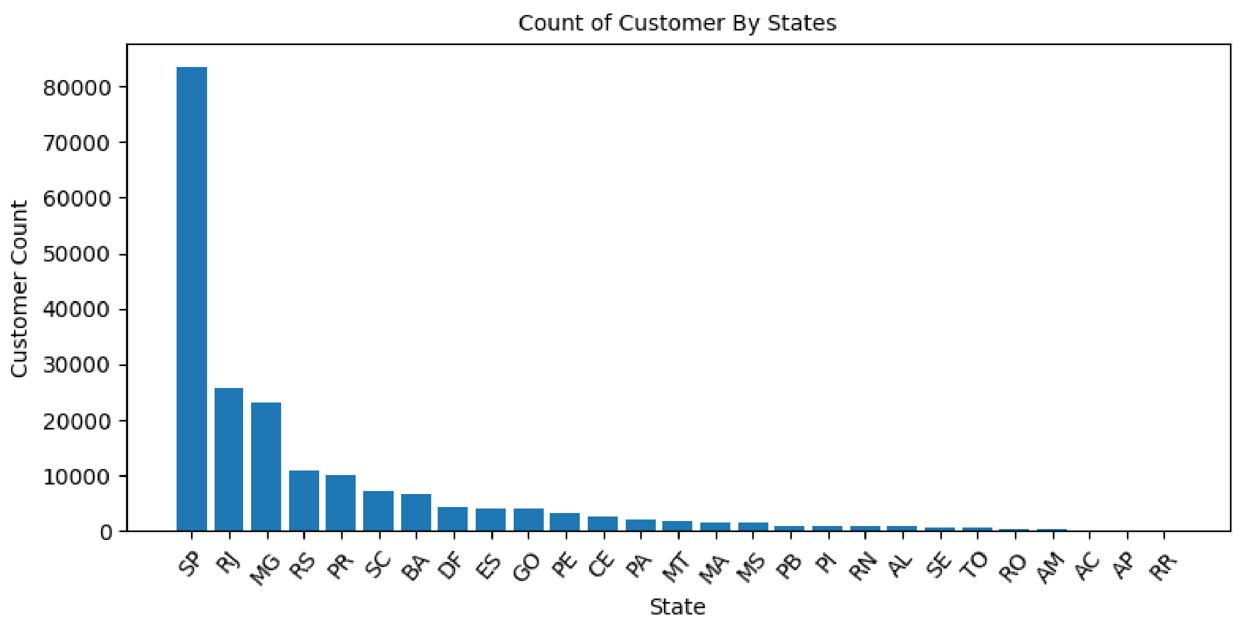
4. Calculate the percentage of orders that were paid in installments

```
query  ="""SELECT (SUM(CASE WHEN payment_installments >=1 THEN 1 ELSE
0 END ))/COUNT(*)*100,2 FROM payments"""
cur.execute(query)
data = cur.fetchall()
"percentage of orders that were paid in installments is", data[0][0]
```

```
('percentage of orders that were paid in installments is',
Decimal('99.9981'))
```

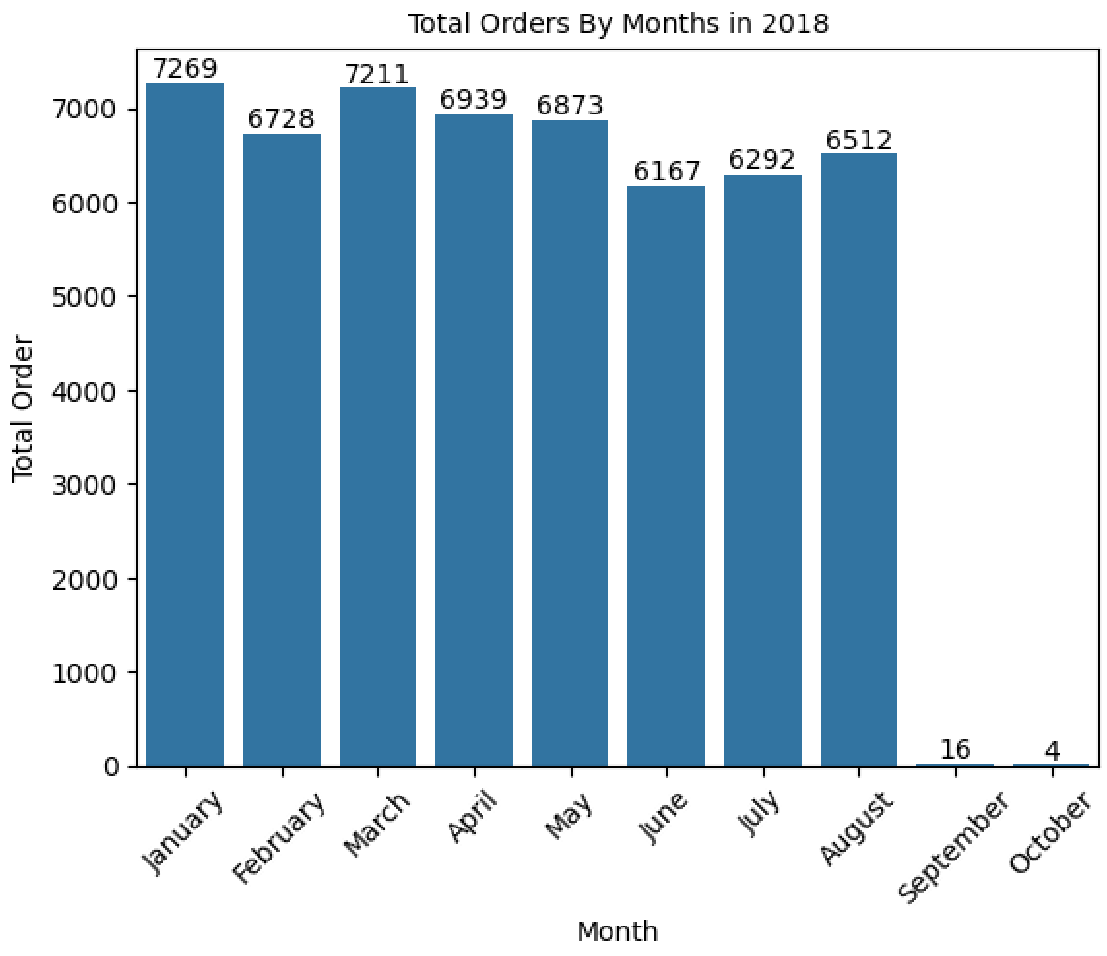
5. Count the number of customers from each state.

```
query = """SELECT customer_state, COUNT(customer_id)as Count
            FROM customers
            GROUP BY customer_state;"""
cur.execute(query)
data = cur.fetchall()
import pandas as pd

df = pd.DataFrame(data,columns=["state", "customer_count"])
df = df.sort_values(by = "customer_count", ascending= False)

plt.figure(figsize= (9,4))
plt.title("Count of Customer By States", fontsize = 10)
plt.bar(df["state"],df["customer_count"])
plt.xticks(rotation =50)
plt.xlabel("State",fontsize = 10)
plt.ylabel("Customer Count",fontsize = 10)
plt.show()
```



6.Calculate the number of orders per month in 2018.

```
query = """SELECT MONTHNAME(order_purchase_timestamp) as Month,
COUNT(order_id) as Total_orders
            FROM orders
            WHERE YEAR(order_purchase_timestamp) = 2018
            GROUP BY Month;"""
cur.execute(query)
data = cur.fetchall()
df = pd.DataFrame(data,columns=["Month","Total Order"])
order = ["January",
"February","March","April","May","June","July","August","September","O
ctober"]
ax = sb.barplot(x = "Month", y= "Total Order", data = df , order =
order)
ax.bar_label(ax.containers[0])

plt.title("Total Orders By Months in 2018", fontsize = 10)
plt.xticks(rotation = 45)
plt.show()
```



7. Find the average number of products per order, grouped by customer city.

```
query = """with count_per_order as(
select
orders.order_id as order_id,
orders.customer_id as customer_id,
count(order_items.order_id) as Total_Order
from orders
join order_items
on orders.order_id = order_items.order_id
group by order_id, customer_id)

select
upper(customers.customer_city) as customer_city,
round(avg(count_per_order.Total_Order),2) as Avg_Orders
from customers
join count_per_order
```

```
on customers.customer_id = count_per_order.customer_id
group by customer_city
order by Avg_Orders desc"""

cur.execute(query)
data = cur.fetchall()

df = pd.DataFrame(data,columns=["Customer City","Avg Prod.Per Order"])
df.head(10)
```

```
        Customer City Avg Prod.Per Order
0      PADRE CARVALHO               7.00
1         CELSO RAMOS               6.50
2               DATAS               6.00
3       CANDIDO GODOI               6.00
4      MATIAS OLIMPIO               5.00
5  MORRO DE SAO PAULO               4.00
6     TEIXEIRA SOARES               4.00
7          CURRALINHO               4.00
8          CIDELANDIA               4.00
9             PICARRA               4.00
```

8. Calculate the percentage of total revenue contributed by each product category.

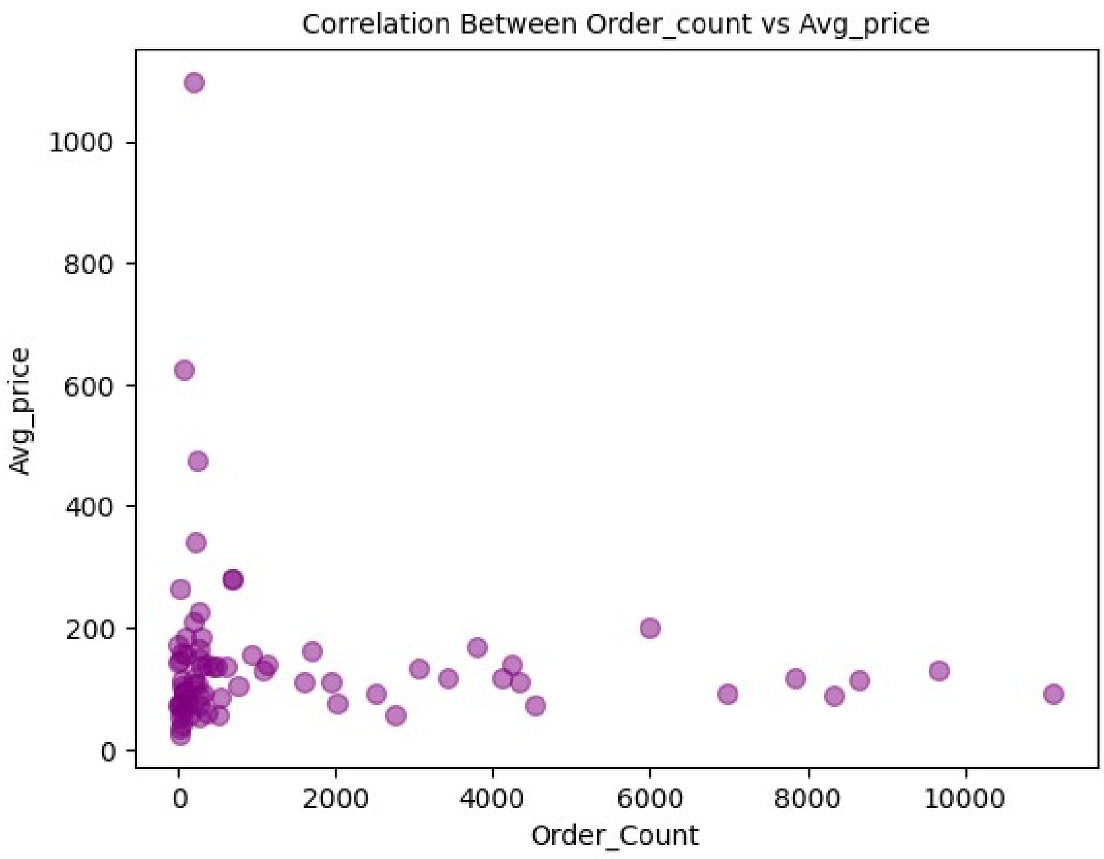
```
query = """SELECT
    upper(p.product_category) AS category,
    ROUND((SUM(pay.payment_value) / (SELECT SUM(payment_value) FROM
payments)) * 100, 2) AS revenue_percentage
FROM products AS p
JOIN order_items AS oi ON p.product_id = oi.product_id
JOIN payments AS pay ON pay.order_id = oi.order_id
GROUP BY p.product_category
ORDER BY revenue_percentage DESC
"""
cur.execute(query)
data = cur.fetchall()

df = pd.DataFrame(data,columns=["Category","Revenue %"])
df
```

```
                    Category  Revenue %
0             BED TABLE BATH      10.70
1              HEALTH BEAUTY      10.35
2       COMPUTER ACCESSORIES       9.90
3       FURNITURE DECORATION       8.93
4            WATCHES PRESENT       8.93
```

```
..                              ...         ...
69                 HOUSE COMFORT 2        0.01
70                  CDS MUSIC DVDS        0.01
71                        PC GAMER        0.01
72  FASHION CHILDREN'S CLOTHING        0.00
73         INSURANCE AND SERVICES        0.00

[74 rows x 2 columns]
```

9.Identify the correlation between product price and the number of times a product has been purchased.

```
query = """select
upper(products.product_category) as category,
count(order_items.product_id) as Total_count,
round(avg(order_items.price),2) as Avg_price
from products
join order_items
on products.product_id = order_items.product_id
group by category"""

cur.execute(query)
data = cur.fetchall()

df= pd.DataFrame(data, columns=["Product
Category","Order_Count","Avg_Price"])
df

arr1 = df["Order_Count"]
arr2 = df["Avg_Price"]

np.corrcoef([arr1,arr2])

plt.scatter(df["Order_Count"],df["Avg_Price"],s = 50, alpha= 0.5,
color = "purple")
plt.xlabel("Order_Count", fontsize= 10)
plt.ylabel("Avg_price", fontsize = 10)
plt.title("Correlation Between Order_count vs Avg_price",fontsize =
10)
plt.show()

# from Graph We can conclude that there is no correlation between
Order_Count and Avg_price
```



10. Calculate the total revenue generated by each seller, and rank them by revenue.

```
query = """select *,dense_rank() over(order by revenue desc) as
rank_No
from
(select
order_items.seller_id as sellers,
round(sum(payments.payment_value),2) as revenue
from order_items
join payments on order_items.order_id= payments.order_id
group by sellers) as a"""

cur.execute(query)
data = cur.fetchall()

df = pd.DataFrame(data,columns=["Seller_id","Revenue",'Rank'])
df.head(10)

                           Seller_id    Revenue  Rank
0  7c67e1448b00f6e969d365cea6b010ab  507166.91     1
```

```
1  1025f0e2d44d7041d6cf58b6550e0bfa  308222.04     2
2  4a3ca9315b744ce9f8e9374361493884  301245.27     3
3  1f50f920176fa81dab994f9023523100  290253.42     4
4  53243585a1d6dc2643021fd1853d8905  284903.08     5
5  da8622b14eb17ae2831f4ac5b9dab84a  272219.32     6
6  4869f7a5dfa277a7dca6462dcf3b52b2  264166.12     7
7  955fee9216a65b617aa5c0531780ce60  236322.30     8
8  fa1c13f2614d7b5c4749cbc52fecda94  206513.23     9
9  7e93a43ef30c4f03f38b393420bc753a  185134.21    10
```

11. Calculate the moving average of order values for each customer over their order history

```
query = """select
customer,
Order_Time,
Payment,
avg(payment)
over(partition by customer
order by Order_Time
rows between 2 preceding and current row ) as Moving_Avg
from
(select
orders.customer_id as Customer,
orders.order_purchase_timestamp as Order_Time,
payments.payment_value as Payment
from payments
join orders on payments.order_id = orders.order_id ) as
OrderDetals;"""

cur.execute(query)
data = cur.fetchall()

df
=pd.DataFrame(data,columns=["Customer","Order_Time","Payments","Moving
_Avg"])
df.head(10)
```

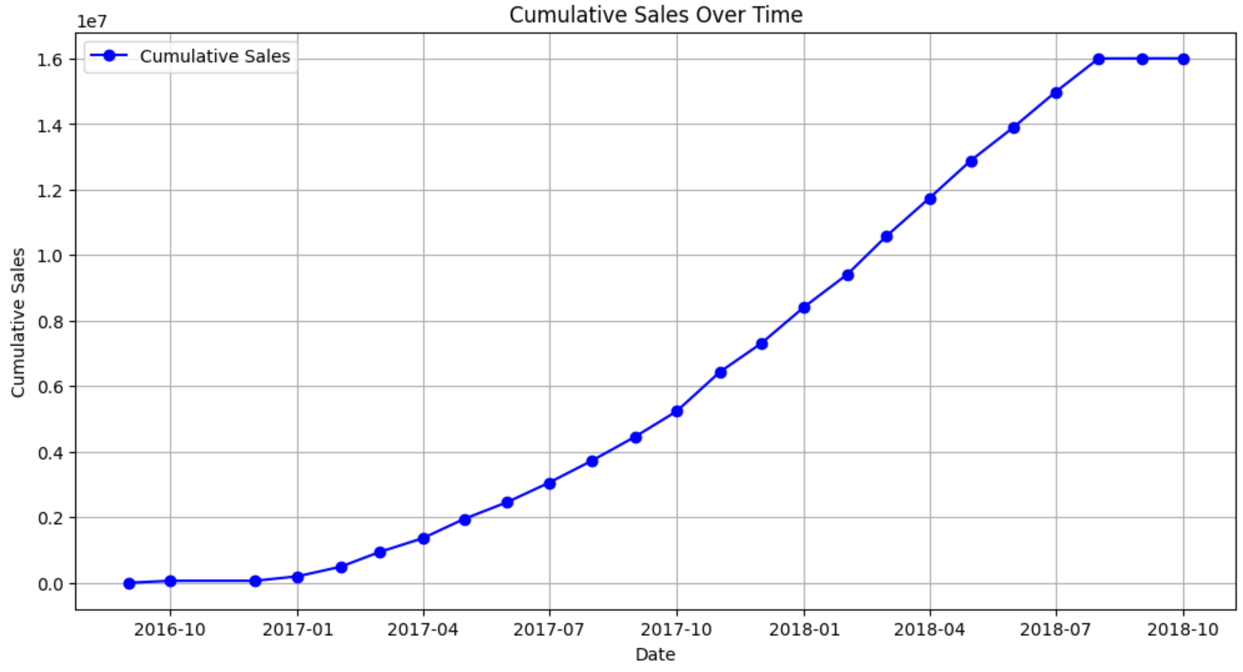
```
                           Customer           Order_Time  Payments  \
0  00012a2ce6f8dcda20d059ce98491703  2017-11-14 16:08:26    114.74
1  000161a058600d5901f007fab4c27140  2017-07-16 09:40:32     67.41
2  0001fd6190edaaf884bcaf3d49edf079  2017-02-28 11:06:43    195.42
3  0002414f95344307404f0ace7a26f1d5  2017-08-16 13:09:20    179.35
4  000379cdec625522490c315e70c7a9fb  2018-04-02 13:42:17    107.01
5  0004164d20a9e969af783496f3408652  2017-04-12 08:35:12     71.80
6  000419c5494106c306a97b5635748086  2018-03-02 17:47:40     49.40
7  00046a560d407e99b969756e0b10f282  2017-12-18 11:08:30    166.59
```

```
8  00050bf6e01e69d5c0fd612f1bcfb69c  2017-09-17 16:04:44     85.23
9  000598caf2ef4117407665ac33275130  2018-08-11 12:14:35   1255.71

    Moving_Avg
0   114.739998
1    67.410004
2   195.419998
3   179.350006
4   107.010002
5    71.800003
6    49.400002
7   166.589996
8    85.230003
9  1255.709961
```

12. Calculate the cumulative sales per month for each year

```
query = """select
Year,
Month,
payment,
sum(payment)
over(order by Year,Month) as Cumulative_Sale
from
(select
year(orders.order_purchase_timestamp) as Year,
month(orders.order_purchase_timestamp) as Month,
round(sum(payments.payment_value),2)as payment
from orders
join payments on orders.order_id = payments.order_id
group by Year, Month
order by Year, Month)AS Details"""

cur.execute(query)
data = cur.fetchall()

df
=pd.DataFrame(data,columns=["Year","Month","Payment","Cumulative_Sales
"])
df

    Year  Month     Payment  Cumulative_Sales
0   2016      9      252.24            252.24
1   2016     10    59090.48          59342.72
2   2016     12       19.62          59362.34
3   2017      1   138488.04         197850.38
```

```
4   2017      2   291908.01         489758.39
5   2017      3   449863.60         939621.99
6   2017      4   417788.03        1357410.02
7   2017      5   592918.82        1950328.84
8   2017      6   511276.38        2461605.22
9   2017      7   592382.92        3053988.14
10  2017      8   674396.32        3728384.46
11  2017      9   727762.45        4456146.91
12  2017     10   779677.88        5235824.79
13  2017     11  1194882.80        6430707.59
14  2017     12   878401.48        7309109.07
15  2018      1  1115004.18        8424113.25
16  2018      2   992463.34        9416576.59
17  2018      3  1159652.12       10576228.71
18  2018      4  1160785.48       11737014.19
19  2018      5  1153982.15       12890996.34
20  2018      6  1023880.50       13914876.84
21  2018      7  1066540.75       14981417.59
22  2018      8  1022425.32       16003842.91
23  2018      9     4439.54       16008282.45
24  2018     10      589.67       16008872.12

# plotting a Graph for Better Understanding :-

# Convert Year and Month columns to a datetime format for easy
plotting
df['Date'] = pd.to_datetime(df['Year'].astype(str) + '-' +
df['Month'].astype(str) + '-01')

# Set 'Date' as the index for better plotting
df.set_index('Date', inplace=True)

# Plotting
plt.figure(figsize=(12, 6))
plt.plot(df.index, df['Cumulative_Sales'], marker='o', color='b',
label='Cumulative Sales')
plt.xlabel('Date')
plt.ylabel('Cumulative Sales')
plt.title('Cumulative Sales Over Time')
plt.legend()
plt.grid(True)
plt.show()
```



13. Calculate the year-over-year growth rate of total sales.

```
query = """with Previous_sales as (select
year(orders.order_purchase_timestamp) as Year,
round(sum(payments.payment_value),2) as Sales
from orders
join payments on orders.order_id = payments.order_id
group by Year
order by Year)

select Year,((Sales-lag(sales,1) over(order by Year))/lag(Sales,1)
over(order by Year)*100)
 from Previous_sales"""

cur.execute(query)
data = cur.fetchall()
data

df = pd.DataFrame(data, columns=["Year","YOY % Change"])
df
```

```
   Year   YOY % Change
0  2016            NaN
1  2017   12112.703761
2  2018      20.000924
```

14. Calculate the retention rate of customers, defined as the percentage of customers who make another purchase within 6 months of their first purchase.

```
query = """WITH first_purchase AS (
SELECT
customers.customer_id,
MIN(orders.order_purchase_timestamp) AS first_order_date
FROM customers
JOIN orders ON customers.customer_id = orders.customer_id
GROUP BY customers.customer_id
),
retained_customer AS (
SELECT
fp.customer_id,
COUNT(DISTINCT orders.order_purchase_timestamp) AS
count_repeat_purchase
FROM first_purchase fp
JOIN orders ON fp.customer_id = orders.customer_id
AND orders.order_purchase_timestamp > fp.first_order_date
AND orders.order_purchase_timestamp < DATE_ADD(fp.first_order_date,
INTERVAL 6 MONTH)
GROUP BY fp.customer_id
)
SELECT
100 * (COUNT(DISTINCT retained_customer.customer_id) / COUNT(DISTINCT
first_purchase.customer_id)) AS retention_rate
FROM first_purchase
LEFT JOIN retained_customer ON first_purchase.customer_id =
retained_customer.customer_id
WHERE retained_customer.count_repeat_purchase > 0
"""

cur.execute(query)
data = cur.fetchall()
data

df = pd.DataFrame(data, columns= ["Retention_Rate"])
df

# Non of our customer is Repeated that the only reason our
Retention_Rate is None/0
```

```
  Retention_Rate
0           None
```

15. Identify the top 3 customers who spent the most money in each year.

```
query = """
select Year, Customer,payment, D_Rank
from
(select
Year(orders.order_purchase_timestamp) as Year,
orders.customer_id as Customer,
round(sum(payments.payment_value),2) as payment,
dense_rank() over(partition by year(orders.order_purchase_timestamp)
order by sum(payments.payment_value) desc) AS D_Rank
from orders
join payments on payments.order_id = orders.order_id
group by Year, Customer) as A
where D_rank <= 3;"""

cur.execute(query)
data = cur.fetchall()
data

df =
pd.DataFrame(data,columns=["Year","Customer_id","Payment","Rank"])
df
```

```
   Year                       Customer_id   Payment  Rank
0  2016  a9dc96b027d1252bbac0a9b72d837fc6   1423.55     1
1  2016  1d34ed25963d5aae4cf3d7f3a4cda173   1400.74     2
2  2016  4a06381959b6670756de02e07b83815f   1227.78     3
3  2017  1617b1357756262bfa56ab541c47bc16  13664.08     1
4  2017  c6e2731c5b391845f6800c97401a43a9   6929.31     2
5  2017  3fd6777bbce08a352fddd04e4a7cc8f6   6726.66     3
6  2018  ec5b2ba62e574342386871631fafd3fc   7274.88     1
7  2018  f48d464a0baaea338cb25f816991ab1f   6922.21     2
8  2018  e0a2412720e9ea4f26c1ac985f6a7358   4809.44     3
```