Analyzed a Dataset of 100,000 orders spanning 2016-2018 using SQL and Python.

In [1]:
```
import pandas as pd
import numpy as np
import mysql.connector
import os

# List of CSV files and their corresponding table names.

csv_files = [
    ('customers.csv', 'customers'),
    ('orders.csv', 'orders'),
    ('sellers.csv', 'sellers'),
    ('products.csv', 'products'),
    ('geolocation.csv', 'geolocation'),
    ('payments.csv', 'payments'),
    ('order_items.csv', 'order_items')
]


# Connect to the MySQL database
conn = mysql.connector.connect(
    host='localhost',
    user='root',
    password='PIyush@12345',
    database='ecommerce'
)
cursor = conn.cursor()


# Folder containing the CSV files
folder_path ='D:\sql project\Ecommerce'

def get_sql_type(dtype):
    if pd.api.types.is_integer_dtype(dtype):
        return 'INT'
    elif pd.api.types.is_float_dtype(dtype):
        return 'FLOAT'
    elif pd.api.types.is_bool_dtype(dtype):
        return 'BOOLEAN'
    elif pd.api.types.is_datetime64_any_dtype(dtype):
        return 'DATETIME'
    else:
        return 'TEXT'

for csv_file, table_name in csv_files:
    file_path = os.path.join(folder_path, csv_file)

    # Read the CSV file into a pandas DataFrame
    df = pd.read_csv(file_path)

    # Replace NaN with None to handle SQL NULL
    df = df.where(pd.notnull(df), None)

    # Debugging: Check for NaN values
    print(f"Processing {csv_file}")
    print(f"NaN values before replacement:\n{df.isnull().sum()}\n")
```

```
    # Clean column names
    df.columns = [col.replace(' ', '_').replace('-', '_').replace('.', '_') for col

    # Generate the CREATE TABLE statement with appropriate data types
    columns = ', '.join([f'`{col}` {get_sql_type(df[col].dtype)}' for col in df.col
    create_table_query = f'CREATE TABLE IF NOT EXISTS `{table_name}` ({columns})'
    cursor.execute(create_table_query)

    # Insert DataFrame data into the MySQL table
    for _, row in df.iterrows():
        # Convert row to tuple and handle NaN/None explicitly
        values = tuple(None if pd.isna(x) else x for x in row)
        sql = f"INSERT INTO `{table_name}` ({', '.join(['`' + col + '`' for col in
        cursor.execute(sql, values)

    # Commit the transaction for the current CSV file
    conn.commit()

# Close the connection
conn.close()
```

```
Processing customers.csv
NaN values before replacement:
customer_id                 0
customer_unique_id          0
customer_zip_code_prefix    0
customer_city               0
customer_state              0
dtype: int64

Processing orders.csv
NaN values before replacement:
order_id                            0
customer_id                         0
order_status                        0
order_purchase_timestamp            0
order_approved_at                 160
order_delivered_carrier_date     1783
order_delivered_customer_date    2965
order_estimated_delivery_date       0
dtype: int64

Processing sellers.csv
NaN values before replacement:
seller_id                 0
seller_zip_code_prefix    0
seller_city               0
seller_state              0
dtype: int64

Processing products.csv
NaN values before replacement:
product_id                      0
product category              610
product_name_length           610
product_description_length    610
product_photos_qty            610
product_weight_g                2
product_length_cm               2
product_height_cm               2
product_width_cm                2
dtype: int64

Processing geolocation.csv
NaN values before replacement:
geolocation_zip_code_prefix    0
geolocation_lat                0
geolocation_lng                0
geolocation_city               0
geolocation_state              0
dtype: int64

Processing payments.csv
NaN values before replacement:
order_id                0
payment_sequential      0
payment_type            0
payment_installments    0
payment_value           0
dtype: int64

Processing order_items.csv
NaN values before replacement:
order_id               0
order_item_id          0
```

```
product_id             0
seller_id              0
shipping_limit_date    0
price                  0
freight_value          0
dtype: int64
```

In [2]:
```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import mysql.connector

conn=mysql.connector.connect(host="localhost",
                             username="root",
                             password="PIyush@12345",
                             database="ecommerce")

cur=conn.cursor()
```

1. List all unique cities where customers are located.

In [3]:
```
query="select distinct customer_city from customers"

cur.execute(query)
output=cur.fetchall()
output
```

Out[3]:
```
[('franca',),
 ('sao bernardo do campo',),
 ('sao paulo',),
 ('mogi das cruzes',),
 ('campinas',),
 ('jaragua do sul',),
 ('timoteo',),
 ('curitiba',),
 ('belo horizonte',),
 ('montes claros',),
 ('rio de janeiro',),
 ('lencois paulista',),
 ('caxias do sul',),
 ('piracicaba',),
 ('guarulhos',),
 ('pacaja',),
 ('florianopolis',),
 ('aparecida de goiania',),
 ('santo andre',),
 ('goiania',),
 ('cachoeiro de itapemirim',),
 ('sao jose dos campos',),
 ('sao roque',),
 ('camacari',),
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 ('sumare',),
 ('novo hamburgo',),
 ('sao luis',),
 ('sao jose',),
 ('santa barbara',),
 ('ribeirao preto',),
 ('ituiutaba',),
 ('taquarituba',),
 ('sao jose dos pinhais',),
 ('barrinha',),
 ('parati',),
 ('dourados',),
 ('trindade',),
 ('cascavel',),
 ('fortaleza',),
 ('brasilia',),
 ('pelotas',),
 ('porto alegre',),
 ('salto',),
 ('jundiai',),
 ('cacapava',),
 ('sao vicente',),
 ('uberlandia',),
 ('botelhos',),
 ('sao goncalo',),
 ('araucaria',),
 ('nova iguacu',),
 ('areia branca',),
 ('campos dos goytacazes',),
 ('sao carlos',),
 ('itajuba',),
 ('cruz das almas',),
 ('vassouras',),
 ('feira de santana',),
 ('niteroi',),
 ('sobral',),
 ('divinopolis',),
 ('paraiba do sul',),
 ('paulista',),
```

```
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('cafeara',),
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('suzano',),
('timbo',),
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```
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('paranavai',),
('pinhais',),
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('cristalandia',),
('castelo do piaui',),
('ibipora',),
('presidente dutra',),
('vera cruz',),
('paulo frontin',),
...]
```

2. Count the number of orders placed in 2017.

In [4]:
```
query="select count(order_id) from orders where year(order_purchase_timestamp)=2017

cur.execute(query)
output=cur.fetchall()
orders=output[0][0]
print('total orders placed in 2017 is' ,orders)
```

```
total orders placed in 2017 is 90202
```

3. Find the total sales per category.

In [5]:
```
query = """ select upper(products.product_category) category,
round(sum(payments.payment_value),2) 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)
output=cur.fetchall()
output


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

Out[5]:

	Category	Sales
0	PERFUMERY	4053909.28
1	FURNITURE DECORATION	11441411.13
2	TELEPHONY	3895056.41
3	BED TABLE BATH	13700429.37
4	AUTOMOTIVE	6818354.65
...	...	...
69	CDS MUSIC DVDS	9595.44
70	LA CUISINE	23308.24
71	FASHION CHILDREN'S CLOTHING	6285.36
72	PC GAMER	17395.44
73	INSURANCE AND SERVICES	2596.08

74 rows × 2 columns

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

In [6]:

```
query = """ select ((sum(case when payment_installments >= 1 then 1
else 0 end))/count(*))*100 from payments
"""

cur.execute(query)

output = cur.fetchall()
data= output[0][0]

print("the percentage of orders that were paid in installments is", data)
```

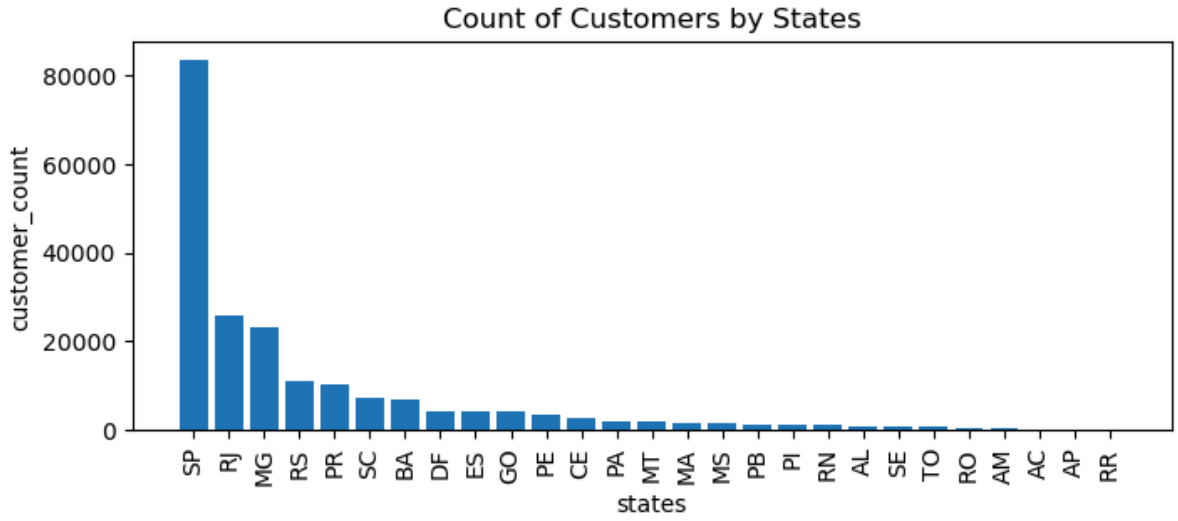
```
the percentage of orders that were paid in installments is 99.9981
```

5. Count the number of customers from each state.

In [7]:
```
query = """ select customer_state ,count(customer_id)
from customers group by customer_state
"""

cur.execute(query)

output = cur.fetchall()
df = pd.DataFrame(output, columns = ["state", "customer_count" ])
df = df.sort_values(by = "customer_count", ascending= False)
plt.figure(figsize = (8,3))
plt.bar(df["state"], df["customer_count"])
plt.xticks(rotation = 90)
plt.xlabel("states")
plt.ylabel("customer_count")
plt.title("Count of Customers by States")
plt.show()
```



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

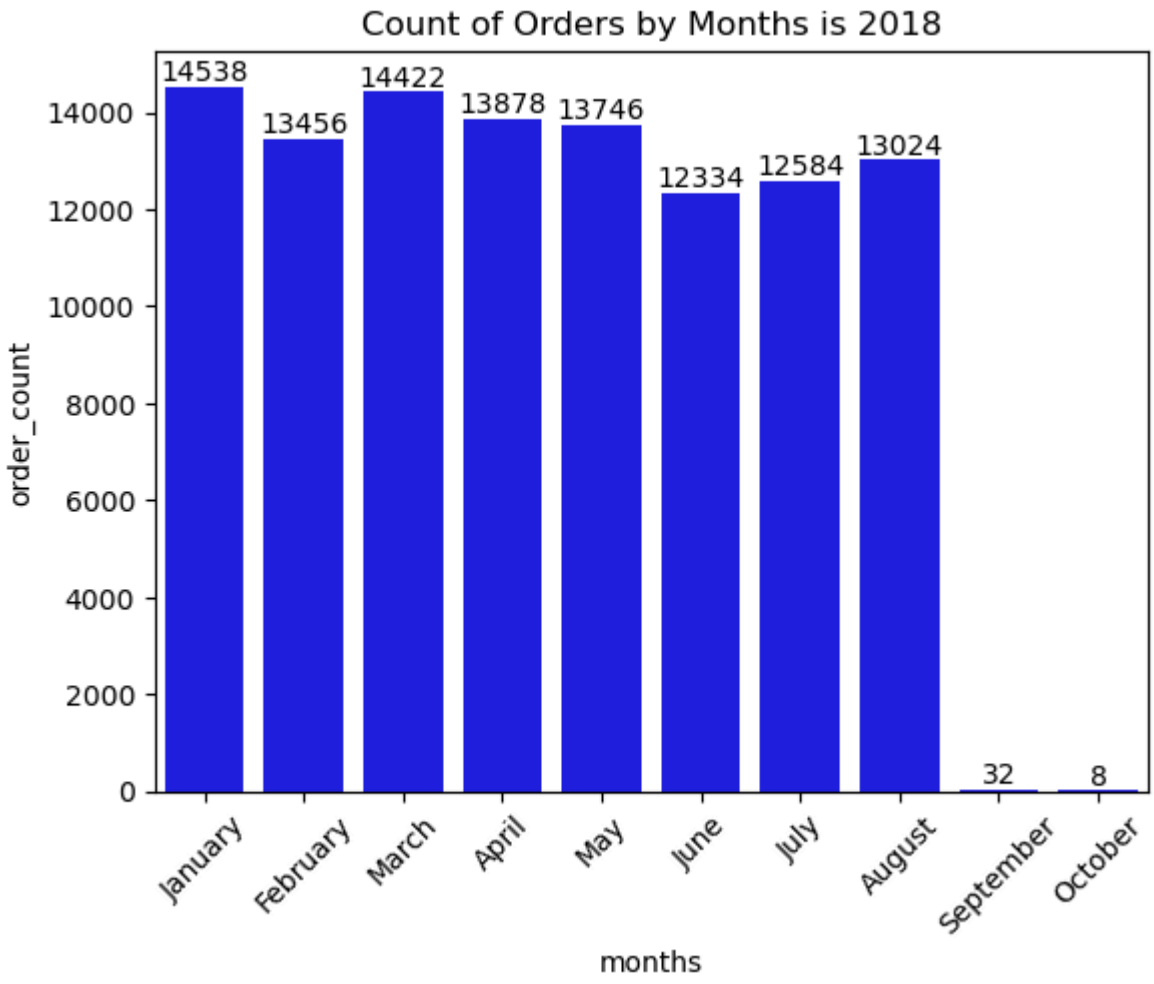
In [8]:
```
query = """ select monthname(order_purchase_timestamp) months, count(order_id) orde
from orders where year(order_purchase_timestamp) = 2018
group by months
"""

cur.execute(query)

data = cur.fetchall()
df = pd.DataFrame(data, columns = ["months", "order_count"])
months = ["January", "February","March","April","May","June","July","August","Septe

ax = sns.barplot(x = df["months"],y =  df["order_count"], data = df, order = months
plt.xticks(rotation = 45)
ax.bar_label(ax.containers[0])
plt.title("Count of Orders by Months is 2018")

plt.show()
```



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

In [9]:
```
query = """with count_per_order as
(select orders.order_id, orders.customer_id, count(order_items.order_id) as oc
from orders join order_items
on orders.order_id = order_items.order_id
group by orders.order_id, orders.customer_id)

select customers.customer_city, round(avg(count_per_order.oc),2) average_orders
from customers join count_per_order
on customers.customer_id = count_per_order.customer_id
group by customers.customer_city order by average_orders desc
"""

cur.execute(query)

output = cur.fetchall()
df = pd.DataFrame(output,columns = ["customer city", "average products/order"])
df.head(10)
```

Out[9]:

	customer city	average products/order
0	padre carvalho	28.00
1	celso ramos	26.00
2	datas	24.00
3	candido godoi	24.00
4	matias olimpio	20.00
5	cidelandia	16.00
6	curralinho	16.00
7	picarra	16.00
8	morro de sao paulo	16.00
9	teixeira soares	16.00

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

In [11]:
```
query = """select upper(products.product_category) category,
round((sum(payments.payment_value)/(select sum(payment_value) from payments))*100,2
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 order by sales_percentage desc"""


cur.execute(query)
output = cur.fetchall()
df = pd.DataFrame(output,columns = ["Category", "percentage distribution"])
df.head()
```

Out[11]:

	Category	percentage distribution
0	BED TABLE BATH	42.79
1	HEALTH BEAUTY	41.41
2	COMPUTER ACCESSORIES	39.61
3	FURNITURE DECORATION	35.73
4	WATCHES PRESENT	35.71

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

In [24]:
```
import pandas as pd
import numpy as np
```

```
import mysql.connector
import os
import matplotlib.pyplot as plt
import seaborn as sns
```

In [26]:
```
conn = mysql.connector.connect(
    host='localhost',
    user='root',
    password='PIyush@12345',
    database='ecommerce'
)
cur = conn.cursor()
```

In [28]:
```
query = """select products.product_category,
count(order_items.product_id),
round(avg(order_items.price),2)
from products join order_items
on products.product_id = order_items.product_id
group by products.product_category"""

cur.execute(query)
output=cur.fetchall()
df = pd.DataFrame(output,columns = ["Category", "order_count","price"])

arr1 = df["order_count"]
arr2 = df["price"]

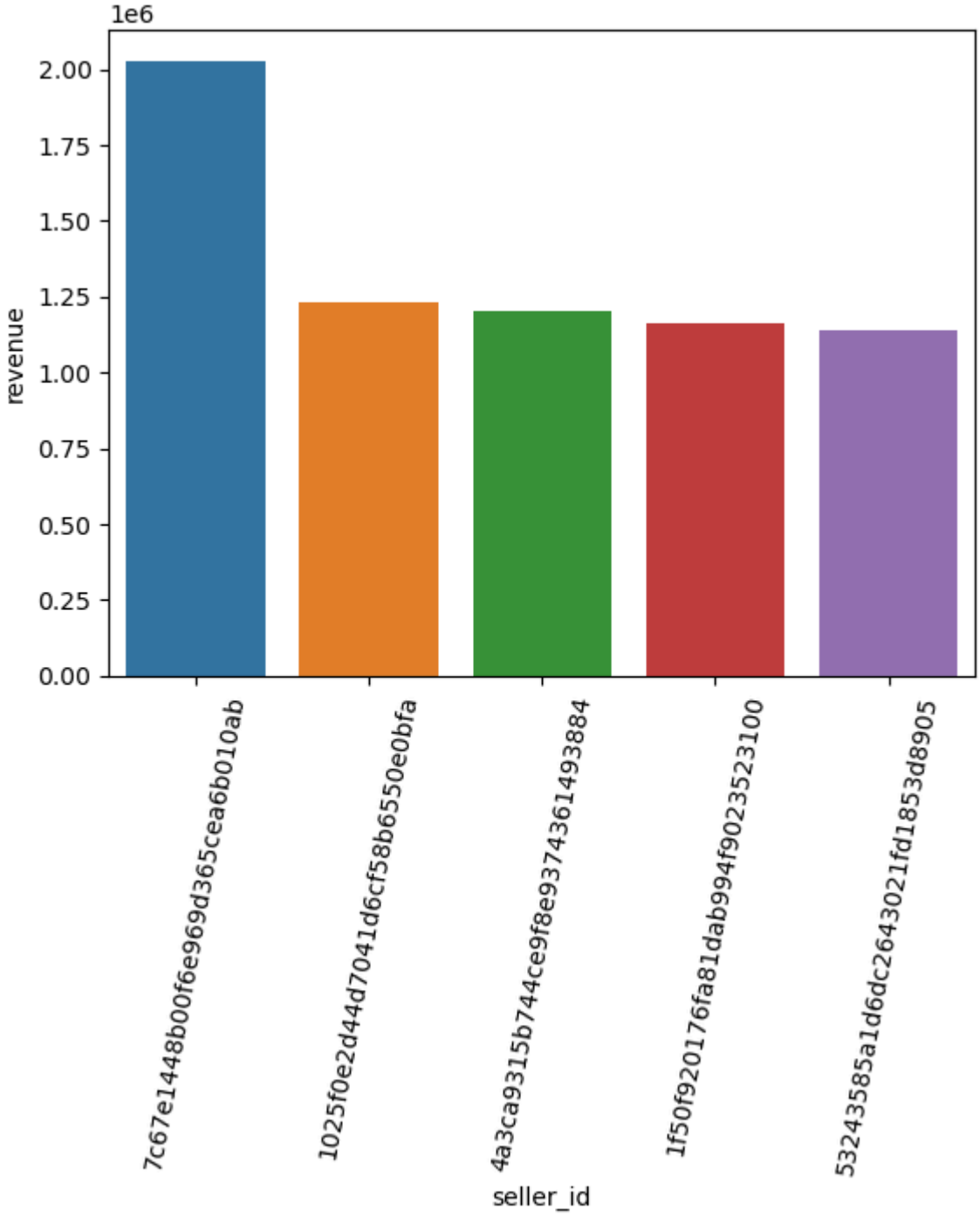
a = np.corrcoef([arr1,arr2])
print("the correlation is", a[0][-1])
```

```
the correlation is -0.10631514167157562
```

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

In [32]:
```
query = """ select *, dense_rank() over(order by revenue desc) as rn from
(select order_items.seller_id, sum(payments.payment_value)
revenue from order_items join payments
on order_items.order_id = payments.order_id
group by order_items.seller_id) as a """

cur.execute(query)
output = cur.fetchall()
df = pd.DataFrame(output, columns = ["seller_id", "revenue", "rank"])
df = df.head()
sns.barplot(x = "seller_id", y = "revenue", data = df)
plt.xticks(rotation = 80)
plt.show()
```



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

In [34]:
```
query = """select years, months , payment, sum(payment)
over(order by years, months) cumulative_sales from
(select year(orders.order_purchase_timestamp) as years,
month(orders.order_purchase_timestamp) as months,
round(sum(payments.payment_value),2) as payment from orders join payments
on orders.order_id = payments.order_id
group by years, months order by years, months) as a
"""
cur.execute(query)
output = cur.fetchall()
```

```
df = pd.DataFrame(output)
df
```

Out[34]:

	0	1	2	3
0	2016	9	1008.96	1008.96
1	2016	10	236361.92	237370.88
2	2016	12	78.48	237449.36
3	2017	1	553952.16	791401.52
4	2017	2	1167632.04	1959033.56
5	2017	3	1799454.40	3758487.96
6	2017	4	1671152.12	5429640.08
7	2017	5	2371675.28	7801315.36
8	2017	6	2045105.52	9846420.88
9	2017	7	2369531.68	12215952.56
10	2017	8	2697585.28	14913537.84
11	2017	9	2911049.80	17824587.64
12	2017	10	3118711.52	20943299.16
13	2017	11	4779531.20	25722830.36
14	2017	12	3513605.92	29236436.28
15	2018	1	4460016.72	33696453.00
16	2018	2	3969853.36	37666306.36
17	2018	3	4638608.48	42304914.84
18	2018	4	4643141.92	46948056.76
19	2018	5	4615928.60	51563985.36
20	2018	6	4095522.00	55659507.36
21	2018	7	4266163.00	59925670.36
22	2018	8	4089701.29	64015371.65
23	2018	9	17758.16	64033129.81
24	2018	10	2358.68	64035488.49

12.Calculate the cumulative sales per month for each year.

In [36]:

```
query = """select years, months , payment, sum(payment)
over(order by years, months) cumulative_sales from
(select year(orders.order_purchase_timestamp) as years,
month(orders.order_purchase_timestamp) as months,
round(sum(payments.payment_value),2) as payment from orders join payments
on orders.order_id = payments.order_id
group by years, months order by years, months) as a
"""
cur.execute(query)
```

```
output = cur.fetchall()
df = pd.DataFrame(output)
df
```

Out[36]:

	0	1	2	3
0	2016	9	1008.96	1008.96
1	2016	10	236361.92	237370.88
2	2016	12	78.48	237449.36
3	2017	1	553952.16	791401.52
4	2017	2	1167632.04	1959033.56
5	2017	3	1799454.40	3758487.96
6	2017	4	1671152.12	5429640.08
7	2017	5	2371675.28	7801315.36
8	2017	6	2045105.52	9846420.88
9	2017	7	2369531.68	12215952.56
10	2017	8	2697585.28	14913537.84
11	2017	9	2911049.80	17824587.64
12	2017	10	3118711.52	20943299.16
13	2017	11	4779531.20	25722830.36
14	2017	12	3513605.92	29236436.28
15	2018	1	4460016.72	33696453.00
16	2018	2	3969853.36	37666306.36
17	2018	3	4638608.48	42304914.84
18	2018	4	4643141.92	46948056.76
19	2018	5	4615928.60	51563985.36
20	2018	6	4095522.00	55659507.36
21	2018	7	4266163.00	59925670.36
22	2018	8	4089701.29	64015371.65
23	2018	9	17758.16	64033129.81
24	2018	10	2358.68	64035488.49

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

In [39]:

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

select years, ((payment - lag(payment, 1) over(order by years))/
lag(payment, 1) over(order by years)) * 100 from a"""
```

```
cur.execute(query)
output = cur.fetchall()
df = pd.DataFrame(output, columns = ["years", "yoy % growth"])
df
```

Out[39]:

	years	yoy % growth
0	2016	NaN
1	2017	12112.703757
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.

In [40]:

```
query = """with a as (select customers.customer_id,
min(orders.order_purchase_timestamp) first_order
from customers join orders
on customers.customer_id = orders.customer_id
group by customers.customer_id),

b as (select a.customer_id, count(distinct orders.order_purchase_timestamp) next_or
from a join orders
on orders.customer_id = a.customer_id
and orders.order_purchase_timestamp > first_order
and orders.order_purchase_timestamp <
date_add(first_order, interval 6 month)
group by a.customer_id)

select 100 * (count( distinct a.customer_id)/ count(distinct b.customer_id))
from a left join b
on a.customer_id = b.customer_id ;"""

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

output
```

Out[40]:

```
[(None,)]
```

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

In [44]:

```
query = """select years, customer_id, payment, d_rank
from
(select year(orders.order_purchase_timestamp) years,
orders.customer_id,
sum(payments.payment_value) payment,
dense_rank() over(partition by year(orders.order_purchase_timestamp)
order by sum(payments.payment_value) desc) d_rank
from orders join payments
on payments.order_id = orders.order_id
group by year(orders.order_purchase_timestamp),
```

```
orders.customer_id) as a
where d_rank <= 3 ;"""

cur.execute(query)
data = cur.fetchall()
df = pd.DataFrame(data, columns = ["years","id","payment","rank"])
sns.barplot(x = "id", y = "payment", data = df, hue = "years")
plt.xticks(rotation = 90)
plt.show()
```