In [1]:
```python
import pandas as pd
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')
    # Added payments.csv for specific handling
]

# Connect to the MySQL database
conn = mysql.connector.connect(
    host='localhost',
    user='root',
    password='abhay55555',
    database='ecommerce'
)
cursor = conn.cursor()

# Folder containing the CSV files
folder_path = "C:\\Users\\abhay\\OneDrive\\Desktop\\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 in df.columns]

    # Generate the CREATE TABLE statement with appropriate data types
    columns = ', '.join([f'`{col}` {get_sql_type(df[col].dtype)}' for col in df.columns])
    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 df.columns])}) VALUES ({', '.join(['%s'] * len(row))})"
        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 [3]:
```python
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import mysql.connector


db = mysql.connector.connect(host = "localhost",
                            username = "root",
                            password = "abhay55555",
                            database = "ecommerce")

cur = db.cursor()
```

List all unique cities where customers are located.

In [4]:
```python
query = """ select distinct customer_city  from customers"""

cur.execute(query)

data = cur.fetchall()

df =  pd.DataFrame(data)
df.head()
```

Out[4]:

	0
0	franca
1	sao bernardo do campo
2	sao paulo
3	mogi das cruzes
4	campinas

Count the number of orders placed in 2017.

In [5]:
```python
query = """ select count(order_id) from orders where year(order_purchase_timestamp) = 2017 """

cur.execute(query)

data = cur.fetchall()

"total orders placed in 2017 are", data[0][0]
```

Out[5]:
```
('total orders placed in 2017 are', 135303)
```

Find the total sales per category.

In [6]:
```python
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)

data = cur.fetchall()

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

Out[6]:

	Category	Sales
0	PERFUMERY	4053909.28
1	FURNITURE DECORATION	11441411.13
2	TELEPHONY	3895056.41
3	FASHION BAGS AND ACCESSORIES	1745266.24
4	BED TABLE BATH	13700429.37
...	...	...
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

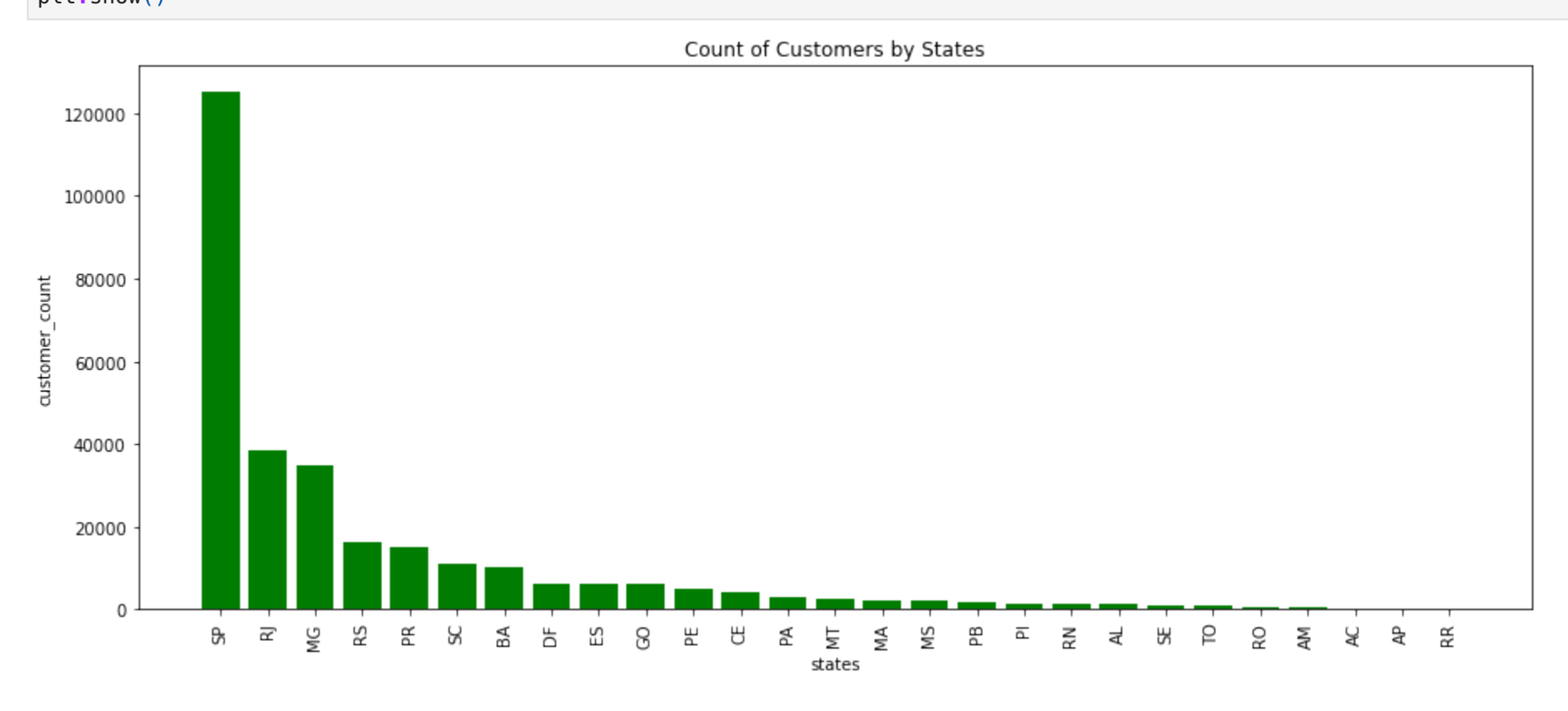
Calculate the percentage of orders that were paid in installments.

In [7]:
```python
query = """ select ((sum(case when payment_installments >= 1 then 1
else 0 end))/count(*))*100 from payments
"""

cur.execute(query)

data = cur.fetchall()

"the percentage of orders that were paid in installments is", data[0][0]
```

Out[7]:
```
('the percentage of orders that were paid in installments is',
 Decimal('99.9981'))
```

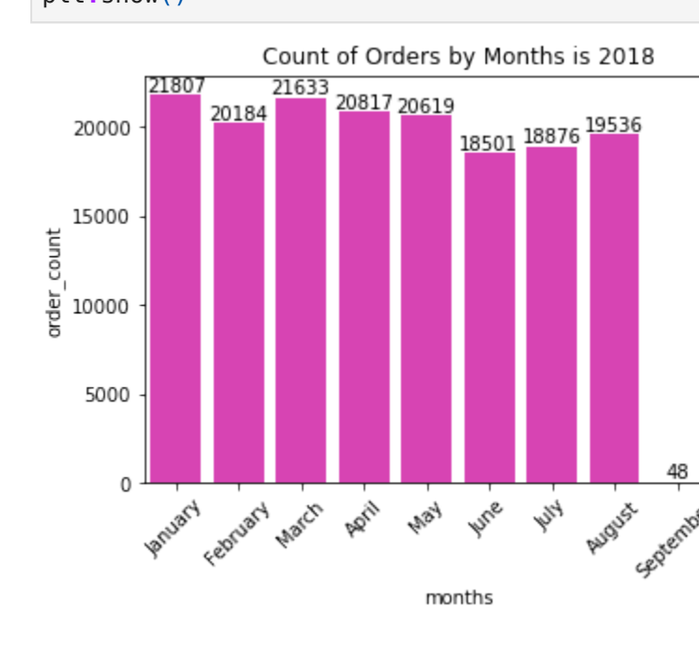
Count the number of customers from each state.

In [8]:
```python
query = """ select customer_state ,count(customer_id)
from customers group by customer_state
"""

cur.execute(query)

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

plt.figure(figsize = (15,6))
plt.bar(df["state"], df["customer_count"], color="g")
plt.xticks(rotation = 90)
plt.xlabel("states")
plt.ylabel("customer_count")
plt.title("Count of Customers by States")
plt.show()
```



Calculate the number of orders per month in 2018.

In [9]:
```python
import seaborn as sns
query = """ select monthname(order_purchase_timestamp) months, count(order_id) order_count
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"])
o = ["January", "February","March","April","May","June","July","August","September","October"]

ax = sns.barplot(x = df["months"],y =  df["order_count"], data = df, order = o, color = "#F02BC0")
plt.xticks(rotation = 45)
ax.bar_label(ax.containers[0])
plt.title("Count of Orders by Months is 2018")

plt.show()
```



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

In [10]:
```python
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)

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

Out[10]:

	customer city	average products/order
0	padre carvalho	42.00
1	celso ramos	39.00
2	datas	36.00
3	candido godoi	36.00
4	matias olimpio	30.00
5	cidelandia	24.00
6	curralinho	24.00
7	picarra	24.00
8	morro de sao paulo	24.00
9	teixeira soares	24.00

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

In [11]:
```python
query = """select upper(products.product_category) category,
round((sum(payments.payment_value)/(select sum(payment_value) from payments))*100,2) sales_percentage
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)
data = cur.fetchall()
df = pd.DataFrame(data,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

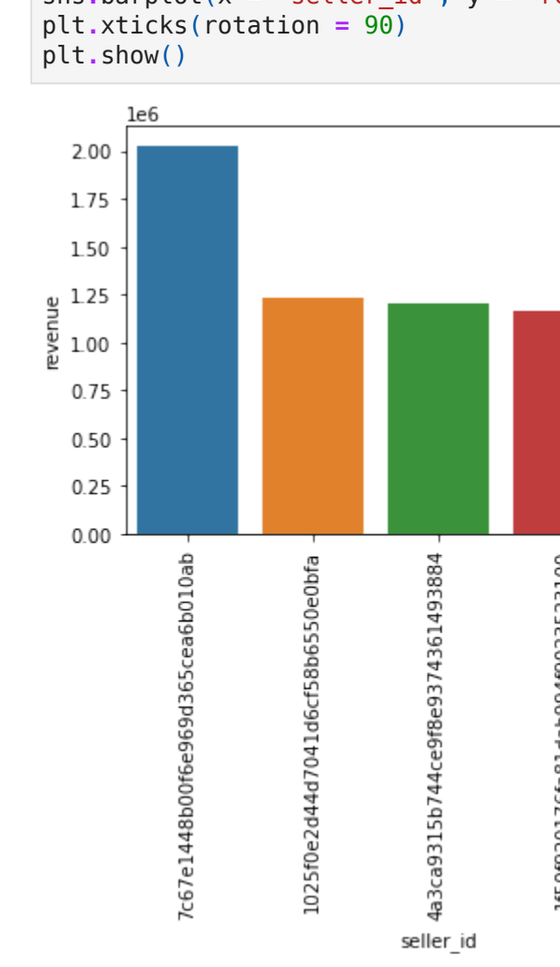
Identify the correlation between product price and the number of times a product has been purchased.

In [12]:
```python
cur = db.cursor()
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)
data = cur.fetchall()
df = pd.DataFrame(data,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
```

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

In [14]:
```python
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)
data = cur.fetchall()
df = pd.DataFrame(data, columns = ["seller_id", "revenue", "rank"])
df = df.head()
sns.barplot(x = "seller_id", y = "revenue", data = df)
plt.xticks(rotation = 90)
plt.show()
```



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

In [15]:
```python
query = """select customer_id, order_purchase_timestamp, payment,
avg(payment) over(partition by customer_id order by order_purchase_timestamp
rows between 2 preceding and current row) as mov_avg
from
(select orders.customer_id, orders.order_purchase_timestamp,
payments.payment_value as payment
from payments join orders
on payments.order_id = orders.order_id) as a"""
cur.execute(query)
data = cur.fetchall()
df = pd.DataFrame(data)
df
```

Out[15]:

	0	1	2	3
0	00012a2ce6f8dcda20d059ce98491703	2017-11-14 16:08:26	114.74	114.739998
1	00012a2ce6f8dcda20d059ce98491703	2017-11-14 16:08:26	114.74	114.739998
2	00012a2ce6f8dcda20d059ce98491703	2017-11-14 16:08:26	114.74	114.739998
3	00012a2ce6f8dcda20d059ce98491703	2017-11-14 16:08:26	114.74	114.739998
4	00012a2ce6f8dcda20d059ce98491703	2017-11-14 16:08:26	114.74	114.739998
...	...	...	...	...
623311	ffffe8b65bbe3087b653a978c870db99	2017-09-29 14:07:03	18.37	18.370001
623312	ffffe8b65bbe3087b653a978c870db99	2017-09-29 14:07:03	18.37	18.370001
623313	ffffe8b65bbe3087b653a978c870db99	2017-09-29 14:07:03	18.37	18.370001
623314	ffffe8b65bbe3087b653a978c870db99	2017-09-29 14:07:03	18.37	18.370001
623315	ffffe8b65bbe3087b653a978c870db99	2017-09-29 14:07:03	18.37	18.370001

623316 rows × 4 columns

Calculate the cumulative sales per month for each year.

In [17]:
```python
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)
data = cur.fetchall()
df = pd.DataFrame(data)
df
```

Out[17]:

	0	1	2	3
0	2016	9	1513.44	1513.44
1	2016	10	354542.88	356056.32
2	2016	12	117.72	356174.04
3	2017	1	830928.24	1187102.28
4	2017	2	1751448.06	2938550.34
5	2017	3	2699181.60	5637731.94
6	2017	4	2506728.18	8144460.12
7	2017	5	3557512.92	11701973.04
8	2017	6	3067658.28	14769631.32
9	2017	7	3554297.52	18323928.84
10	2017	8	4046377.92	22370306.76
11	2017	9	4366574.70	26736881.46
12	2017	10	4678067.28	31414948.74
13	2017	11	7169296.80	38584245.54
14	2017	12	5270408.88	43854654.42
15	2018	1	6690025.07	50544679.49
16	2018	2	5954780.04	56499459.53
17	2018	3	6957912.72	63457372.25
18	2018	4	6964712.88	70422085.13
19	2018	5	6923892.91	77345978.04
20	2018	6	6143283.00	83489261.04
21	2018	7	6399244.49	89888505.53
22	2018	8	6134551.93	96023057.46
23	2018	9	26637.24	96049694.70
24	2018	10	3538.02	96053232.72

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

In [18]:
```python
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)
data = cur.fetchall()
df = pd.DataFrame(data, columns = ["years", "yoy % growth"])
df
```

Out[18]:

	years	yoy % growth
0	2016	NaN
1	2017	12112.703759
2	2018	20.000924

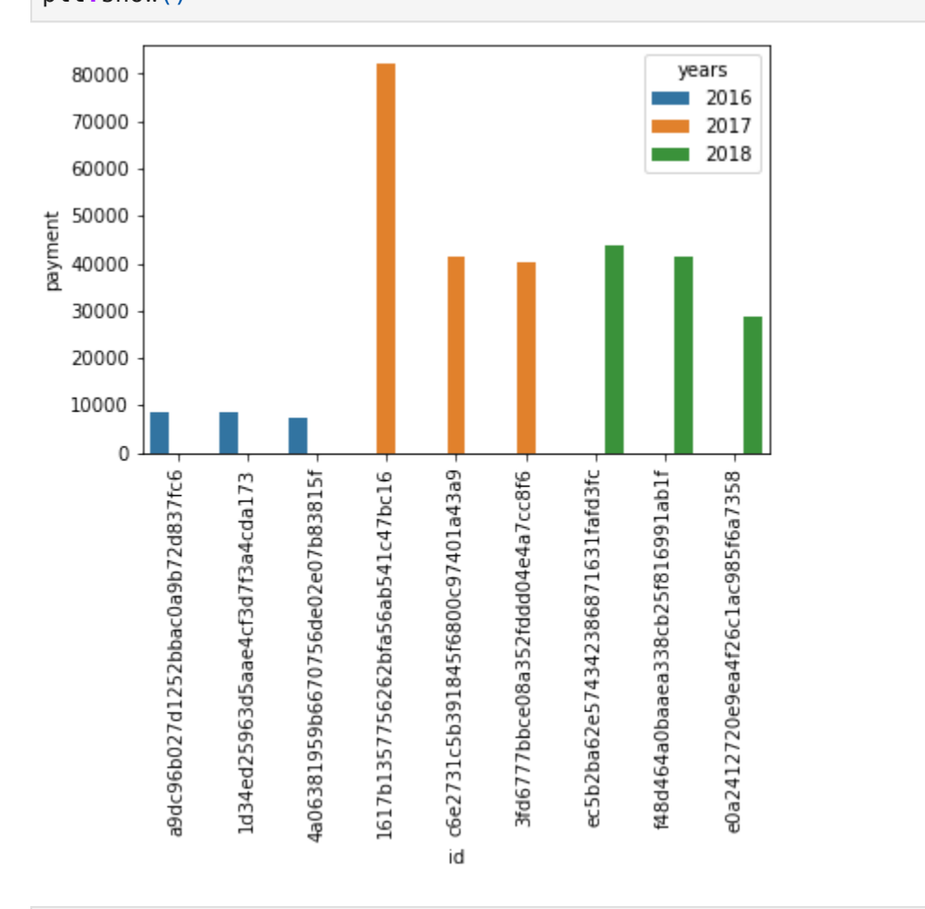
Calculate the retention rate of customers, defined as the percentage of customers who make another purchase within 6 months of their first purchase.

In [19]:
```python
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_order
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)
data = cur.fetchall()

data
```

Out[19]:
```
[(None,)]
```

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

In [20]:
```python
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()
```



In [ ]: