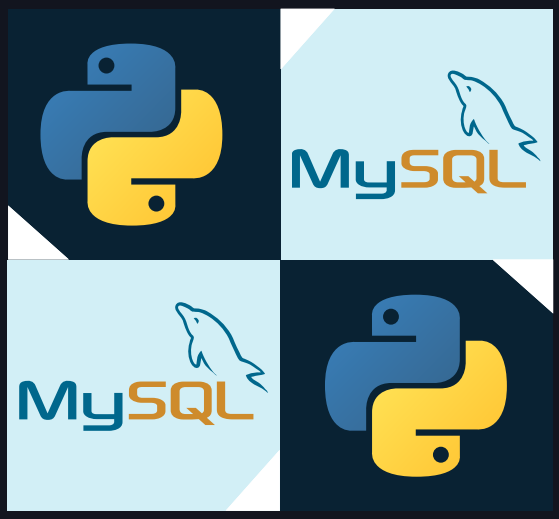
SQL - PYTHON ECOMMERCE DATA ANALYSIS



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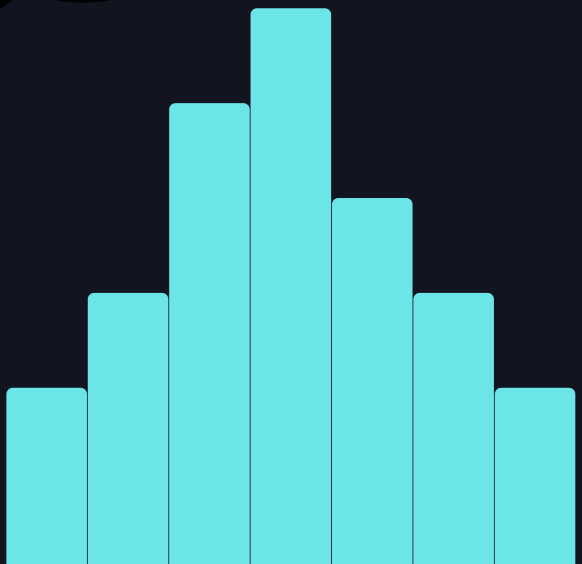
Why are we using Python to write SQL commands



Objective

The project aims to analyze e-commerce data to identify key trends and insights, including customer locations, order volumes, and sales performance across product categories. It focuses on understanding customer behavior, tracking revenue growth, and evaluating retention rates to inform business strategies. The analysis seeks to enhance decision-making and optimize marketing and product offerings.

Why use Python for data insertion into a MySQL database when we can easily use the MySQL import Excel file option?

Using Python for data insertion into a MySQL database offers significant advantages in terms of automation, data cleaning, error handling, scalability, and integration with other tools. While the MySQL import Excel file option is suitable for simple, one-time imports, Python provides a more robust and flexible solution for complex and large-scale data import requirements, ensuring higher data quality and consistency in your project.

Why are we using Python to write SQL commands

Using Python to write SQL commands provides significant advantages in terms of automation, data processing, error handling, integration, scalability, reusability, and security. In your project, these benefits translated into efficient, automated, and reliable data import processes, ensuring high data quality and consistency. This approach also allowed for advanced data analysis and visualization, providing valuable insights from the data.

```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import numpy as np
import mysql.connector


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

cur = db.cursor()
```

List all unique cities where customers are located.

```
query = """ select distinct customer_city from customers """

cur.execute(query)

data = cur.fetchall()

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

	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.

```
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]
```

```
('total orders placed in 2017 are', 45101)
```

Find the total sales per category.

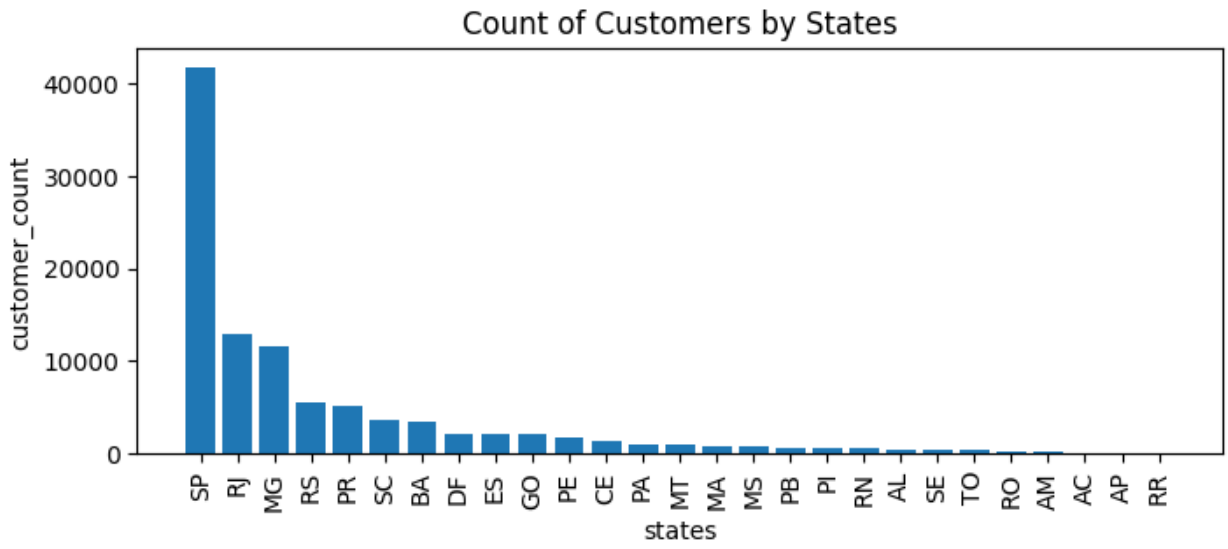
```
query = """ select upper(products.product_category) category,
round(sum(payments.payment_value),2) sales
from products join order_items
on products.product_id = order_items.product_id
join payments
on payments.order_id = order_items.order_id
group by category
"""

cur.execute(query)

data = cur.fetchall()

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

```
                         Category       Sales
0                      PERFUMERY   506738.66
1           FURNITURE DECORATION  1430176.39
2                      TELEPHONY   486882.05
3   FASHION BAGS AND ACCESSORIES   218158.28
4                BED TABLE BATH  1712553.67
..                          ...         ...
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]
```

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 from payments
"""

cur.execute(query)

data = cur.fetchall()

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

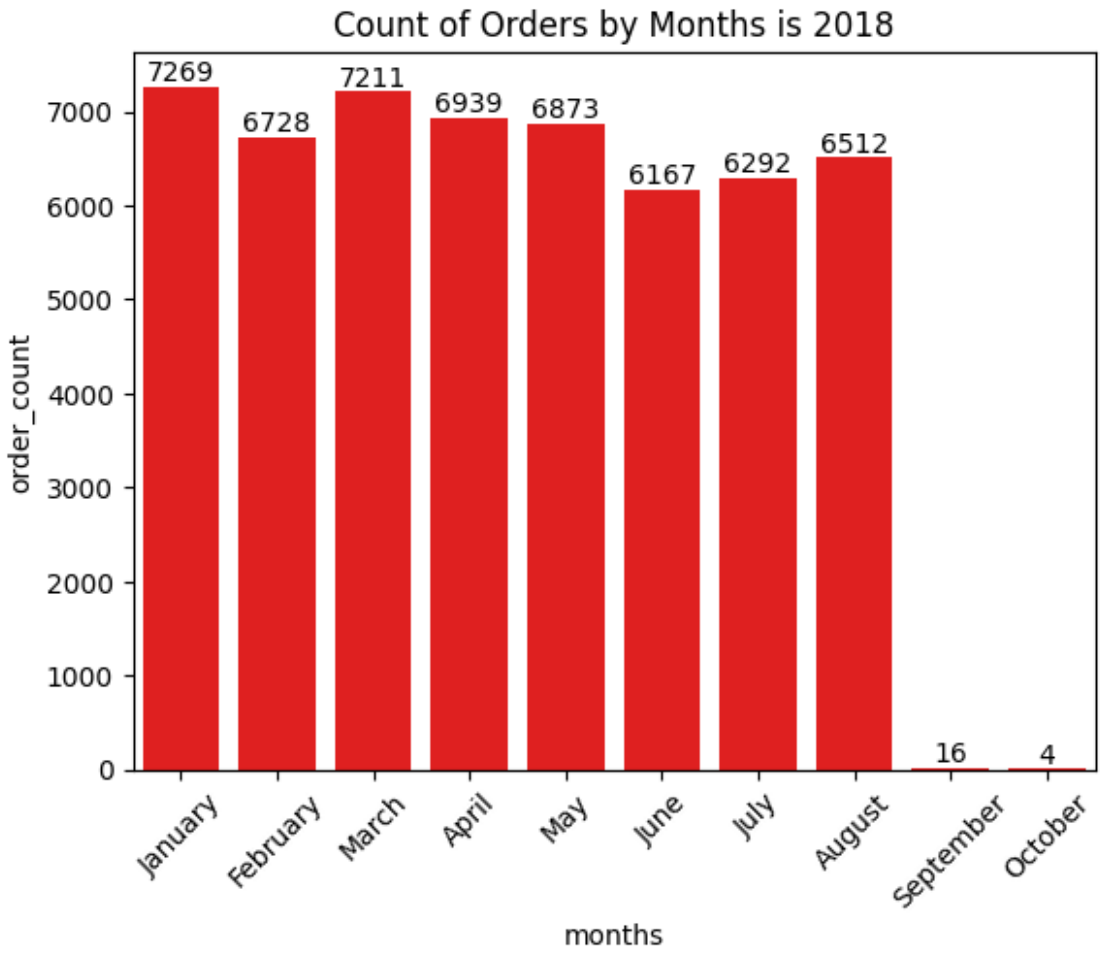
```
('the percentage of orders that were paid in installments is',
 Decimal('99.9981'))

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 = (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()
```



Calculate the number of orders per month in 2018.

```
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","O
ctober"]
ax = sns.barplot(x = df["months"],y =  df["order_count"], data = df,
order = o, color = "red")
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.

```
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)
```

	customer city	average products/order
0	padre carvalho	7.00
1	celso ramos	6.50
2	candido godoi	6.00
3	datas	6.00
4	matias olimpio	5.00
5	morro de sao paulo	4.00
6	cidelandia	4.00
7	picarra	4.00
8	teixeira soares	4.00
9	curralinho	4.00

```
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()
```

	Category	percentage distribution
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

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

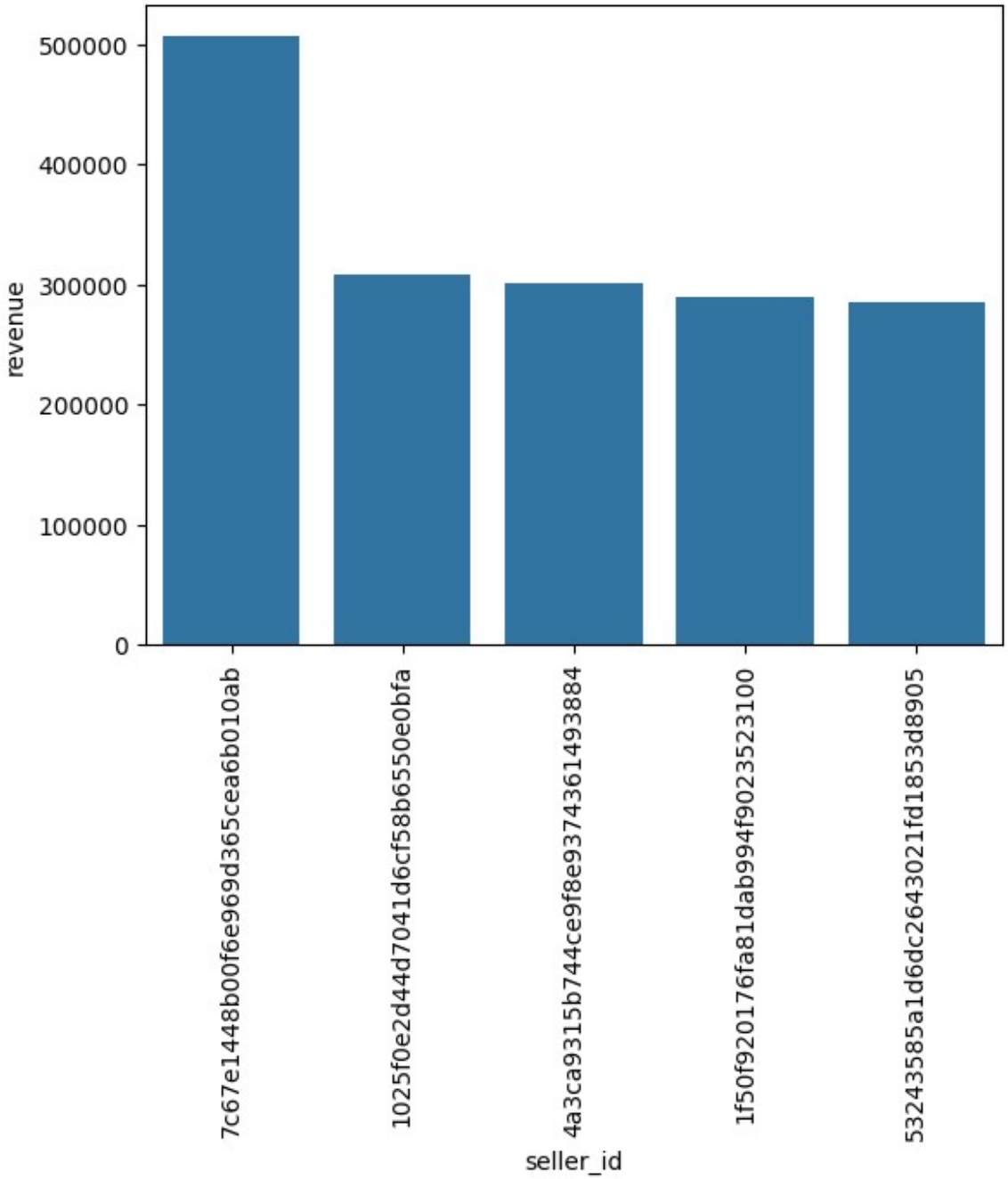
```
cur = db.cursor()
query = """select products.product_category,
count(order_items.product_id),
round(avg(order_items.price),2)
from products join order_items
on products.product_id = order_items.product_id
group by products.product_category"""

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.

```
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.

```
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
```

```
                                        0                    1       2
\
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

...                                  ...                  ...     ...

103881  fffecc9f79fd8c764f843e9951b11341  2018-03-29 16:59:26   71.23

103882  fffeda5b6d849fbd39689bb92087f431  2018-05-22 13:36:02   63.13

103883  ffff42319e9b2d713724ae527742af25  2018-06-13 16:57:05  214.13

103884  ffffa3172527f765de70084a7e53aae8  2017-09-02 11:53:32   45.50

103885  fffe8b65bbe3087b653a978c870db99  2017-09-29 14:07:03   18.37


                   3
0       114.739998
1        67.410004
2       195.419998
3       179.350006
4       107.010002
...            ...
```

```
103881   27.120001
103882   63.130001
103883  214.130005
103884   45.500000
103885   18.370001

[103886 rows x 4 columns]
```

Calculate the cumulative sales per month for each year.

```
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
```

	0	1	2	3
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
```

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

```
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
```

```
   years  yoy % growth
0   2016           NaN
1   2017  12112.703761
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.

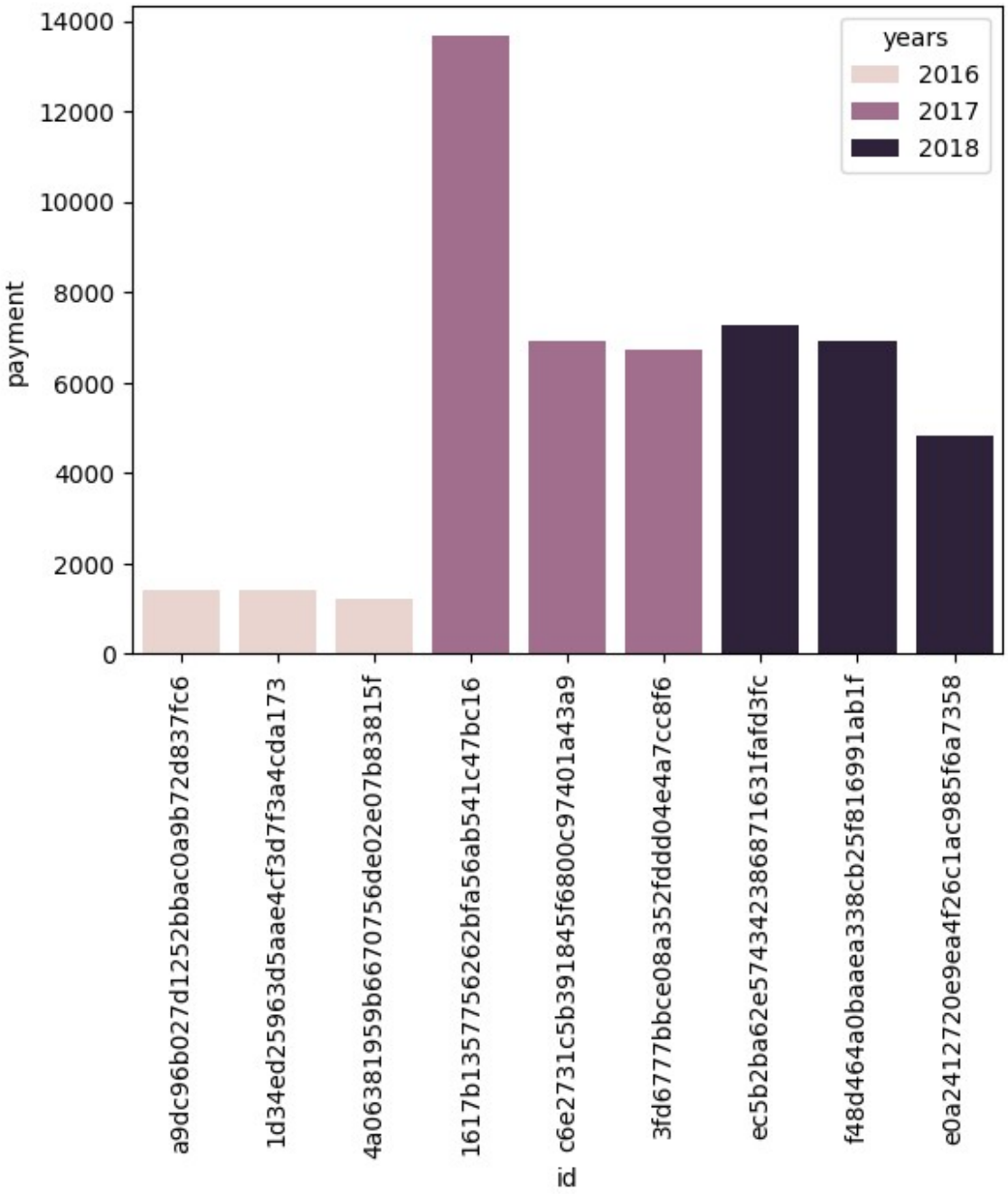
```
query = """with a as (select customers.customer_id,
min(orders.order_purchase_timestamp) first_order
from customers join orders
on customers.customer_id = orders.customer_id
group by customers.customer_id),

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
```

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

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

```
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()
```


14000
12000
10000
8000
6000
4000
2000
0
payment
years
2016
2017
2018
a9dc96b027d1252bbac0a9b72d837fc6
1d34ed25963d5aae4cf3d7f3a4cda173
4a063819596670756de02e07b83815f
1617b1357756262bfa56ab541c47bc16
c6e2731c5b391845f6800c97401a43a9
3fd6777bbce08a352fddd04e4a7cc8f6
ec5b2ba62e574342386871631fafd3fc
f48d464a0baaea338cb25f816991ab1f
e0a2412720e9ea4f26c1ac985f6a7358
id

Insights

- 📍 Customer Locations: Customers are distributed across various cities, with some cities showing higher concentrations of customers.
- 📈 Order Volume: A substantial number of orders were placed in 2017, with monthly order counts in 2018 revealing fluctuations and seasonality.
- 🛒 Category Sales: Categories such as "BED TABLE BATH" and "HEALTH BEAUTY" contribute significantly to overall sales, indicating high-performing segments.
- 💳 Installment Payments: The vast majority of orders are paid in installments, suggesting a strong preference for installment payment options among customers.
- 📊 Revenue Trends: Consistent revenue growth over the years and top-spending customers highlight robust market performance and effective customer retention strategies.