MySQL + Python E-commerce Data Analysis

November 1, 2024

[1]:
```
# 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'),  # Added payments.csv for specific handling
#     ('order_items.csv', 'order_items')  # Added payments.csv for specific␣
 ↪handling
# ]

# # Connect to the MySQL database
# conn = mysql.connector.connect(
#     host='host_name',
#     user='user_name',
#     password='password',
#     database='database_name'
# cursor = conn.cursor()

# # Folder containing the CSV files
# folder_path = 'add_own_file_path.csv'

# 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()
```

If you want to show it then let it be, else leave it.

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


db = mysql.connector.connect(host = "127.0.0.1",
                             username = "root",
                             password = "0987n@nd!n!0987",
                             database = "ecommerce")

cur = db.cursor()
```

1 List all unique cities where customers are located.

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

cur.execute(query)

data = cur.fetchall()

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

[3]:

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

2 Count the number of orders placed in 2017.

[4]:
```
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]
```

[4]: ('total orders placed in 2017 are', 45101)

3 Find the total sales per category.

[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)

data = cur.fetchall()

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

[5]:

	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]

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

[6]:
```
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]
```

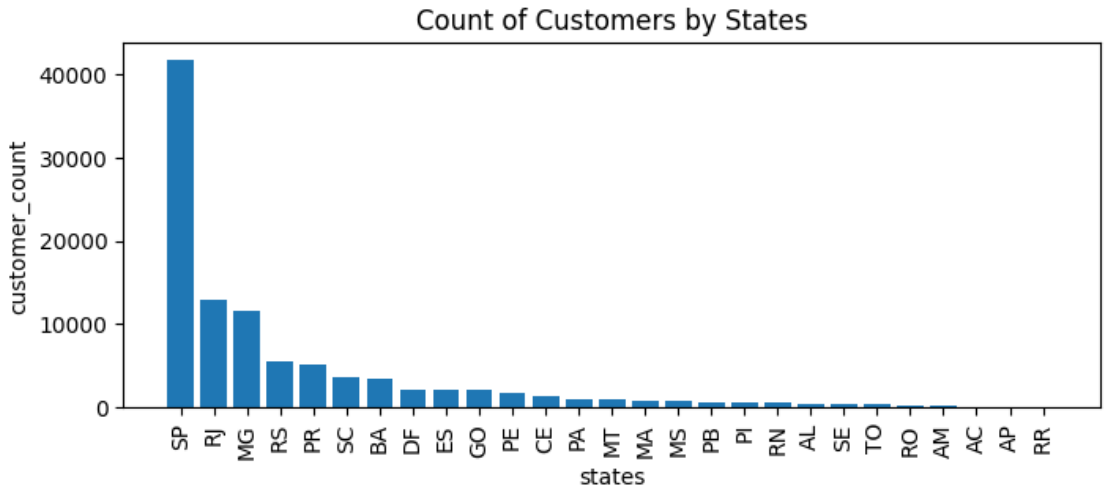
[6]:
```
('the percentage of orders that were paid in installments is',
 Decimal('99.9981'))
```

5 Count the number of customers from each state.

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

cur.execute(query)

data = cur.fetchall()
# print(data)

df = pd.DataFrame(data, columns = ["state", "customer_count" ])
print(df)

df = df.sort_values(by = "customer_count", ascending= False) # for descending␣
 ↪order


plt.figure(figsize = (8,3)) # for chart size

plt.bar(df["state"], df["customer_count"])

plt.xticks(rotation = 90) # for rotation label names

plt.xlabel("states")
plt.ylabel("customer_count")
plt.title("Count of Customers by States")
plt.show()
```

```
   state  customer_count
0     SP           41746
1     SC            3637
2     MG           11635
3     PR            5045
4     RJ           12852
5     RS            5466
6     PA             975
7     GO            2020
8     ES            2033
9     BA            3380
10    MA             747
11    MS             715
12    CE            1336
13    DF            2140
```

14	RN	485
15	PE	1652
16	MT	907
17	AM	148
18	AP	68
19	AL	413
20	RO	253
21	PB	536
22	TO	280
23	PI	495
24	AC	81
25	SE	350
26	RR	46

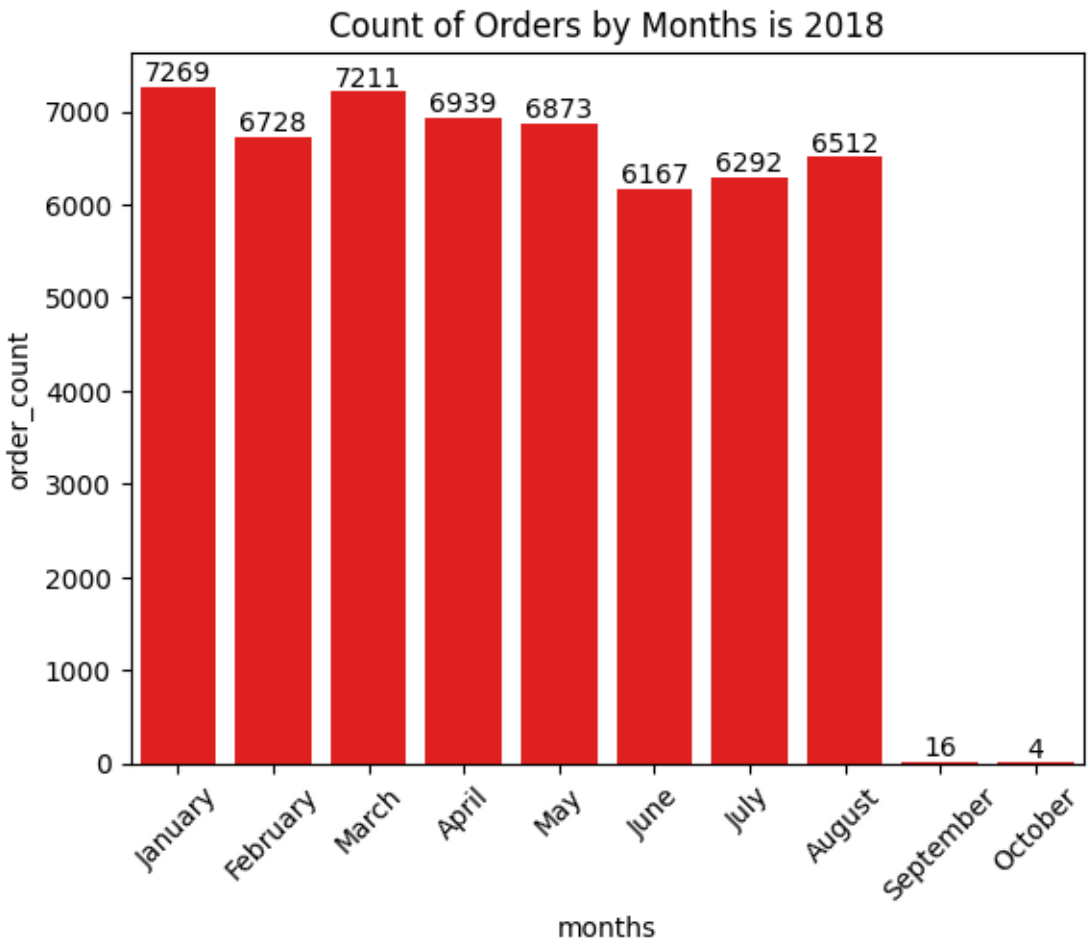


6 Calculate the number of orders per month in 2018.

[8]:
```
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"])
print(df)
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 = "red")

plt.xticks(rotation = 45)

ax.bar_label(ax.containers[0]) # for bar data number

plt.title("Count of Orders by Months is 2018")

plt.show()
```

	months	order_count
0	July	6292
1	August	6512
2	February	6728
3	June	6167
4	March	7211
5	January	7269
6	May	6873
7	April	6939
8	September	16
9	October	4



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

[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)
```

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

df.head(10)
```

[9]:

	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

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

[10]:
```
query = """ select upper(products.product_category) category,
round((sum(payments.payment_value)/(select sum(payment_value) from␣
 ↪payments))*100,2) 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
order by sales desc;
"""

cur.execute(query)

data = cur.fetchall()

df = pd.DataFrame(data, columns = ["Category", "percentage distribution"])
df.head(10)

# plt.pie(df["percentage distribution"], labels = df["Category"])
# plt.show
```

[10]:

	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
5	SPORT LEISURE	8.70
6	HOUSEWARES	6.84
7	AUTOMOTIVE	5.32
8	GARDEN TOOLS	5.24
9	COOL STUFF	4.87

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

[11]:
```
import numpy as np

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"])

# for correlation
arr1 = df["order_count"]
arr2 = df["price"]

a = np.corrcoef([arr1,arr2])
print("the correlation is", a[0][-1])
print()
df.head(5)
```

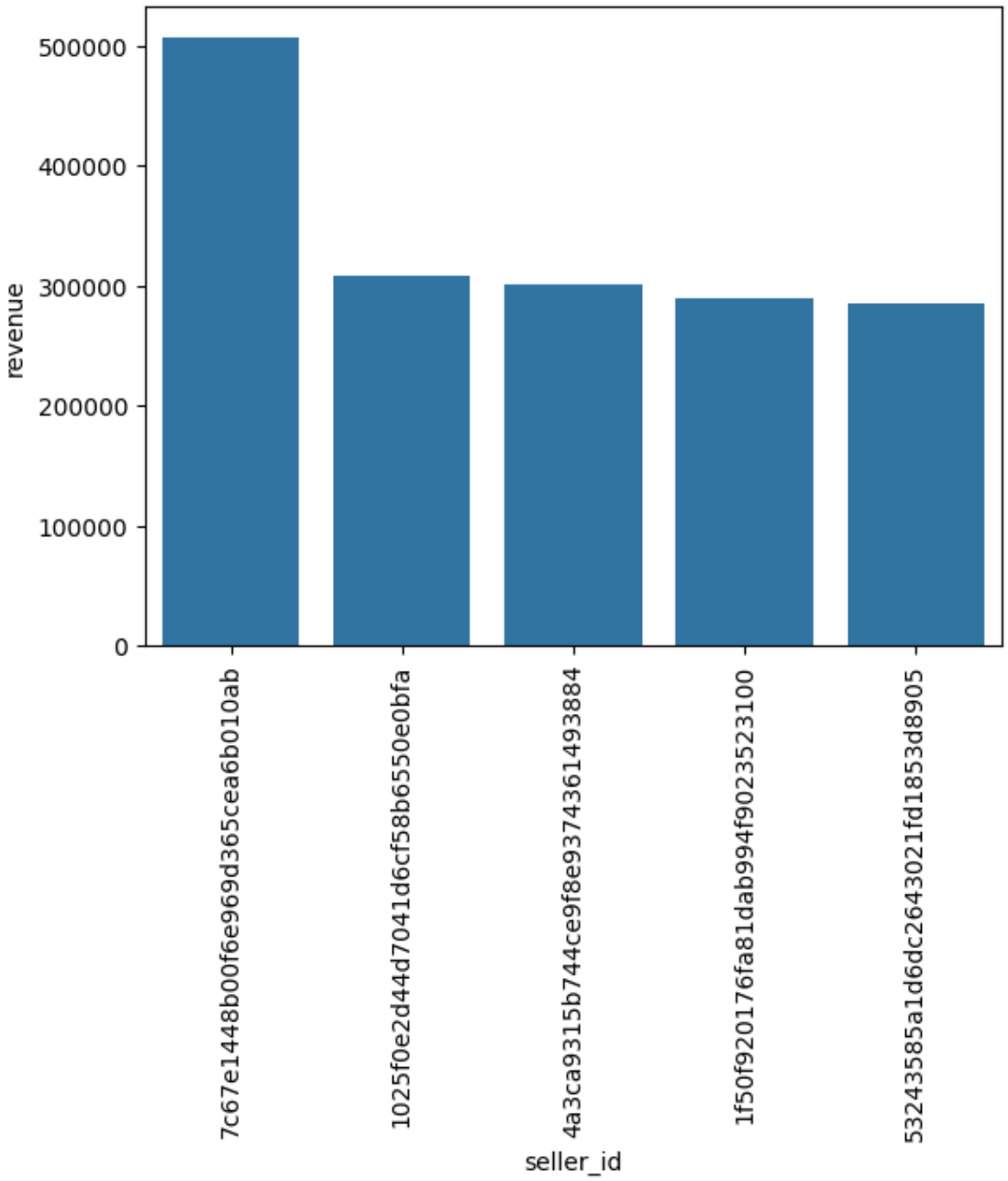
```
the correlation is -0.10631514167157562
```

[11]:

	Category	order_count	price
0	HEALTH BEAUTY	9670	130.16
1	sport leisure	8641	114.34
2	Cool Stuff	3796	167.36
3	computer accessories	7827	116.51
4	Watches present	5991	201.14

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

[12]:
```
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()
```



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

[13]:
```
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 orders join payments
on payments.order_id = orders.order_id) as a;
"""

cur.execute(query)

data = cur.fetchall()

df = pd.DataFrame(data, columns = ["customer_id", "order_history", "price",␣
 ↪"moving_avg"])
df
```

[13]:

	customer_id	order_history	price	\
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	

	moving_avg
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]

12 Calculate the cumulative sales per month for each year.

[14]:
```
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, columns = ["years", "months", "payment",␣
 ↪"cumulative_sales"])
df

# visual data using line charts
```

[14]:

	years	months	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
```

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

[15]:
```
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) ## cur is curser

data = cur.fetchall()
df = pd.DataFrame(data, columns = ["years", "YOY % growth"])
df
```

[15]:

	years	YOY % growth
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.

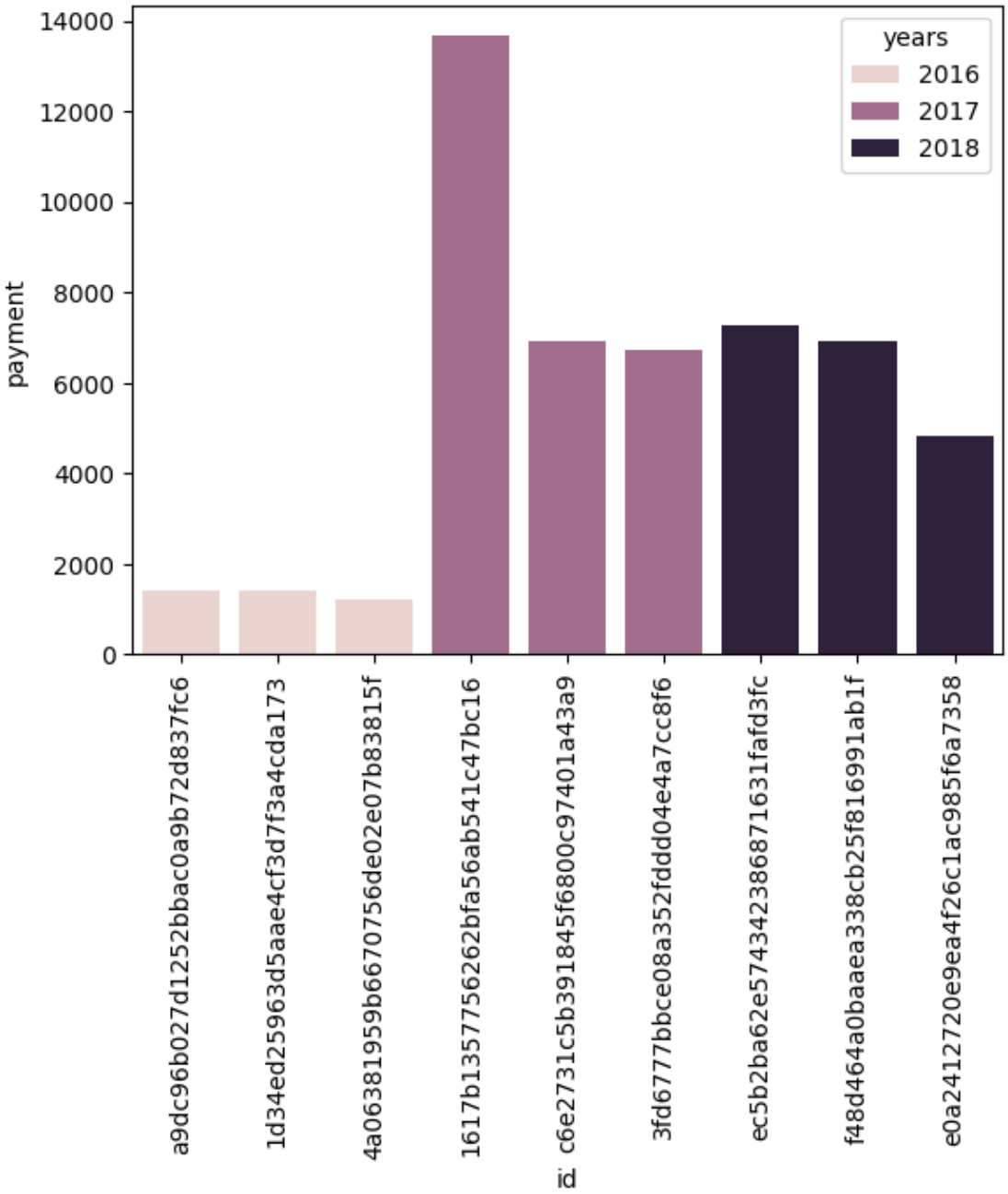
[16]:
```
query = """with a as (select customers.customer_id,
min(orders.order_purchase_timestamp) first_order
from customers join orders
on customers.customer_id = orders.customer_id
group by customers.customer_id),

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
```

[16]:
```
[(None,)]
```

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

[17]:
```
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