

```
In [1]: import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import mysql.connector

db = mysql.connector.connect(host = "localhost",
                             username = "root",
                             password = "password",
                             database = "name of dataset")
cur = db.cursor()
```

```
In [2]: # 1.List all unique cities where customers are located

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

cur.execute(query)

data = cur.fetchall()
data
```

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('capim grosso',),
('guaira',),
('euclides da cunha paulista',),
('lagoa da prata',),
('nanuque',),
('luis antonio',),
('senador firmino',),
('viradouro',),
('itabera',),
('cambara',),
('sananduva',),
('tapera',),
('tupaciguara',),
('colombo',),
('ananindeua',),
('coribe',),

('rio doce',),
('mogi mirim',),
('tocos do moji',),
('beberibe',),
('formosa do rio preto',),
('claudio',),
('rio paranaiba',),
('humberto de campos',),
('camocim de sao felix',),
('santo antonio de posse',),
('mesquita',),
('passa quatro',),
('belo oriente',),
('alto araguaia',),
('igarassu',),
('porto velho',),
('cajazeiras',),
('garopaba',),
('rio azul',),
('dois correlos',),
('sooretama',),
('cruzeiro do oeste',),
('nazare paulista',),
('riversul',),
('iguaracu',),
('maracas',),
('parana',),
('reboucas',),
('ametista do sul',),
('itu',),
('cacu',),
('vespasiano',),
('lindolfo collor',),
('sao lourenco',),
('santana do sobrado',),
('cafelandia',),
('ibiapina',),
('schroeder',),
('sao joao do oriente',),
('matao',),
('itanhandu',),
('santo angelo',),
('capinopolis',),
('colatina',),
('nova mutum',),
('munhoz de melo',),
('ibate',),
('unai',),
('medeiros neto',),
('anta',),
('ouroeste',),
('central',),
('nova independencia',),
('itapema',),
('sao jose do cedro',),
('camutanga',),
('ipumirim',),
('cristalia',),
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('panelas',),

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('comodoro',),
('domingos martins',),
('tangua',),
('sao gotardo',),
('araguaína',),
('ilheus',),
('louveira',),
('imbituba',),
('ouricuri',),
('itatinga',),
('santo cristo',),
("arraial d'ajuda",),
('piracanjuba',),
('russas',),
('lambari',),
('vargem alta',),
('sacra familia do tingua',),
('assis chateaubriand',),
('lago da pedra',),
('unistalda',),
('sao joao evangelista',),
('paramirim',),
('goias',),
('paracuru',),
('cruz alta',),
('presidente bernardes',),
('pains',),
('sao goncalo do rio preto',),
('jacinto machado',),
('sobralia',),
('maraba',),
('paraibuna',),
('toropi',),
('jauru',),
('cristalandia',),
('castelo do piaui',),
('ibipora',),
('presidente dutra',),
('vera cruz',),
('paulo frontin',),
...)
```

In [3]: # 2. Count the number of orders placed in 2017.

```
query = """ select count(order_id) from orders where year(order_purchase_timestamp) =
cur.execute(query)

data = cur.fetchall()

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

Out[3]: ('total orders placed in 2017 are', 45101)

In [4]: # 3. Find the total sales per category.

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

```

join payments
on payments.order_id = order_ite.order_id
group by category
"""

cur.execute(query)

data = cur.fetchall()

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

```

Out[4]:

	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 × 2 columns

In [5]:

```

# 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 from payments
"""

cur.execute(query)

data = cur.fetchall()

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

```

Out[5]:

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

In [6]:

```

# 5. Count the number of customers from each state.

query = """ select customer_state ,count(customer_id)
from customers group by customer_state
"""

cur.execute(query)

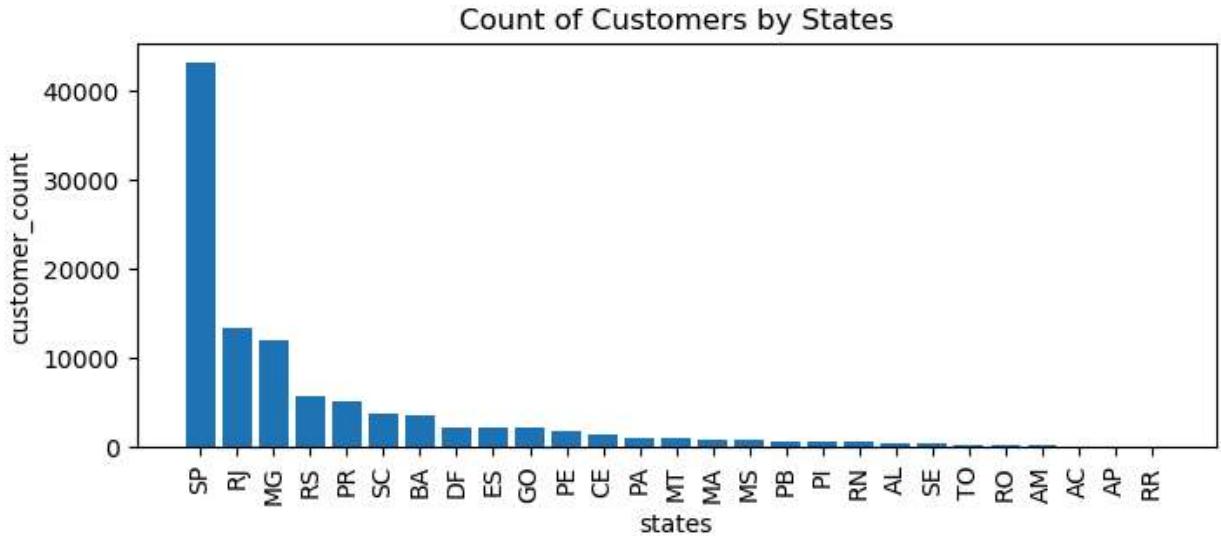
data = cur.fetchall()
df = pd.DataFrame(data, columns = ["state", "customer_count" ])
df = df.sort_values(by = "customer_count", ascending= False)

```

```

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()

```



In [7]:

```

#Calculate the number of orders per month in 2018.
query = """ select monthname(order_purchase_timestamp) months, count(order_id) order_c
from orders where year(order_purchase_timestamp) = 2018
group by months
"""

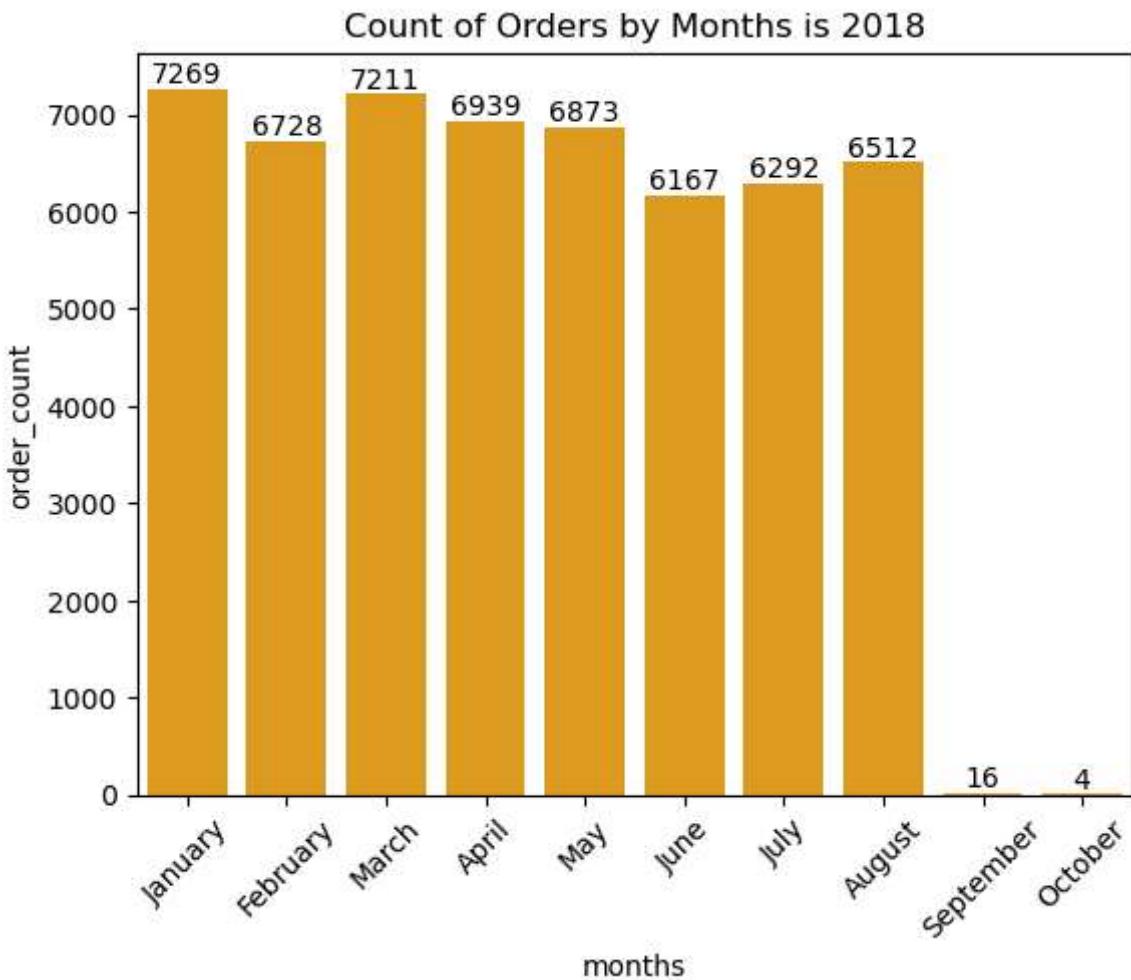
cur.execute(query)

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

ax = sns.barplot(x = df["months"],y = df["order_count"], data = df, order = o, color = "#3182bd")
plt.xticks(rotation = 45)
ax.bar_label(ax.containers[0])
plt.title("Count of Orders by Months is 2018")

plt.show()

```



```
In [8]: #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_ite.order_id) as oc  
from orders join order_ite  
on orders.order_id = order_ite.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[8]:

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

In [9]:

```
# Calculate the percentage of total revenue contributed by each product category.
query = """select upper(products.product_category) category,
round((sum(payments.payment_value)/(select sum(payment_value) from payments))*100,2) s
from products join order_ite
on products.product_id = order_ite.product_id
join payments
on payments.order_id = order_ite.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[9]:

	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

In [10]:

```
# Identify the correlation between product price and the number of times a product has
import numpy as np
query = """select products.product_category,
count(order_ite.product_id),
round(avg(order_ite.price),2)
from products join order_ite
on products.product_id = order_ite.product_id
group by products.product_category"""

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

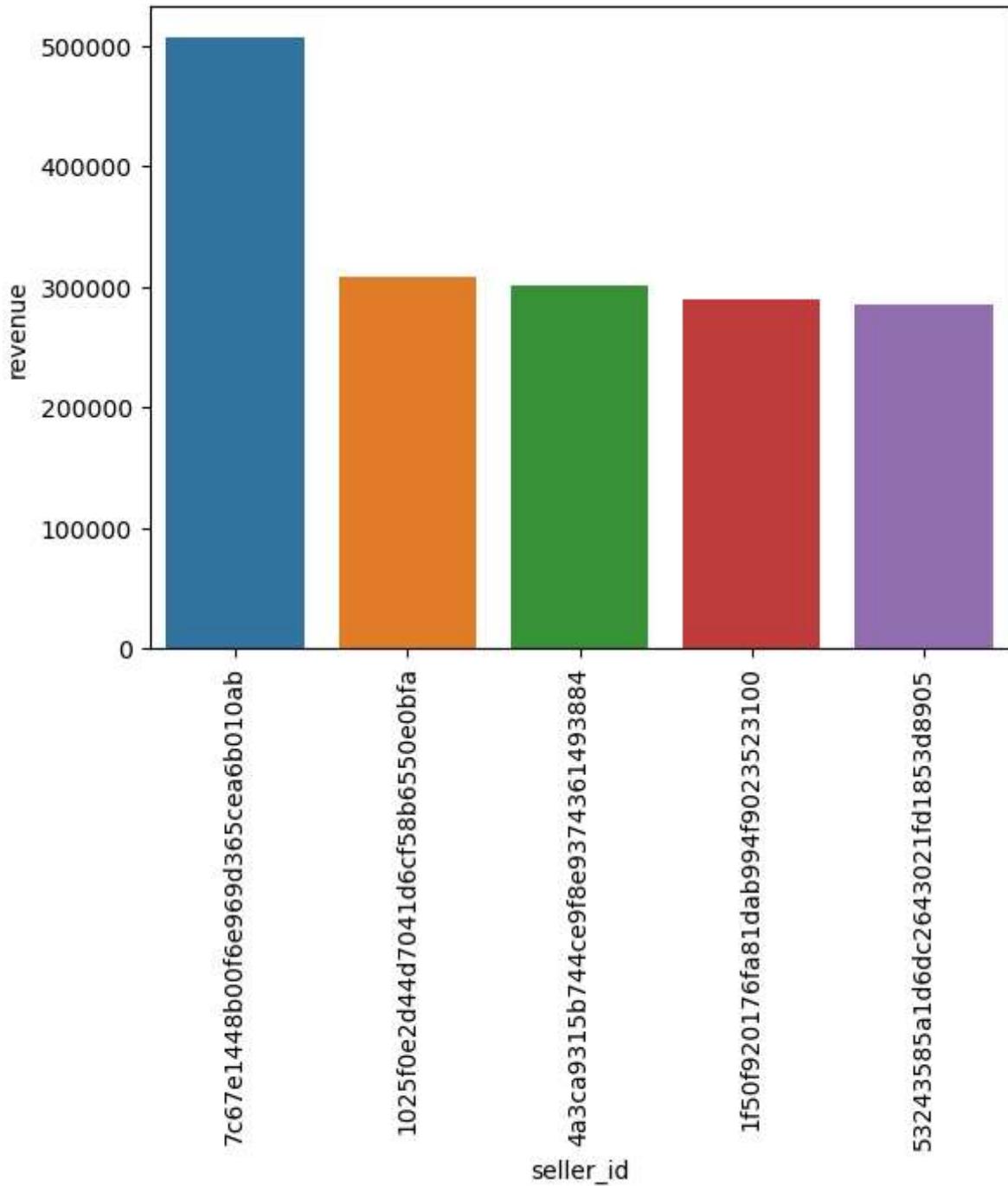
```
arr1 = df["order_count"]
arr2 = df["price"]

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

```
the correlation is -0.10631514167157562
```

```
In [11]: # 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_ite.seller_id, sum(payments.payment_value)
revenue from order_ite join payments
on order_ite.order_id = payments.order_id
group by order_ite.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()
```



```
In [12]: # Calculate the moving average of order values for each customer over their order hist
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[12]:

	0	1	2	3
0	00012a2ce6f8dcda20d059ce98491703	2017-11-14 16:08:26	114.74	114.739998
1	000161a058600d5901f007fab4c27140	2017-07-16 09:40:32	67.41	67.410004
2	0001fd6190edaaf884bcf3d49edf079	2017-02-28 11:06:43	195.42	195.419998
3	0002414f95344307404f0ace7a26f1d5	2017-08-16 13:09:20	179.35	179.350006
4	000379cdec625522490c315e70c7a9fb	2018-04-02 13:42:17	107.01	107.010002
...
103881	ffffecc9f79fd8c764f843e9951b11341	2018-03-29 16:59:26	71.23	27.120001
103882	ffffeda5b6d849fb939689bb92087f431	2018-05-22 13:36:02	63.13	63.130001
103883	ffff42319e9b2d713724ae527742af25	2018-06-13 16:57:05	214.13	214.130005
103884	fffffa3172527f765de70084a7e53aae8	2017-09-02 11:53:32	45.50	45.500000
103885	fffffe8b65bbe3087b653a978c870db99	2017-09-29 14:07:03	18.37	18.370001

103886 rows × 4 columns

In [13]:

```
# 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
```

Out[13]:

	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

In [14]:

```
# 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", "yo % growth"])
df
```

Out[14]:

	years	yoY % growth
0	2016	NaN
1	2017	12112.703761
2	2018	20.000924

In [15]:

```
# Calculate the retention rate of customers, defined as the percentage of customers who
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()

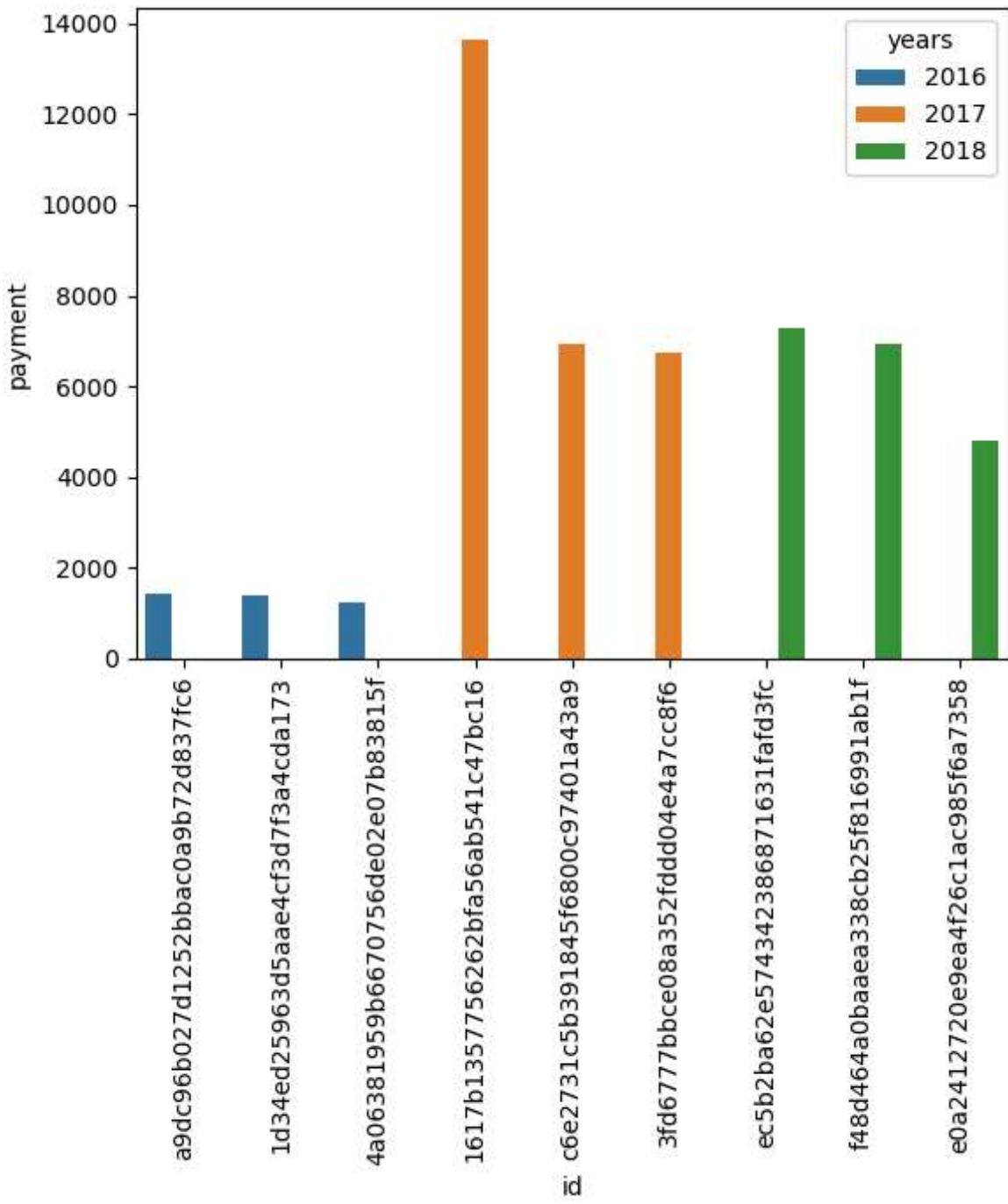
data
```

Out[15]:

In [16]:

```
# 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()
```



In []: