Question 1

Given some sample data, write a program to answer the following: click here to access the required data set (https://docs.google.com/spreadsheets/d/16i38oonuX1y1g7C_UAmiK9GkY7cS-64DfiDMNiR41LM/edit#gid=0)

On Shopify, we have exactly 100 sneaker shops, and each of these shops sells only one model of shoe. We want to do some analysis of the average order value (AOV). When we look at orders data over a 30 day window, we naively calculate an AOV of $3145.13. Given that we know these shops are selling sneakers, a relatively affordable item, something seems wrong with our analysis.

Think about what could be going wrong with our calculation. Think about a better way to evaluate this data. What metric would you report for this dataset? What is its value?

In [119…
```
import pandas as pd
import numpy as np
```

In [120…
```
sales_df = pd.read_csv("sales_data.csv")
```

In [121…
```
sales_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 5000 entries, 0 to 4999
Data columns (total 7 columns):
 #   Column          Non-Null Count  Dtype 
---  ------          --------------  ----- 
 0   order_id        5000 non-null   int64 
 1   shop_id         5000 non-null   int64 
 2   user_id         5000 non-null   int64 
 3   order_amount    5000 non-null   int64 
 4   total_items     5000 non-null   int64 
 5   payment_method  5000 non-null   object
 6   created_at      5000 non-null   object
dtypes: int64(5), object(2)
memory usage: 273.6+ KB
```

First, I will take a look at the dataset with some samples to get a rough idea of the structure of the dataset.

In [122…
```
#visualize the data
sales_df.sample(20)
```

Out[122…

	order_id	shop_id	user_id	order_amount	total_items	payment_method	created_at
							2017-03-

1940	1941	46	916	166	1	debit	26 19:16:48
2379	2380	24	980	280	2	debit	2017-03-08 18:46:33
2584	2585	89	700	392	2	cash	2017-03-21 12:18:52
2300	2301	82	764	531	3	credit_card	2017-03-27 23:29:38
3176	3177	96	856	459	3	debit	2017-03-01 7:47:32
1544	1545	34	794	122	1	credit_card	2017-03-24 11:41:02
3249	3250	81	941	354	2	debit	2017-03-11 14:09:22
1315	1316	86	763	260	2	cash	2017-03-06 1:32:05
1312	1313	82	927	531	3	credit_card	2017-03-20 8:32:00
2484	2485	8	996	528	4	debit	2017-03-09 17:26:20
79	80	20	838	254	2	credit_card	2017-03-03 14:00:25
1686	1687	74	901	459	3	credit_card	2017-03-01 0:43:39
3627	3628	16	860	312	2	debit	2017-03-22 20:07:42
4565	4566	40	782	161	1	cash	2017-03-21 3:39:41
942	943	93	915	456	4	cash	2017-03-12 7:00:39
4608	4609	82	743	354	2	cash	2017-03-13 10:30:55
1085	1086	7	970	224	2	debit	2017-03-08 16:54:11
1613	1614	18	792	156	1	credit_card	2017-03-10 7:37:09

3813	3814	46	813	498	3	cash	2017-03-27 3:31:57
3883	3884	60	957	354	2	debit	2017-03-29 4:19:59

Naive AOV

Given the data are already in a 30 day window (March), the naive way to calculate AOV is to divide the revenue by the number of orders.

In [123…
```
Naive_AOV_30 = sales_df.order_amount.sum() / sales_df.order_id.count()
```

In [124…
```
Naive_AOV_30
```

Out[124… 3145.128

However, if we look at the 20 samples from above, none of the order_amount value are close to $3145.13. To further investigate, we shall look at the highest order_amount in the data, and see if there is skewness.

In [75]:
```
sales_df.skew(axis=0)
```

Out[75]:
```
order_id          0.000000
shop_id           0.013830
user_id          -0.034052
order_amount     16.675033
total_items      17.065556
dtype: float64
```

Both the order_amount and total_items are pretty positively skewed, we shall take a look the top order_amount and total_items.

In [125…
```
sales_df.sort_values(['order_amount','total_items'], ascending=False).head(50
```

Out[125…

	order_id	shop_id	user_id	order_amount	total_items	payment_method	created_at
15	16	42	607	704000	2000	credit_card	2017-03-07 4:00:00
60	61	42	607	704000	2000	credit_card	2017-03-04 4:00:00
520	521	42	607	704000	2000	credit_card	2017-03-02 4:00:00
1104	1105	42	607	704000	2000	credit_card	2017-03-24 4:00:00
1362	1363	42	607	704000	2000	credit_card	2017-03-15 4:00:00

1436	1437	42	607	704000	2000	credit_card	2017-03-11 4:00:00
1562	1563	42	607	704000	2000	credit_card	2017-03-19 4:00:00
1602	1603	42	607	704000	2000	credit_card	2017-03-17 4:00:00
2153	2154	42	607	704000	2000	credit_card	2017-03-12 4:00:00
2297	2298	42	607	704000	2000	credit_card	2017-03-07 4:00:00
2835	2836	42	607	704000	2000	credit_card	2017-03-28 4:00:00
2969	2970	42	607	704000	2000	credit_card	2017-03-28 4:00:00
3332	3333	42	607	704000	2000	credit_card	2017-03-24 4:00:00
4056	4057	42	607	704000	2000	credit_card	2017-03-28 4:00:00
4646	4647	42	607	704000	2000	credit_card	2017-03-02 4:00:00
4868	4869	42	607	704000	2000	credit_card	2017-03-22 4:00:00
4882	4883	42	607	704000	2000	credit_card	2017-03-25 4:00:00
691	692	78	878	154350	6	debit	2017-03-27 22:51:43
2492	2493	78	834	102900	4	debit	2017-03-04 4:37:34
1259	1260	78	775	77175	3	credit_card	2017-03-27 9:27:20
2564	2565	78	915	77175	3	debit	2017-03-25 1:19:35
2690	2691	78	962	77175	3	debit	2017-03-22 7:33:25
2906	2907	78	817	77175	3	debit	2017-03-16 3:45:46
3403	3404	78	928	77175	3	debit	2017-03-16 9:45:05
3724	3725	78	766	77175	3	credit_card	2017-03-16 14:13:26

4192	4193	78	787	77175	3	credit_card	2017-03-18 9:25:32
4420	4421	78	969	77175	3	debit	2017-03-09 15:21:35
4715	4716	78	818	77175	3	debit	2017-03-05 5:10:44
490	491	78	936	51450	2	debit	2017-03-26 17:08:19
493	494	78	983	51450	2	cash	2017-03-16 21:39:35
511	512	78	967	51450	2	cash	2017-03-09 7:23:14
617	618	78	760	51450	2	cash	2017-03-18 11:18:42
1529	1530	78	810	51450	2	cash	2017-03-29 7:12:01
2452	2453	78	709	51450	2	cash	2017-03-27 11:04:04
2495	2496	78	707	51450	2	cash	2017-03-26 4:38:52
2512	2513	78	935	51450	2	debit	2017-03-18 18:57:13
2818	2819	78	869	51450	2	debit	2017-03-17 6:25:51
2821	2822	78	814	51450	2	cash	2017-03-02 17:13:25
3101	3102	78	855	51450	2	credit_card	2017-03-21 5:10:34
3167	3168	78	927	51450	2	cash	2017-03-12 12:23:08
3705	3706	78	828	51450	2	credit_card	2017-03-14 20:43:15
4079	4080	78	946	51450	2	cash	2017-03-20 21:14:00
4311	4312	78	960	51450	2	debit	2017-03-01 3:02:10

4412	4413	78	756	51450	2	debit	2017-03-02 4:13:39
160	161	78	990	25725	1	credit_card	2017-03-12 5:56:57
1056	1057	78	800	25725	1	debit	2017-03-15 10:16:45
1193	1194	78	944	25725	1	debit	2017-03-16 16:38:26
1204	1205	78	970	25725	1	credit_card	2017-03-17 22:32:21
1384	1385	78	867	25725	1	cash	2017-03-17 16:38:06
1419	1420	78	912	25725	1	cash	2017-03-30 12:23:43

Next, just by looking at the data returned, there is one customer user_id 607 which bought 2000 items from the same shop in mutiple orders, while most orders are under 6 items. Also, the price for one sneaker in shop_id 78 is $25725, which does not make any sense given that a sneaker is a relatively afforable item. This is the reason why our AOV is so high. To obtain a more reasonable AOV, we shall drop the all the outlier, tuples with total_items = 2000, and the tuples where 1 sneaker is not priced reasonable, ie. shop_id 78 with the sneaker priced at \$25725.

In [97]:
```
index = sales_df[(sales_df['order_amount'] >= 25725)].index
sales_df.drop(index, inplace = True)
```

In [100…
```
AOV_30 = sales_df.order_amount.sum() / sales_df.order_id.count()
print(AOV_30)
```

```
302.58051448247926
```

After some data cleaning, the new AOV is $302.58.

Using median aggregator instead of average

Apart from cleaning the data by dropping some outliers, we can also apply median which return the central stendency for skewed distributions.

In [108…
```
sales_df = pd.read_csv("sales_data.csv")
```

In [113…
```
sales_df.order_amount.median()
```

Out[113… 284.0

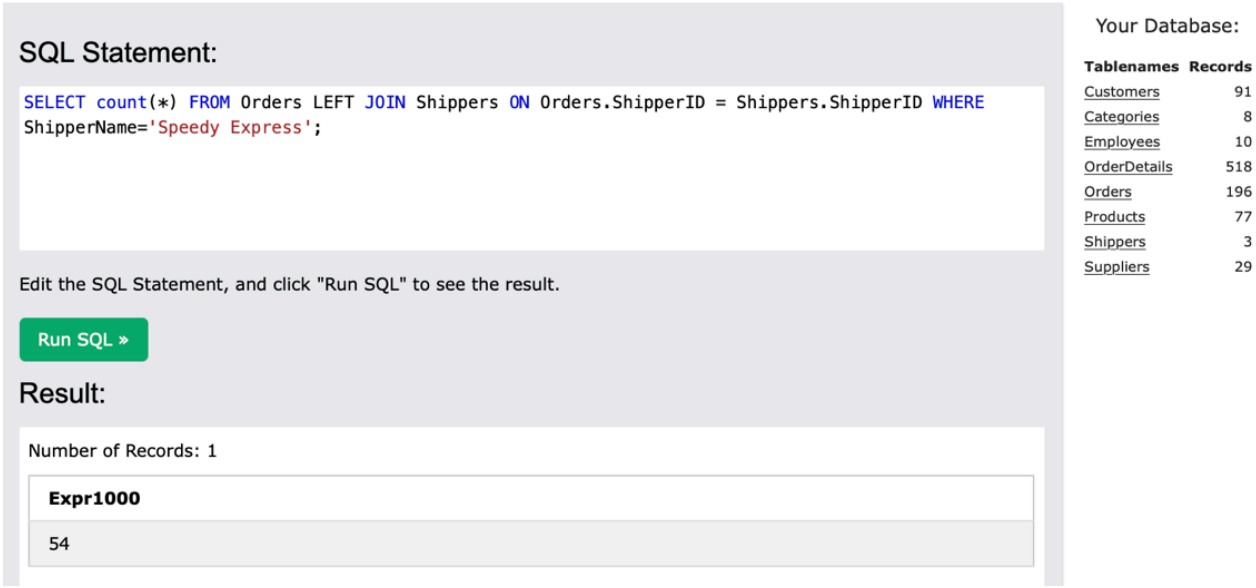
With median, we get $284 even with the skewed data remain in the dataset.

Question 2

For this question you'll need to use SQL. Follow this link (https://www.w3schools.com/SQL/TRYSQL.ASP?FILENAME=TRYSQL_SELECT_ALL) to access the data set required for the challenge. Please use queries to answer the following questions. Paste your queries along with your final numerical answers below.

a. How many orders were shipped by Speedy Express in total?

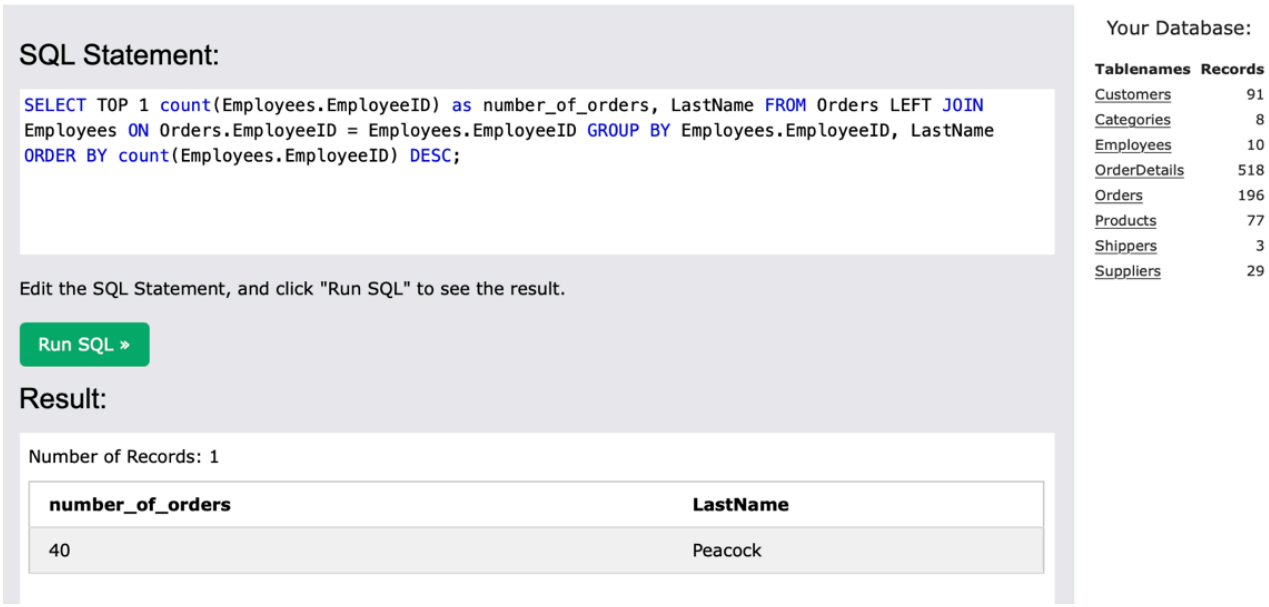
SQL Query: SELECT count(*) FROM Orders LEFT JOIN Shippers ON Orders.ShipperID = Shippers.ShipperID WHERE ShipperName='Speedy Express';



54 orders were shipped by Speedy Express.

b. What is the last name of the employee with the most orders?

SQL Query: SELECT TOP 1 count(Employees.EmployeeID) as number_of_orders, LastName FROM Orders LEFT JOIN Employees ON Orders.EmployeeID = Employees.EmployeeID GROUP BY Employees.EmployeeID, LastName ORDER BY count(Employees.EmployeeID) DESC;

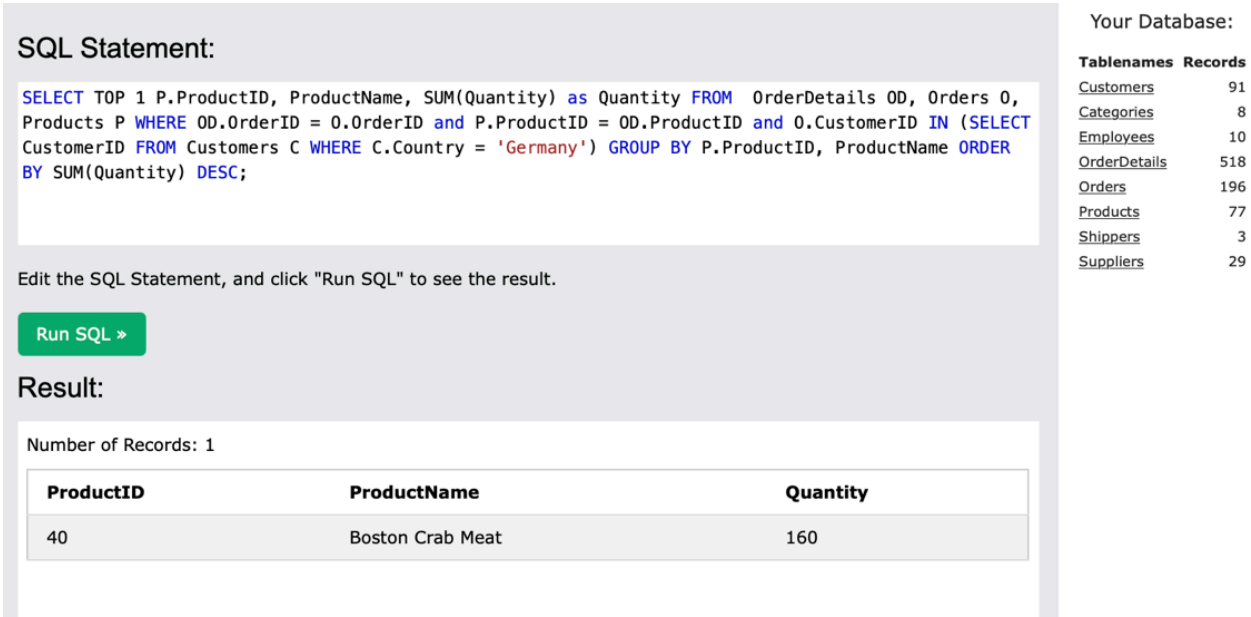


Peacock is the last name of the employee with the most orders.

c. What product was ordered the most by customers in Germany?

SQL Query: SELECT TOP 1 P.ProductID, ProductName, SUM(Quantity) as Quantity FROM OrderDetails OD, Orders O, Products P WHERE OD.OrderID = O.OrderID and P.ProductID = OD.ProductID and O.CustomerID IN (SELECT CustomerID FROM Customers C WHERE C.Country = 'Germany') GROUP BY P.ProductID, ProductName ORDER BY SUM(Quantity) DESC;

Boston Crab Meat was being ordered the most and have a total sale of 160 units by customers in Germany.



In [ ]: