Shopify DS Application Q1ABC

January 11, 2022

0.1 Question 1.A

[16]:
```
import pandas as pd
import numpy as np
import math
from statistics import mean

sneaker = pd.read_csv('2019 Winter Data Science Intern Challenge Data Set -␣
↪Sheet1.csv')
sneaker
```

[16]:
```
      order_id  shop_id  user_id  order_amount  total_items payment_method  \
0            1       53      746           224            2           cash
1            2       92      925            90            1           cash
2            3       44      861           144            1           cash
3            4       18      935           156            1    credit_card
4            5       18      883           156            1    credit_card
…          …        …        …             …            …            …
4995      4996       73      993           330            2          debit
4996      4997       48      789           234            2           cash
4997      4998       56      867           351            3           cash
4998      4999       60      825           354            2    credit_card
4999      5000       44      734           288            2          debit

               created_at
0     2017-03-13 12:36:56
1     2017-03-03 17:38:52
2      2017-03-14 4:23:56
3     2017-03-26 12:43:37
4      2017-03-01 4:35:11
…                    …
4995  2017-03-30 13:47:17
4996  2017-03-16 20:36:16
4997   2017-03-19 5:42:42
4998  2017-03-16 14:51:18
4999  2017-03-18 15:48:18

[5000 rows x 7 columns]
```

[26]:
```
summary = sneaker.describe()
summary
```

[26]:
```
          order_id      shop_id      user_id   order_amount  total_items
count  5000.000000  5000.000000  5000.000000    5000.000000   5000.00000
mean   2500.500000    50.078800   849.092400    3145.128000      8.78720
std    1443.520003    29.006118    87.798982   41282.539349    116.32032
min       1.000000     1.000000   607.000000      90.000000      1.00000
25%    1250.750000    24.000000   775.000000     163.000000      1.00000
50%    2500.500000    50.000000   849.000000     284.000000      2.00000
75%    3750.250000    75.000000   925.000000     390.000000      3.00000
max    5000.000000   100.000000   999.000000  704000.000000   2000.00000
```

[93]:
```
sneaker['order_amount'].median()
```

[93]:
```
284.0
```

Checking for any missing values

[22]:
```
sneaker.isnull().sum()
```

[22]:
```
order_id          0
shop_id           0
user_id           0
order_amount      0
total_items       0
payment_method    0
created_at        0
dtype: int64
```

We can conclude that there are no missing(null) values

To figure out where the value \$3145.13, came from (as given in the question), I assumed that it was just taken from the mean of the order amounts. I came up with this assumption from observing that mean of order_amount in the summary chart above, matched the value given. Since the values match exactly, I can safely assume that this was how the value of $3145.13 was actually calculated. To be sure:

[19]:
```
pred_aov = statistics.mean(sneaker.order_amount)
pred_aov
```

[19]:
```
3145.128
```

We know that the average order value that was calculated is $3145.13, which doesn't make sense as sneakers (on average) are not nearly as expensive. However, we can divide the total revenue by the number of orders for each shop (by grouping by shop_id), and then obtain the average for all of these values.

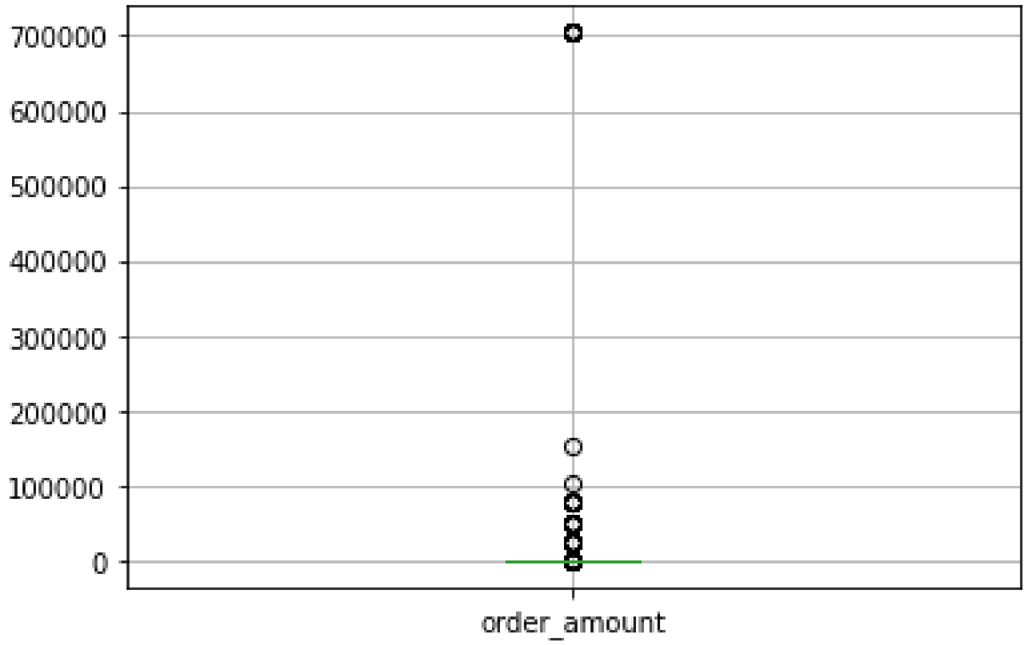
```
[46]: statistics.mean(sneaker.groupby('shop_id').apply(lambda x:␣
       ↪(sum(x['order_amount']))/(sum(x['total_items']))))
```

```
[46]: 407.99
```

This is still a high average for affordable sneakers. This leads me to believe that there are some outliers which have a very high price, that is driving the mean to be higher than expected. Let's see what the boxplot looks like:

```
[47]: sneaker.boxplot(column = "order_amount")
```

```
[47]: <AxesSubplot:>
```



There are a lot of outliers! Also referring back to the summary chart, I can see that the maximum value for the order_amount is $704000, this is INSANELY high! There is also a standard deviation of about 41282, which means there is a lot of variation within the data points in the order amount column. When thinking about the types of buyers that could exist, there are buyers that are just buying for themselves, or there are store owners/suppliers buying a bulk amount of shoes, which explains the high values order amounts. Let's dig into this issue:

```
[54]: outlier = sneaker.groupby(['order_amount']).size().reset_index(name =␣
       ↪'count_of_order_amount').sort_values(by='order_amount', ascending = False)
      outlier.head(15)
```

```
[54]:      order_amount  count_of_order_amount
      257        704000                     17
```

```
256         154350                        1
255         102900                        1
254          77175                        9
253          51450                       16
252          25725                       19
251           1760                        1
250           1408                        2
249           1086                        1
248           1064                        1
247           1056                        3
246            980                        1
245            965                        1
244            960                        2
243            948                        1
```

This chart gives us a visual of how there are several orders of \$704000, in fact 17 orders, we can also see that the same pattern follows for order amounts of $51450, \$25725 with many orders with the exact same amounts.

[55]:
```python
big_order_amounts = sneaker.sort_values(by= 'order_amount', ascending = False)
big_order_amounts.head(15)
```

[55]:
```
      order_id  shop_id  user_id  order_amount  total_items payment_method  \
2153      2154       42      607        704000         2000    credit_card
3332      3333       42      607        704000         2000    credit_card
520        521       42      607        704000         2000    credit_card
1602      1603       42      607        704000         2000    credit_card
60          61       42      607        704000         2000    credit_card
2835      2836       42      607        704000         2000    credit_card
4646      4647       42      607        704000         2000    credit_card
2297      2298       42      607        704000         2000    credit_card
1436      1437       42      607        704000         2000    credit_card
4882      4883       42      607        704000         2000    credit_card
4056      4057       42      607        704000         2000    credit_card
15          16       42      607        704000         2000    credit_card
1104      1105       42      607        704000         2000    credit_card
1562      1563       42      607        704000         2000    credit_card
2969      2970       42      607        704000         2000    credit_card

               created_at  new_aov
2153   2017-03-12 4:00:00    352.0
3332   2017-03-24 4:00:00    352.0
520    2017-03-02 4:00:00    352.0
1602   2017-03-17 4:00:00    352.0
60     2017-03-04 4:00:00    352.0
2835   2017-03-28 4:00:00    352.0
4646   2017-03-02 4:00:00    352.0
```

```
2297  2017-03-07 4:00:00    352.0
1436  2017-03-11 4:00:00    352.0
4882  2017-03-25 4:00:00    352.0
4056  2017-03-28 4:00:00    352.0
15    2017-03-07 4:00:00    352.0
1104  2017-03-24 4:00:00    352.0
1562  2017-03-19 4:00:00    352.0
2969  2017-03-28 4:00:00    352.0
```

From the table above, it looks like 1 shop (shop_id is 42) has all the big orders of \$704000. Let us check if this is the case for $51450 and \$25725

[59]:
```
sneaker.loc[sneaker['order_amount'].isin([704000, 51450, 25725])].
↪sort_values(by='order_amount', ascending=False)
```

[59]:
```
      order_id  shop_id  user_id  order_amount  total_items payment_method  \
15          16       42      607        704000         2000    credit_card
1362      1363       42      607        704000         2000    credit_card
2969      2970       42      607        704000         2000    credit_card
2835      2836       42      607        704000         2000    credit_card
4056      4057       42      607        704000         2000    credit_card
60          61       42      607        704000         2000    credit_card
2297      2298       42      607        704000         2000    credit_card
2153      2154       42      607        704000         2000    credit_card
1562      1563       42      607        704000         2000    credit_card
1436      1437       42      607        704000         2000    credit_card
1602      1603       42      607        704000         2000    credit_card
3332      3333       42      607        704000         2000    credit_card
1104      1105       42      607        704000         2000    credit_card
4882      4883       42      607        704000         2000    credit_card
4868      4869       42      607        704000         2000    credit_card
520        521       42      607        704000         2000    credit_card
4646      4647       42      607        704000         2000    credit_card
511        512       78      967         51450            2           cash
3167      3168       78      927         51450            2           cash
3705      3706       78      828         51450            2    credit_card
3101      3102       78      855         51450            2    credit_card
490        491       78      936         51450            2          debit
2821      2822       78      814         51450            2           cash
2818      2819       78      869         51450            2          debit
493        494       78      983         51450            2           cash
2495      2496       78      707         51450            2           cash
2512      2513       78      935         51450            2          debit
2452      2453       78      709         51450            2           cash
4079      4080       78      946         51450            2           cash
617        618       78      760         51450            2           cash
1529      1530       78      810         51450            2           cash
```

```
4311      4312        78      960          51450              2          debit
4412      4413        78      756          51450              2          debit
3440      3441        78      982          25725              1          debit
4040      4041        78      852          25725              1           cash
3780      3781        78      889          25725              1           cash
4505      4506        78      866          25725              1          debit
4584      4585        78      997          25725              1           cash
2548      2549        78      861          25725              1           cash
3151      3152        78      745          25725              1    credit_card
3085      3086        78      910          25725              1           cash
2922      2923        78      740          25725              1          debit
2773      2774        78      890          25725              1           cash
2270      2271        78      855          25725              1    credit_card
1452      1453        78      812          25725              1    credit_card
1419      1420        78      912          25725              1           cash
1384      1385        78      867          25725              1           cash
1204      1205        78      970          25725              1    credit_card
1193      1194        78      944          25725              1          debit
1056      1057        78      800          25725              1          debit
160        161        78      990          25725              1    credit_card
4918      4919        78      823          25725              1           cash

               created_at  new_aov
15     2017-03-07 4:00:00    352.0
1362   2017-03-15 4:00:00    352.0
2969   2017-03-28 4:00:00    352.0
2835   2017-03-28 4:00:00    352.0
4056   2017-03-28 4:00:00    352.0
60     2017-03-04 4:00:00    352.0
2297   2017-03-07 4:00:00    352.0
2153   2017-03-12 4:00:00    352.0
1562   2017-03-19 4:00:00    352.0
1436   2017-03-11 4:00:00    352.0
1602   2017-03-17 4:00:00    352.0
3332   2017-03-24 4:00:00    352.0
1104   2017-03-24 4:00:00    352.0
4882   2017-03-25 4:00:00    352.0
4868   2017-03-22 4:00:00    352.0
520    2017-03-02 4:00:00    352.0
4646   2017-03-02 4:00:00    352.0
511    2017-03-09 7:23:14  25725.0
3167  2017-03-12 12:23:08  25725.0
3705  2017-03-14 20:43:15  25725.0
3101   2017-03-21 5:10:34  25725.0
490   2017-03-26 17:08:19  25725.0
2821  2017-03-02 17:13:25  25725.0
2818   2017-03-17 6:25:51  25725.0
```

```
493   2017-03-16 21:39:35  25725.0
2495   2017-03-26 4:38:52  25725.0
2512  2017-03-18 18:57:13  25725.0
2452  2017-03-27 11:04:04  25725.0
4079  2017-03-20 21:14:00  25725.0
617   2017-03-18 11:18:42  25725.0
1529   2017-03-29 7:12:01  25725.0
4311   2017-03-01 3:02:10  25725.0
4412   2017-03-02 4:13:39  25725.0
3440  2017-03-19 19:02:54  25725.0
4040  2017-03-02 14:31:12  25725.0
3780  2017-03-11 21:14:50  25725.0
4505  2017-03-22 22:06:01  25725.0
4584  2017-03-25 21:48:44  25725.0
2548  2017-03-17 19:36:00  25725.0
3151  2017-03-18 13:13:07  25725.0
3085   2017-03-26 1:59:27  25725.0
2922  2017-03-12 20:10:58  25725.0
2773  2017-03-26 10:36:43  25725.0
2270  2017-03-14 23:58:22  25725.0
1452  2017-03-17 18:09:54  25725.0
1419  2017-03-30 12:23:43  25725.0
1384  2017-03-17 16:38:06  25725.0
1204  2017-03-17 22:32:21  25725.0
1193  2017-03-16 16:38:26  25725.0
1056  2017-03-15 10:16:45  25725.0
160    2017-03-12 5:56:57  25725.0
4918  2017-03-15 13:26:46  25725.0
```

We can observe from the table above that the same pattern occurs, however for order amounts of \$704000, there are 2000 total items, but for order amounts of \$51450, there are 2 total items, and for order amounts of \$25725, there is only 1 total item. Since double \$25725 is exactly \$51450, this leads me to believe that the orders with \$51450, are just 2 orders of \$25725. I can also conclude that the orders with order amounts of \$704000 could not be justified as a regular buyer (customers only buying a reasonable amount of pairs of shoes at a reasonable price), as it probably is a supplier buying mass amounts of shoes (hence, the 2000 orders).

However the orders of \$25725 seem to be very high if it is just one pair of shoe, I will assume that there was a data entry error for this, and assume it was inputted as cents instead of dollars. I will change both values of \$25725 and \$51450 as dollar amounts, since both order amounts relate to one another.

[87]:
```
sneaker.loc[sneaker['order_amount'] == 51450, 'order_amount'] = 514.50
sneaker.loc[sneaker['order_amount'] == 25725, 'order_amount'] = 257.25
```

[89]:
```
sneaker.loc[sneaker['order_amount'].isin([704000, 514.50, 257.25])].
 ↪sort_values(by='order_amount', ascending=False)
```

```
[89]:       order_id  shop_id  user_id  order_amount  total_items payment_method  \
      15          16       42      607     704000.00         2000    credit_card
      1362      1363       42      607     704000.00         2000    credit_card
      2969      2970       42      607     704000.00         2000    credit_card
      2835      2836       42      607     704000.00         2000    credit_card
      4056      4057       42      607     704000.00         2000    credit_card
      60          61       42      607     704000.00         2000    credit_card
      2297      2298       42      607     704000.00         2000    credit_card
      2153      2154       42      607     704000.00         2000    credit_card
      1562      1563       42      607     704000.00         2000    credit_card
      1436      1437       42      607     704000.00         2000    credit_card
      1602      1603       42      607     704000.00         2000    credit_card
      3332      3333       42      607     704000.00         2000    credit_card
      1104      1105       42      607     704000.00         2000    credit_card
      4882      4883       42      607     704000.00         2000    credit_card
      4868      4869       42      607     704000.00         2000    credit_card
      520        521       42      607     704000.00         2000    credit_card
      4646      4647       42      607     704000.00         2000    credit_card
      511        512       78      967        514.50            2           cash
      3167      3168       78      927        514.50            2           cash
      3705      3706       78      828        514.50            2    credit_card
      3101      3102       78      855        514.50            2    credit_card
      490        491       78      936        514.50            2          debit
      2821      2822       78      814        514.50            2           cash
      2818      2819       78      869        514.50            2          debit
      493        494       78      983        514.50            2           cash
      2495      2496       78      707        514.50            2           cash
      2512      2513       78      935        514.50            2          debit
      2452      2453       78      709        514.50            2           cash
      4079      4080       78      946        514.50            2           cash
      617        618       78      760        514.50            2           cash
      1529      1530       78      810        514.50            2           cash
      4311      4312       78      960        514.50            2          debit
      4412      4413       78      756        514.50            2          debit
      3440      3441       78      982        257.25            1          debit
      4040      4041       78      852        257.25            1           cash
      3780      3781       78      889        257.25            1           cash
      4505      4506       78      866        257.25            1          debit
      4584      4585       78      997        257.25            1           cash
      2548      2549       78      861        257.25            1           cash
      3151      3152       78      745        257.25            1    credit_card
      3085      3086       78      910        257.25            1           cash
      2922      2923       78      740        257.25            1          debit
      2773      2774       78      890        257.25            1           cash
      2270      2271       78      855        257.25            1    credit_card
      1452      1453       78      812        257.25            1    credit_card
      1419      1420       78      912        257.25            1           cash
```

```
1384      1385       78     867        257.25            1          cash
1204      1205       78     970        257.25            1   credit_card
1193      1194       78     944        257.25            1         debit
1056      1057       78     800        257.25            1         debit
160        161       78     990        257.25            1   credit_card
4918      4919       78     823        257.25            1          cash

               created_at  new_aov
15     2017-03-07 4:00:00    352.0
1362   2017-03-15 4:00:00    352.0
2969   2017-03-28 4:00:00    352.0
2835   2017-03-28 4:00:00    352.0
4056   2017-03-28 4:00:00    352.0
60     2017-03-04 4:00:00    352.0
2297   2017-03-07 4:00:00    352.0
2153   2017-03-12 4:00:00    352.0
1562   2017-03-19 4:00:00    352.0
1436   2017-03-11 4:00:00    352.0
1602   2017-03-17 4:00:00    352.0
3332   2017-03-24 4:00:00    352.0
1104   2017-03-24 4:00:00    352.0
4882   2017-03-25 4:00:00    352.0
4868   2017-03-22 4:00:00    352.0
520    2017-03-02 4:00:00    352.0
4646   2017-03-02 4:00:00    352.0
511    2017-03-09 7:23:14  25725.0
3167  2017-03-12 12:23:08  25725.0
3705  2017-03-14 20:43:15  25725.0
3101   2017-03-21 5:10:34  25725.0
490   2017-03-26 17:08:19  25725.0
2821  2017-03-02 17:13:25  25725.0
2818   2017-03-17 6:25:51  25725.0
493   2017-03-16 21:39:35  25725.0
2495   2017-03-26 4:38:52  25725.0
2512  2017-03-18 18:57:13  25725.0
2452  2017-03-27 11:04:04  25725.0
4079  2017-03-20 21:14:00  25725.0
617   2017-03-18 11:18:42  25725.0
1529   2017-03-29 7:12:01  25725.0
4311   2017-03-01 3:02:10  25725.0
4412   2017-03-02 4:13:39  25725.0
3440  2017-03-19 19:02:54  25725.0
4040  2017-03-02 14:31:12  25725.0
3780  2017-03-11 21:14:50  25725.0
4505  2017-03-22 22:06:01  25725.0
4584  2017-03-25 21:48:44  25725.0
2548  2017-03-17 19:36:00  25725.0
```

```
3151  2017-03-18 13:13:07  25725.0
3085   2017-03-26 1:59:27  25725.0
2922  2017-03-12 20:10:58  25725.0
2773  2017-03-26 10:36:43  25725.0
2270  2017-03-14 23:58:22  25725.0
1452  2017-03-17 18:09:54  25725.0
1419  2017-03-30 12:23:43  25725.0
1384  2017-03-17 16:38:06  25725.0
1204  2017-03-17 22:32:21  25725.0
1193  2017-03-16 16:38:26  25725.0
1056  2017-03-15 10:16:45  25725.0
160    2017-03-12 5:56:57  25725.0
4918  2017-03-15 13:26:46  25725.0
```

[90]:
```
statistics.mean(sneaker.groupby('shop_id').apply(lambda x:␣
 ↪(sum(x['order_amount']))/(sum(x['total_items']))))
```

[90]:
```
260.3928125
```

An AOV of \$260.39 seems a lot better!

0.2 Question 1. B

I would report the median for this dataset, since we saw that one shop (shop_id 42) has 17 transactions of 2000 units with the value of \$704000 from seller 42 (seller_id), which skews the data very heavily. Median values are not as heavily influenced by outliers as opposed to the mean.

0.3 Question 1. C

It's value is \$284.0 as analyzed above.