case_study_analysis

October 24, 2022

```
[ ]: import numpy as np
     import pandas as pd
     import matplotlib.pyplot as plt
     from matplotlib import rc
     from matplotlib.ticker import PercentFormatter
     from scipy.stats import mannwhitneyu, ttest_ind
```

1 Initial Thoughts/Ideas to Investigate:

- Summary statistics
  - What proportion of booking are mobile?
  - Where are the mobile bookings made? (Pie chart)
  - How has this changed over time (group by week or month)? (Use linear regression)
- Hypothesis tests
  - Any specific countries using one platform above others?
  - Difference in booking windows between desktop users and mobile users? (t-test/welch's test)
  - Difference in average booking value (will need to statify by country) (boxplot)?
  - Difference in net orders?
  - Are mobile users more/less likely to travel within same country/region?

2 Further Questions:

- Given a more precise date/time of when bookings are made, could look for trends in when mobile devices are more commonly used
- Given the Super Region associated with each Property Country, could investigate whether customers booking through mobile devices are more/less likely to travel within the same region or outside of it

```
[ ]: # importing data as data frame

     entire_data = pd.read_excel("expedia_dataset.xlsx")
```

```
[ ]: entire_data
```

```
[ ]:           Week Mobile Indicator Name Platform Type Name Super Region  \
     0      2016-W45              Desktop            Desktop         APAC
```

```
1      2016-W45               Desktop            Desktop         APAC
2      2016-W45               Desktop            Desktop         APAC
3      2016-W45               Desktop            Desktop         APAC
4      2016-W45               Desktop            Desktop         APAC
…         …                   …                …          …
73683  2017-W48                Mobile         Mobile Web          NaN
73684  2017-W48                Mobile         Mobile Web          NaN
73685  2017-W48                Mobile         Mobile Web          NaN
73686  2017-W48                Mobile         Mobile Web          NaN
73687  2017-W48                Mobile         Mobile Web          NaN

      Country Name Booking Window Group Property Country  \
0      South Korea            8-14 days          Algeria
1      South Korea             +90 days          Andorra
2      South Korea           46-60 days          Andorra
3        Australia           31-45 days        Argentina
4        Australia           15-30 days        Argentina
…            …                  …              …
73683           US           15-30 days          Vietnam
73684           US           31-45 days          Vietnam
73685           US           46-60 days          Vietnam
73686           US            8-14 days          Vietnam
73687           US             +90 days          Vietnam

       Net Gross Booking Value USD  Net Orders
0                        -608.4244          -3
1                        -512.1796          -2
2                         103.4298           1
3                         395.9592           1
4                         373.4194           1
…                            …         …
73683                     748.2964           6
73684                    2379.9672           7
73685                      66.7100           1
73686                     591.3000           2
73687                     -69.6500           1

[73688 rows x 9 columns]
```

[ ]:

```
entire_data["Year"] = [int(list(entire_data["Week"])[x][0:4]) for x in␣
 ↪range(len(entire_data))]
entire_data
```

[ ]:

```
           Week Mobile Indicator Name Platform Type Name Super Region  \
0      2016-W45               Desktop            Desktop         APAC
1      2016-W45               Desktop            Desktop         APAC
2      2016-W45               Desktop            Desktop         APAC
```

```
3      2016-W45               Desktop            Desktop         APAC
4      2016-W45               Desktop            Desktop         APAC
…         …                   …                …          …
73683  2017-W48                Mobile         Mobile Web          NaN
73684  2017-W48                Mobile         Mobile Web          NaN
73685  2017-W48                Mobile         Mobile Web          NaN
73686  2017-W48                Mobile         Mobile Web          NaN
73687  2017-W48                Mobile         Mobile Web          NaN

      Country Name Booking Window Group Property Country  \
0      South Korea            8-14 days          Algeria
1      South Korea             +90 days          Andorra
2      South Korea           46-60 days          Andorra
3        Australia           31-45 days        Argentina
4        Australia           15-30 days        Argentina
…            …                  …              …
73683           US           15-30 days          Vietnam
73684           US           31-45 days          Vietnam
73685           US           46-60 days          Vietnam
73686           US            8-14 days          Vietnam
73687           US             +90 days          Vietnam

       Net Gross Booking Value USD  Net Orders  Year
0                        -608.4244          -3  2016
1                        -512.1796          -2  2016
2                         103.4298           1  2016
3                         395.9592           1  2016
4                         373.4194           1  2016
…                            …         …   …
73683                     748.2964           6  2017
73684                    2379.9672           7  2017
73685                      66.7100           1  2017
73686                     591.3000           2  2017
73687                     -69.6500           1  2017

[73688 rows x 10 columns]
```

2.0.1 Data Quality Issue

There are **3405** instances of the data where the 'Net Orders' is a negative number. This is assummed to be data quality issue since if a customer cancels all bookings then expect 'Net Orders' to be 0.

This makes up about **4.6%** of the data, so I have chosen to **remove** them.

Another option would have been to also consider whther the 'Net Gross Booking Value USD' was positive or negative and postentially take the negative instances to be bookings that were fully cancelled (assuming that the booking were technically cancelled more than once) - in a real life situation I would have discussed this with a more experienced collegue or the person who provided the data.

```
[ ]: entire_data = entire_data[entire_data['Net Orders'] >= 0]
```

```
[ ]: (entire_data["Net Gross Booking Value USD"] < 0).sum()
```

```
[ ]: 3083
```

2.0.2 Data Quality Issue

There are a further **3083** instances where the ‘Net Gross Booking Value USD’ is strictly negative.

Again, I will assume that this is because bookings have technically been cancelled more than once on the system. With the data provided, I am unable to recover the actual booking value but this could potentially be resolved given the initial number of bookings and the number of bookings cancelled and the values of each of these.

To resolve this, these instances will also be removed. At this point, around **8.8%** of the initial data has been removed.

There are also a small number of instances of cancelled bookings with very low, but non-zero ‘Net Gross Booking Value USD’. I will assume that this may be due to small fares not being refunded or currency issues and leave these as is. These values are close to zero anyway so are unlikely to skew the analysis much.

```
[ ]: entire_data = entire_data[entire_data['Net Gross Booking Value USD'] >= 0]
```

```
[ ]: # seperate into desktop and mobile bookings

     desktop_data = entire_data[entire_data["Mobile Indicator Name"] == "Desktop"]
     mobile_data = entire_data[entire_data["Mobile Indicator Name"] == "Mobile"]
     mobile_web_data = mobile_data[mobile_data["Platform Type Name"] == "Mobile Web"]
     mobile_app_data = mobile_data[mobile_data["Platform Type Name"] == "Mobile App"]
```

```
[ ]: # with pd.ExcelWriter('separated_data.xlsx') as writer:
     #     desktop_data.to_excel(writer, sheet_name='desktop')
     #     mobile_data.to_excel(writer, sheet_name='mobile')
     #     mobile_web_data.to_excel(writer, sheet_name='mobile_web')
     #     mobile_app_data.to_excel(writer, sheet_name='mobile_app')
```

```
[ ]: # checking there are no missing bookings

     print(len(desktop_data) + len(mobile_data) == len(entire_data))
     print(len(desktop_data) + len(mobile_web_data) + len(mobile_app_data) ==␣
      ↪len(entire_data))
```

```
True
True
```

[ ]:

```
print(f"Overall percentage of mobile bookings (including those which were␣
 ↪cancelled): {100 * len(mobile_data)/len(entire_data)}%")
print(f"Out of the mobile bookings, percentage made on app: {100 *␣
 ↪len(mobile_app_data)/len(mobile_data)}%")
print(f"Out of the mobile bookings, percentage made on web: {100 *␣
 ↪len(mobile_web_data)/len(mobile_data)}%")
```

```
Overall percentage of mobile bookings (including those which were cancelled):
52.20982142857143%
Out of the mobile bookings, percentage made on app: 48.7416274761294%
Out of the mobile bookings, percentage made on web: 51.2583725238706%
```

[ ]:

```
#delete:
# Will start by just considering the bookings which were not cancelled, and␣
 ↪then will conduct some analysis to see whether there are any links between␣
 ↪device and amount of cancelled bookings
```

[ ]:

```
#delete:
# desktop_data_fullfilled = desktop_data[desktop_data["Net Orders"] > 0]
# mobile_data_fullfilled = mobile_data[mobile_data["Net Orders"] > 0]
# mobile_web_data_fullfilled = mobile_web_data[mobile_web_data["Net Orders"] >␣
 ↪0]
# mobile_app_data_fullfilled = mobile_app_data[mobile_app_data["Net Orders"] >␣
 ↪0]
```

2.1 How did the amount of mobile bookings changed between 2016 and 2017?

[ ]:

```
entire_data.groupby(by=["Week"]).count()
```

[ ]:

```
          Mobile Indicator Name  Platform Type Name  Super Region  \
Week
2016-W45                   7785                7785          5667
2016-W46                   7882                7882          5723
2016-W47                   7633                7633          5508
2016-W48                   7664                7664          5560
2017-W45                   9280                9280          6791
2017-W46                   9200                9200          6741
2017-W47                   8794                8794          6415
2017-W48                   8962                8962          6578

          Country Name  Booking Window Group  Property Country  \
Week
2016-W45          7785                  7785              7785
2016-W46          7882                  7882              7882
2016-W47          7633                  7633              7633
2016-W48          7664                  7664              7664
2017-W45          9280                  9280              9280
```

```
2017-W46          9200                  9200                  9200
2017-W47          8794                  8794                  8794
2017-W48          8962                  8962                  8962

          Net Gross Booking Value USD  Net Orders  Year
Week
2016-W45                         7785        7785  7785
2016-W46                         7882        7882  7882
2016-W47                         7633        7633  7633
2016-W48                         7664        7664  7664
2017-W45                         9280        9280  9280
2017-W46                         9200        9200  9200
2017-W47                         8794        8794  8794
2017-W48                         8962        8962  8962
```

```
[ ]: entire_data.groupby(by=["Week"]).count()["Mobile Indicator Name"].sum() ==␣
      ↪len(entire_data)
```

```
[ ]: True
```

```
[ ]: mobile_data.groupby(by=["Week"]).count()
```

```
[ ]:           Mobile Indicator Name  Platform Type Name  Super Region  \
     Week
     2016-W45                   3883                3883          2782
     2016-W46                   3951                3951          2812
     2016-W47                   3812                3812          2715
     2016-W48                   3872                3872          2747
     2017-W45                   5015                5015          3619
     2017-W46                   5001                5001          3627
     2017-W47                   4713                4713          3396
     2017-W48                   4838                4838          3478

               Country Name  Booking Window Group  Property Country  \
     Week
     2016-W45          3883                  3883              3883
     2016-W46          3951                  3951              3951
     2016-W47          3812                  3812              3812
     2016-W48          3872                  3872              3872
     2017-W45          5015                  5015              5015
     2017-W46          5001                  5001              5001
     2017-W47          4713                  4713              4713
     2017-W48          4838                  4838              4838

               Net Gross Booking Value USD  Net Orders  Year
     Week
     2016-W45                         3883        3883  3883
```

```
2016-W46                           3951         3951  3951
2016-W47                           3812         3812  3812
2016-W48                           3872         3872  3872
2017-W45                           5015         5015  5015
2017-W46                           5001         5001  5001
2017-W47                           4713         4713  4713
2017-W48                           4838         4838  4838
```

[ ]:

```
desktop_proportion = desktop_data.groupby(by=["Week"]).count()["Mobile␣
 ↪Indicator Name"] / entire_data.groupby(by=["Week"]).count()["Mobile␣
 ↪Indicator Name"]
mobile_proportion = mobile_data.groupby(by=["Week"]).count()["Mobile Indicator␣
 ↪Name"] / entire_data.groupby(by=["Week"]).count()["Mobile Indicator Name"]
mobile_app_proportion = mobile_app_data.groupby(by=["Week"]).count()["Mobile␣
 ↪Indicator Name"] / entire_data.groupby(by=["Week"]).count()["Mobile␣
 ↪Indicator Name"]
mobile_web_proportion = mobile_web_data.groupby(by=["Week"]).count()["Mobile␣
 ↪Indicator Name"] / entire_data.groupby(by=["Week"]).count()["Mobile␣
 ↪Indicator Name"]
```

[ ]:

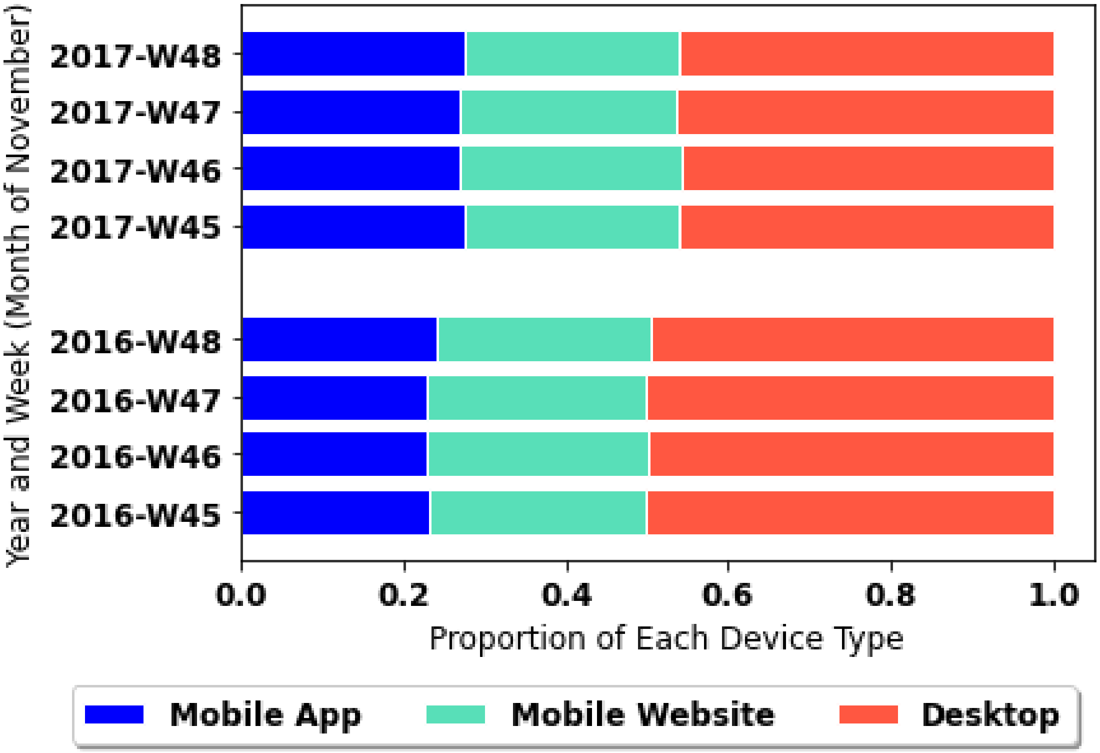
```
plt.rcParams.update({'font.size': 12})
```

[ ]:

```
rc('font', weight='bold')

bars = np.add(mobile_app_proportion, mobile_web_proportion).tolist()

labels = ["2016-W45", "2016-W46", "2016-W47", "2016-W48", "2017-W45",␣
 ↪"2017-W46", "2017-W47", "2017-W48"]
plt.barh([0,1,2,3,5,6,7,8], mobile_app_proportion, color='#0000FD', label =␣
 ↪"Mobile App", edgecolor='white')
plt.barh([0,1,2,3,5,6,7,8], mobile_web_proportion, color='#58DFB8', left =␣
 ↪mobile_app_proportion, label = 'Mobile Website', edgecolor='white')
plt.barh([0,1,2,3,5,6,7,8], desktop_proportion, color='#FF5741', left = bars,␣
 ↪label = 'Desktop', edgecolor='white')
plt.legend(loc='upper center', bbox_to_anchor=(0.39, -0.2), fancybox=True,␣
 ↪shadow=True, ncol=3)
plt.yticks([0,1,2,3,5,6,7,8], labels, fontweight='bold')
plt.ylabel("Year and Week (Month of November)")
plt.xlabel("Proportion of Each Device Type")
```

[ ]:

```
Text(0.5, 0, 'Proportion of Each Device Type')
```



Conducting Mann-Whitney hypothesis test to deduce whether the proportions of mobile bookings in 2016 and 2017 are likely to come from different distributions.

This test is used since it does not assume a particular underlying ditribution such as normal.

```
[ ]: mannwhitneyu(mobile_proportion[0:4], mobile_proportion[4:8], alternative="less")
     # ttest_ind(mobile_proportion[0:4], mobile_proportion[4:8], equal_var=False)
```

```
[ ]: MannwhitneyuResult(statistic=0.0, pvalue=0.014285714285714285)
```

Significant at $\alpha = 0.05$

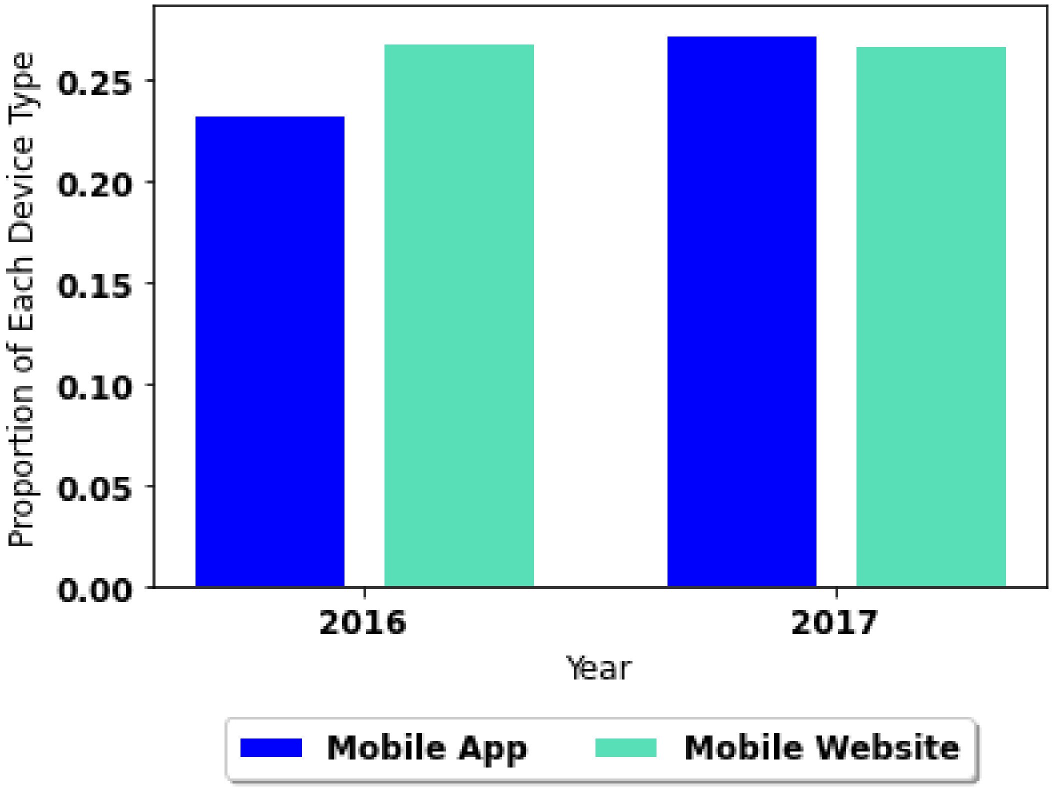
2.2 Is this growth in app or website usage or both?

```
[ ]: average_app_proportions = [mobile_app_proportion[0:4].mean(), 0,␣
      ↪mobile_app_proportion[4:8].mean(), 0]
     average_web_proportions = [0, mobile_web_proportion[0:4].mean(), 0,␣
      ↪mobile_web_proportion[4:8].mean()]
```

```
[ ]: rc('font', weight='bold')

     plt.bar([0,1,2.5,3.5], average_app_proportions, color='#0000FD', label =␣
      ↪"Mobile App", edgecolor='white')
```

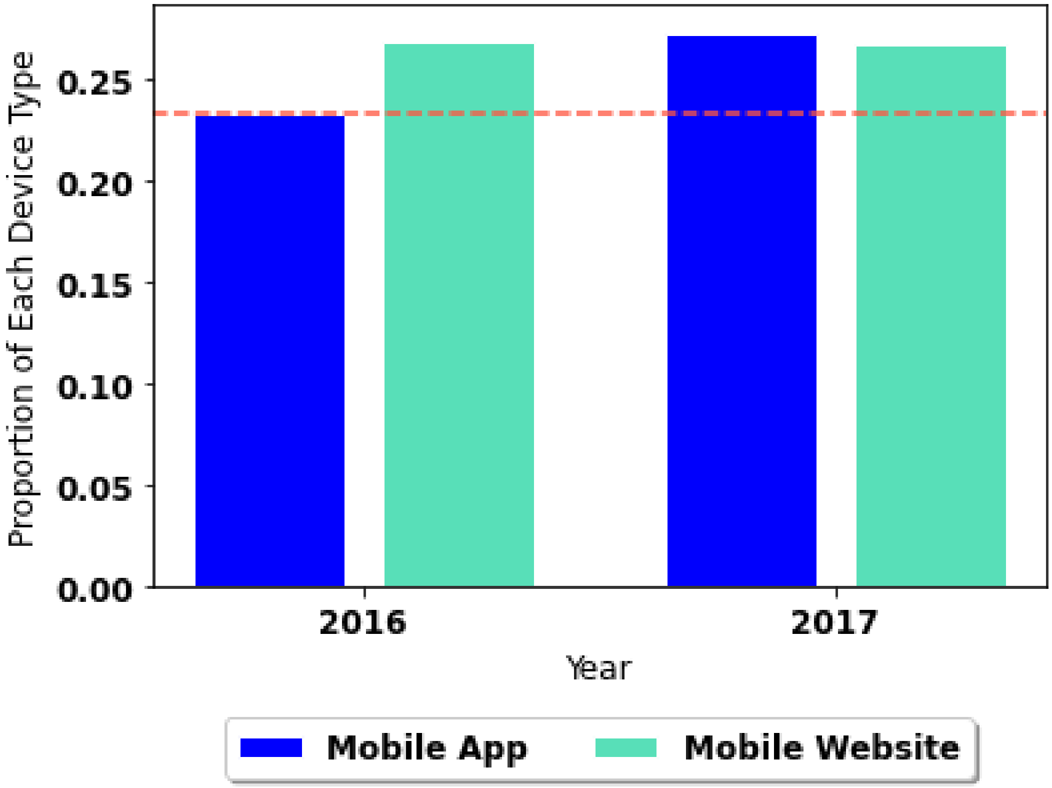
```
plt.bar([0,1,2.5,3.5], average_web_proportions, color='#58DFB8', label =␣
↪"Mobile Website", edgecolor='white')
plt.xticks([0.5, 3], ["2016", "2017"], fontweight='bold')
plt.legend(loc='upper center', bbox_to_anchor=(0.5, -0.2), fancybox=True,␣
↪shadow=True, ncol=3)
plt.ylabel("Proportion of Each Device Type")
plt.xlabel("Year")
```

[ ]:
```
Text(0.5, 0, 'Year')
```



[ ]:
```
rc('font', weight='bold')

plt.bar([0,1,2.5,3.5], average_app_proportions, color='#0000FD', label =␣
↪"Mobile App", edgecolor='white')
plt.bar([0,1,2.5,3.5], average_web_proportions, color='#58DFB8', label =␣
↪"Mobile Website", edgecolor='white')
plt.xticks([0.5, 3], ["2016", "2017"], fontweight='bold')
plt.legend(loc='upper center', bbox_to_anchor=(0.5, -0.2), fancybox=True,␣
↪shadow=True, ncol=3)
plt.ylabel("Proportion of Each Device Type")
plt.xlabel("Year")
plt.axhline(mobile_app_proportion[0:4].mean(), color='#FF5741', linestyle='--')
# plt.axhline(mobile_web_proportion[0:4].mean(), color='#FF5741',␣
↪linestyle='--')
```

```
[ ]: <matplotlib.lines.Line2D at 0x7ffd525f03d0>
```



```
[ ]: mannwhitneyu(mobile_app_proportion[0:4], mobile_app_proportion[4:8],␣
      ↪alternative="less")
```

```
[ ]: MannwhitneyuResult(statistic=0.0, pvalue=0.014285714285714285)
```

```
[ ]: mannwhitneyu(mobile_web_proportion[0:4], mobile_web_proportion[4:8],␣
      ↪alternative="less")
```

```
[ ]: MannwhitneyuResult(statistic=11.0, pvalue=0.8285714285714285)
```

2.3 Where are the users?

```
[ ]: entire_data.groupby(by=["Super Region"]).count()
[ ]:                Week  Mobile Indicator Name  Platform Type Name  Country Name  \
     Super Region
     APAC          21802                  21802               21802         21802
     EMEA          21616                  21616               21616         21616
     LATAM          5565                   5565                5565          5565

                  Booking Window Group  Property Country  \
     Super Region
     APAC                        21802             21802
     EMEA                        21616             21616
     LATAM                        5565              5565

                  Net Gross Booking Value USD  Net Orders   Year
     Super Region
     APAC                               21802       21802  21802
     EMEA                               21616       21616  21616
     LATAM                               5565        5565   5565
```

```
[ ]: entire_data.groupby(by=["Super Region"]).count()["Week"].sum() ==␣
      ↪len(entire_data)
```

```
[ ]: False
```

```
[ ]: entire_data.groupby(by=["Super Region"]).count()["Week"].sum() -␣
      ↪len(entire_data)
```

```
[ ]: -18217
```

2.3.1 Data Quality Issue

18217 instances do not specify the “Super Region”.

Looking more closely at this shows that this is the case only for bookings made in the US and is true for all bookings made in the US.

This is fixed by adding a specific super region for the US.

```
[ ]: entire_data["Super Region"] = entire_data["Super Region"].fillna("US")
```

```
[ ]: entire_data.groupby(by=["Super Region"]).count()["Week"].sum() ==␣
      ↪len(entire_data)
```

```
[ ]: True
```

```
[ ]: entire_data.groupby(by=["Super Region"]).count()
```

```
[ ]:                Week  Mobile Indicator Name  Platform Type Name  Country Name  \
     Super Region
```

```
APAC          21802                  21802               21802         21802
EMEA          21616                  21616               21616         21616
LATAM          5565                   5565                5565          5565
US            18217                  18217               18217         18217

              Booking Window Group  Property Country  \
Super Region
APAC                         21802             21802
EMEA                         21616             21616
LATAM                         5565              5565
US                           18217             18217

              Net Gross Booking Value USD  Net Orders   Year
Super Region
APAC                                21802       21802  21802
EMEA                                21616       21616  21616
LATAM                                5565        5565   5565
US                                  18217       18217  18217
```

[ ]:

```
desktop_data = entire_data[entire_data["Mobile Indicator Name"] == "Desktop"]
mobile_data = entire_data[entire_data["Mobile Indicator Name"] == "Mobile"]
mobile_web_data = mobile_data[mobile_data["Platform Type Name"] == "Mobile Web"]
mobile_app_data = mobile_data[mobile_data["Platform Type Name"] == "Mobile App"]
```

Will only present 2017 data for the following...

[ ]:

```
entire_data_2017 = entire_data[entire_data["Year"]==2017]
entire_data_2016 = entire_data[entire_data["Year"]==2016]
```

[ ]:

```
desktop_data_2017 = entire_data_2017[entire_data_2017["Mobile Indicator Name"]␣
 ↪== "Desktop"]
mobile_data_2017 = entire_data_2017[entire_data_2017["Mobile Indicator Name"]␣
 ↪== "Mobile"]
mobile_web_data_2017 = mobile_data_2017[mobile_data_2017["Platform Type Name"]␣
 ↪== "Mobile Web"]
mobile_app_data_2017 = mobile_data_2017[mobile_data_2017["Platform Type Name"]␣
 ↪== "Mobile App"]
```

[ ]:

```
desktop_data_2016 = entire_data_2016[entire_data_2016["Mobile Indicator Name"]␣
 ↪== "Desktop"]
mobile_data_2016 = entire_data_2016[entire_data_2016["Mobile Indicator Name"]␣
 ↪== "Mobile"]
mobile_web_data_2016 = mobile_data_2016[mobile_data_2016["Platform Type Name"]␣
 ↪== "Mobile Web"]
mobile_app_data_2016 = mobile_data_2016[mobile_data_2016["Platform Type Name"]␣
 ↪== "Mobile App"]
```

```
[ ]: (len(desktop_data_2017)-len(desktop_data_2016))/len(desktop_data_2016)
```

```
[ ]: 0.07917907548879968
```

```
[ ]: (len(mobile_data_2017)-len(mobile_data_2016))/len(mobile_data_2016)
```

```
[ ]: 0.26092279932981055
```

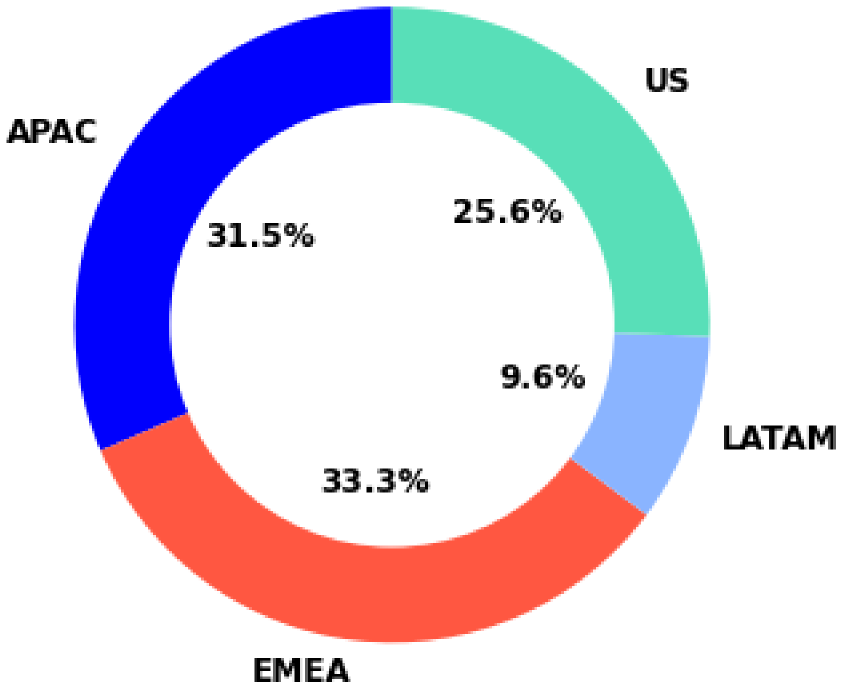
```
[ ]: (len(entire_data_2017)-len(entire_data_2016))/len(entire_data_2016)
```

```
[ ]: 0.17026224002066917
```

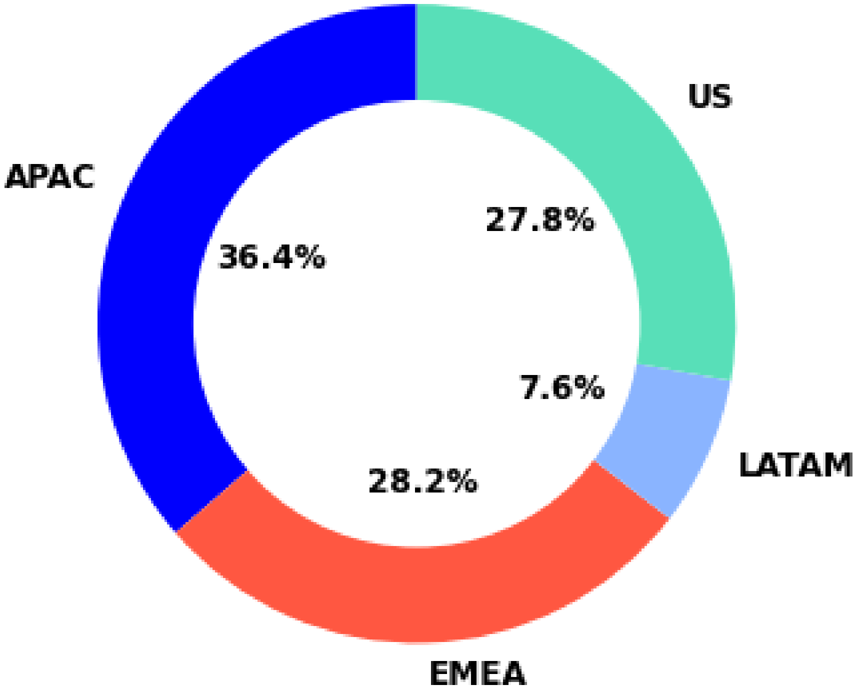
```
[ ]: desktop_data_2017.groupby(by=["Super Region"]).count()["Week"]
```

```
[ ]: Super Region
     APAC     5248
     EMEA     5553
     LATAM    1604
     US       4264
     Name: Week, dtype: int64
```

```
[ ]: labels = ['APAC', 'EMEA', 'LATAM', 'US']
     sizes = desktop_data_2017.groupby(by=["Super Region"]).count()["Week"]
     colors = ['#0000FD','#FF5741','#8AB4FF','#58DFB8']
     plt.pie(sizes, colors = colors, labels=labels, autopct='%1.1f%%', pctdistance=0.
      ↪5,startangle=90)

     centre_circle = plt.Circle((0,0),0.70,fc='white')
     fig = plt.gcf()
     fig.gca().add_artist(centre_circle)

     plt.axis('equal')
     plt.tight_layout()
     plt.show()
```

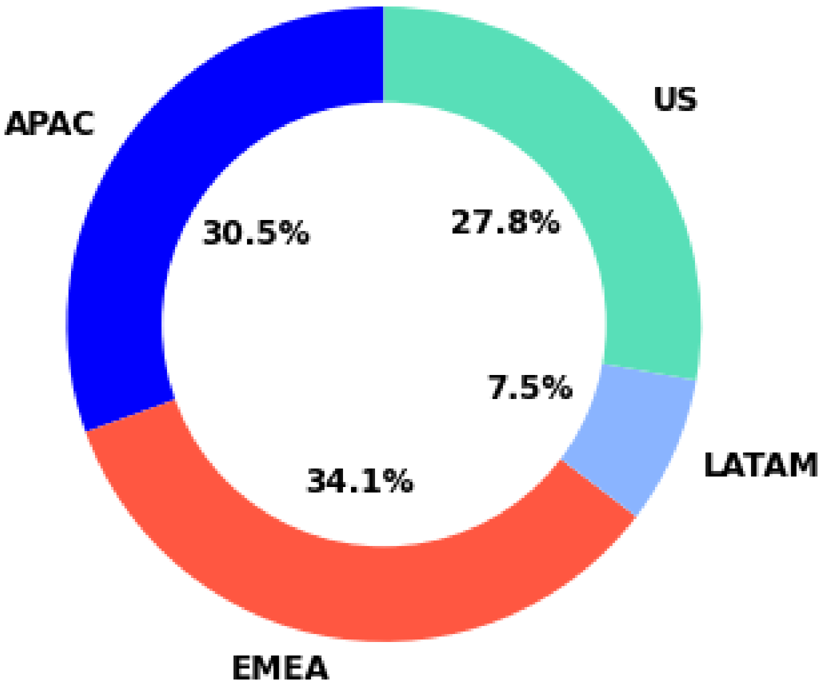


```
[ ]: labels = ['APAC', 'EMEA', 'LATAM', 'US']
     sizes = mobile_app_data_2017.groupby(by=["Super Region"]).count()["Week"]
     colors = ['#0000FD','#FF5741','#8AB4FF','#58DFB8']
     plt.pie(sizes, colors = colors, labels=labels, autopct='%1.1f%%', pctdistance=0.
      ↪5, startangle=90)

     centre_circle = plt.Circle((0,0),0.70,fc='white')
     fig = plt.gcf()
     fig.gca().add_artist(centre_circle)

     plt.axis('equal')
     plt.tight_layout()
     plt.show()
```



[ ]:

```
labels = ['APAC', 'EMEA', 'LATAM', 'US']
sizes = mobile_web_data_2017.groupby(by=["Super Region"]).count()["Week"]
colors = ['#0000FD','#FF5741','#8AB4FF','#58DFB8']
plt.pie(sizes, colors = colors, labels=labels, autopct='%1.1f%%', pctdistance=0.5,startangle=90)

centre_circle = plt.Circle((0,0),0.70,fc='white')
fig = plt.gcf()
fig.gca().add_artist(centre_circle)

plt.axis('equal')
plt.tight_layout()
plt.show()
```



[ ]:

```
entire_data_2017_apac = entire_data_2017[entire_data_2017["Super Region"]=="APAC"]
entire_data_2017_emea = entire_data_2017[entire_data_2017["Super Region"]=="EMEA"]
entire_data_2017_latam = entire_data_2017[entire_data_2017["Super Region"]=="LATAM"]
entire_data_2017_us = entire_data_2017[entire_data_2017["Super Region"]=="US"]
```

[ ]:

[ ]:

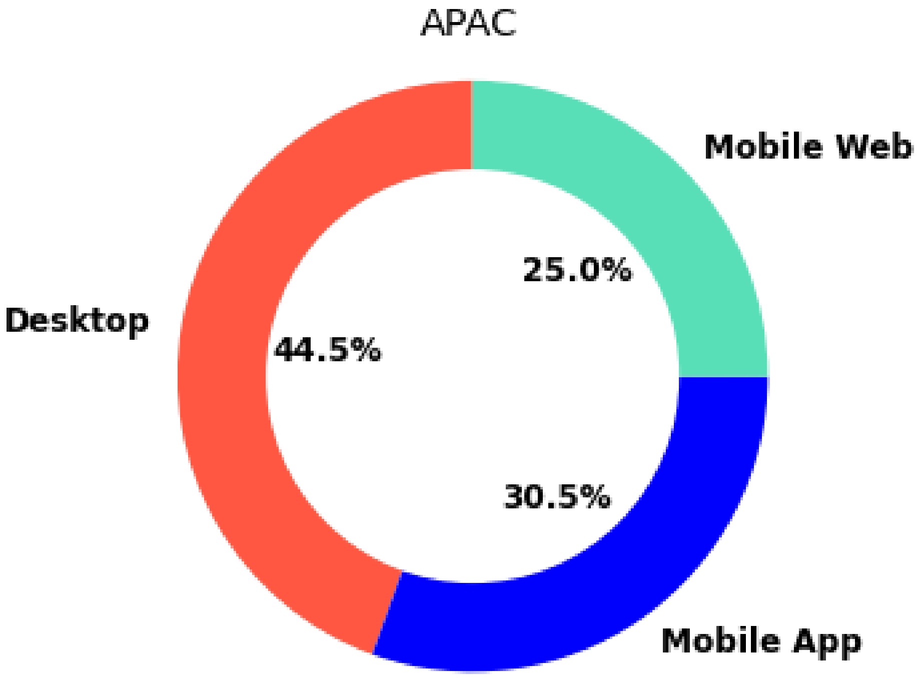
```
entire_data_2017_apac.groupby(by=["Platform Type Name"]).count()["Week"]
```

[ ]:

```
Platform Type Name
Desktop       5248
Mobile App    3597
Mobile Web    2952
Name: Week, dtype: int64
```

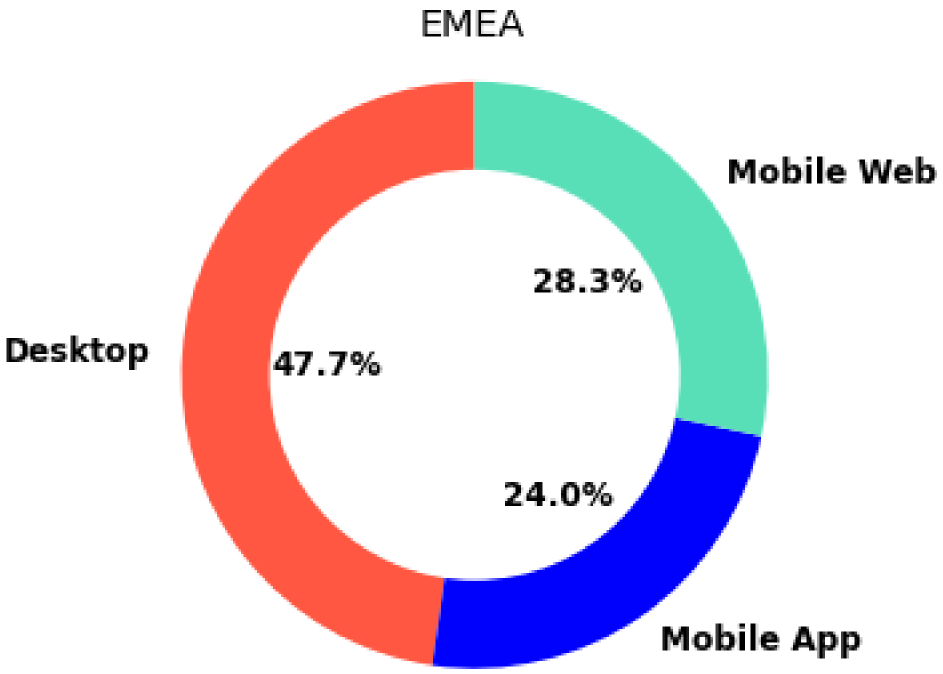
[ ]:

```
labels = ['Desktop', 'Mobile App', 'Mobile Web']
sizes = entire_data_2017_apac.groupby(by=["Platform Type Name"]).count()["Week"]
colors = ['#FF5741','#0000FD','#58DFB8']
plt.pie(sizes, colors = colors, labels=labels, autopct='%1.1f%%', pctdistance=0.5,startangle=90)
plt.title("APAC")

centre_circle = plt.Circle((0,0),0.70,fc='white')
fig = plt.gcf()
fig.gca().add_artist(centre_circle)

plt.axis('equal')
plt.tight_layout()
plt.show()
# plt.title("APAc")
```

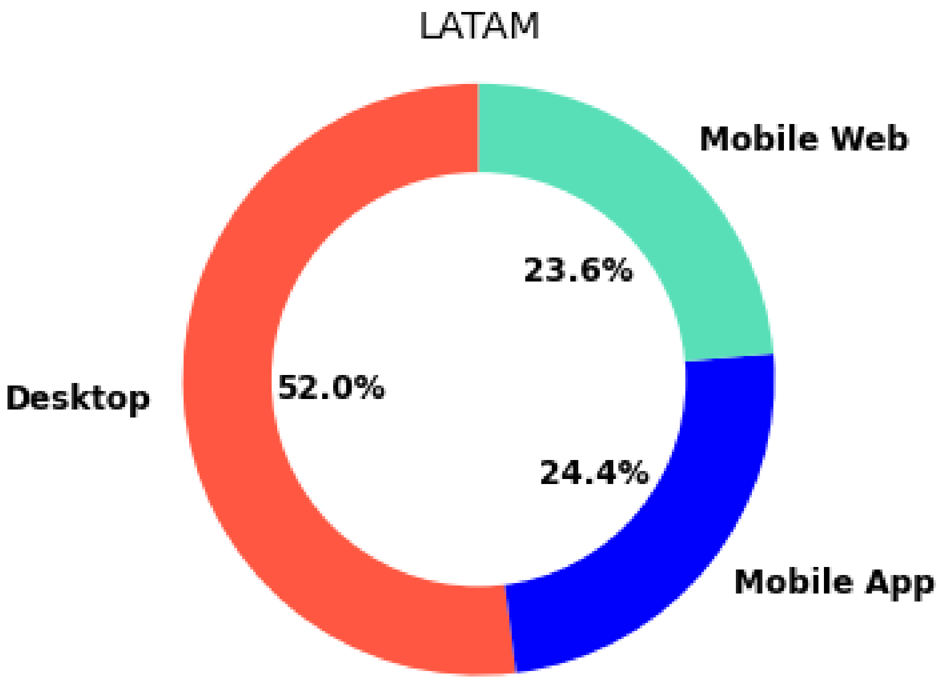


[ ]:

```
labels = ['Desktop', 'Mobile App', 'Mobile Web']
sizes = entire_data_2017_emea.groupby(by=["Platform Type Name"]).count()["Week"]
colors = ['#FF5741','#0000FD','#58DFB8']
plt.pie(sizes, colors = colors, labels=labels, autopct='%1.1f%%', pctdistance=0.
 ↪5,startangle=90)
plt.title("EMEA")

centre_circle = plt.Circle((0,0),0.70,fc='white')
fig = plt.gcf()
fig.gca().add_artist(centre_circle)

plt.axis('equal')
plt.tight_layout()
plt.show()
```

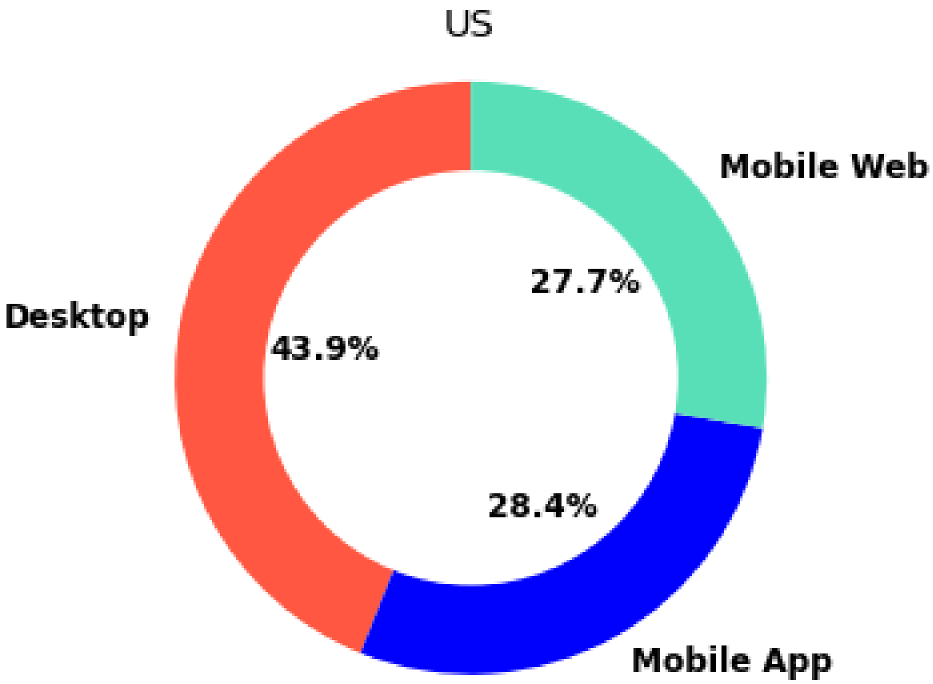


[ ]:
```
labels = ['Desktop', 'Mobile App', 'Mobile Web']
sizes = entire_data_2017_latam.groupby(by=["Platform Type Name"]).
 ↪count()["Week"]
colors = ['#FF5741','#0000FD','#58DFB8']
plt.pie(sizes, colors = colors, labels=labels, autopct='%1.1f%%', pctdistance=0.
 ↪5,startangle=90)
plt.title("LATAM")

centre_circle = plt.Circle((0,0),0.70,fc='white')
fig = plt.gcf()
fig.gca().add_artist(centre_circle)

plt.axis('equal')
plt.tight_layout()
plt.show()
```



[ ]:

```
labels = ['Desktop', 'Mobile App', 'Mobile Web']
sizes = entire_data_2017_us.groupby(by=["Platform Type Name"]).count()["Week"]
colors = ['#FF5741','#0000FD','#58DFB8']
plt.pie(sizes, colors = colors, labels=labels, autopct='%1.1f%%', pctdistance=0.5,startangle=90)
plt.title("US")

centre_circle = plt.Circle((0,0),0.70,fc='white')
fig = plt.gcf()
fig.gca().add_artist(centre_circle)

plt.axis('equal')
plt.tight_layout()
plt.show()
```



2.4 Any particular countries using particular platforms?

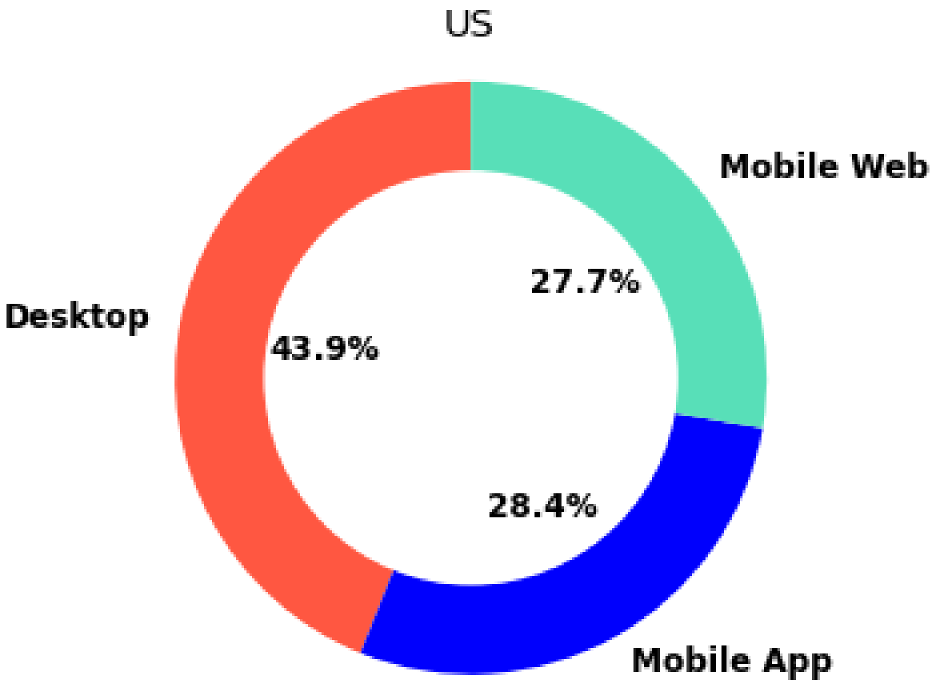
```
[ ]: entire_data.groupby(by=["Country Name"]).count()
```

```
[ ]:                 Week  Mobile Indicator Name  Platform Type Name  \
     Country Name
     Australia       6735                   6735                6735
     Brazil          5565                   5565                5565
     Hong Kong       6029                   6029                6029
     Norway          7986                   7986                7986
     South Korea     9038                   9038                9038
     US             18217                  18217               18217
     United Kingdom 13630                  13630               13630

                    Super Region  Booking Window Group  Property Country  \
     Country Name
     Australia              6735                  6735              6735
     Brazil                 5565                  5565              5565
     Hong Kong              6029                  6029              6029
     Norway                 7986                  7986              7986
     South Korea            9038                  9038              9038
     US                    18217                 18217             18217
     United Kingdom        13630                 13630             13630
```

```
                Net Gross Booking Value USD  Net Orders   Year
Country Name
Australia                              6735        6735   6735
Brazil                                 5565        5565   5565
Hong Kong                              6029        6029   6029
Norway                                 7986        7986   7986
South Korea                            9038        9038   9038
US                                    18217       18217  18217
United Kingdom                        13630       13630  13630
```

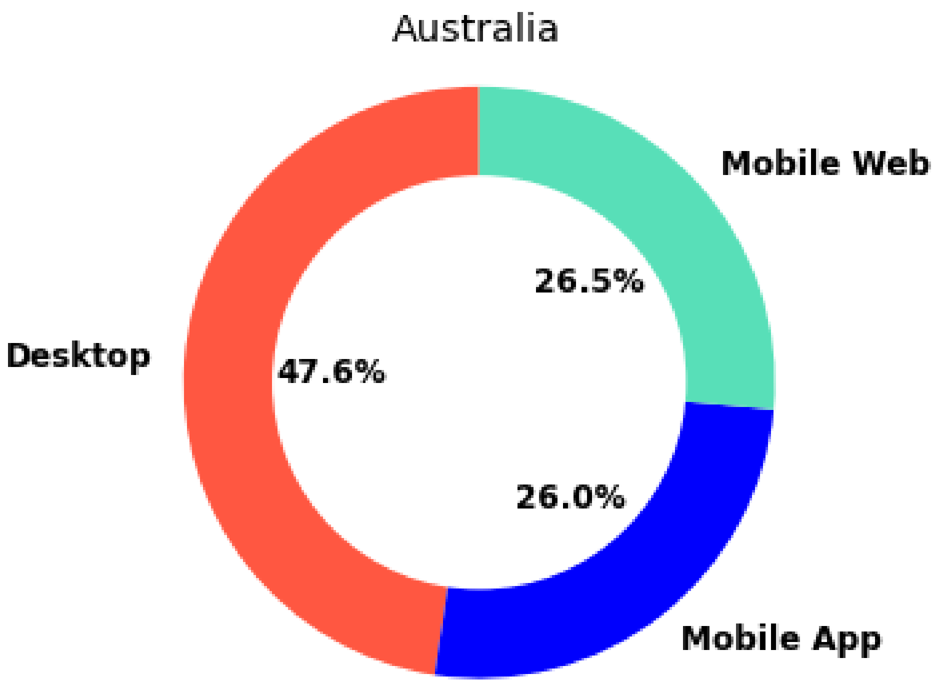
```
[ ]: entire_data_2017_australia = entire_data_2017[entire_data_2017["Country␣
      ↪Name"]=="Australia"]
     entire_data_2017_brazil = entire_data_2017[entire_data_2017["Country␣
      ↪Name"]=="Brazil"]
     entire_data_2017_hk = entire_data_2017[entire_data_2017["Country Name"]=="Hong␣
      ↪Kong"]
     entire_data_2017_norway = entire_data_2017[entire_data_2017["Country␣
      ↪Name"]=="Norway"]
     entire_data_2017_sk = entire_data_2017[entire_data_2017["Country Name"]=="South␣
      ↪Korea"]
     entire_data_2017_uk = entire_data_2017[entire_data_2017["Country␣
      ↪Name"]=="United Kingdom"]
```

```
[ ]: labels = ['Desktop', 'Mobile App', 'Mobile Web']
     sizes = entire_data_2017_us.groupby(by=["Platform Type Name"]).count()["Week"]
     colors = ['#FF5741','#0000FD','#58DFB8']
     plt.pie(sizes, colors = colors, labels=labels, autopct='%1.1f%%', pctdistance=0.
      ↪5,startangle=90)
     plt.title("US")

     centre_circle = plt.Circle((0,0),0.70,fc='white')
     fig = plt.gcf()
     fig.gca().add_artist(centre_circle)

     plt.axis('equal')
     plt.tight_layout()
     plt.show()
```



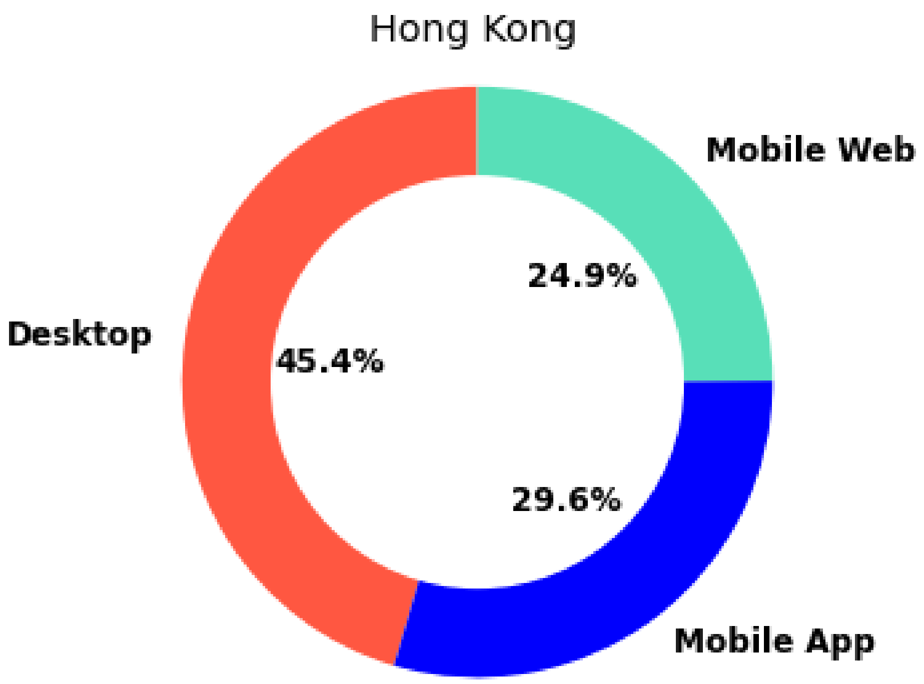
[ ]:

```
labels = ['Desktop', 'Mobile App', 'Mobile Web']
sizes = entire_data_2017_australia.groupby(by=["Platform Type Name"]).
 ↪count()["Week"]
colors = ['#FF5741','#0000FD','#58DFB8']
plt.pie(sizes, colors = colors, labels=labels, autopct='%1.1f%%', pctdistance=0.
 ↪5,startangle=90)
plt.title("Australia")

centre_circle = plt.Circle((0,0),0.70,fc='white')
fig = plt.gcf()
fig.gca().add_artist(centre_circle)

plt.axis('equal')
plt.tight_layout()
plt.show()
```



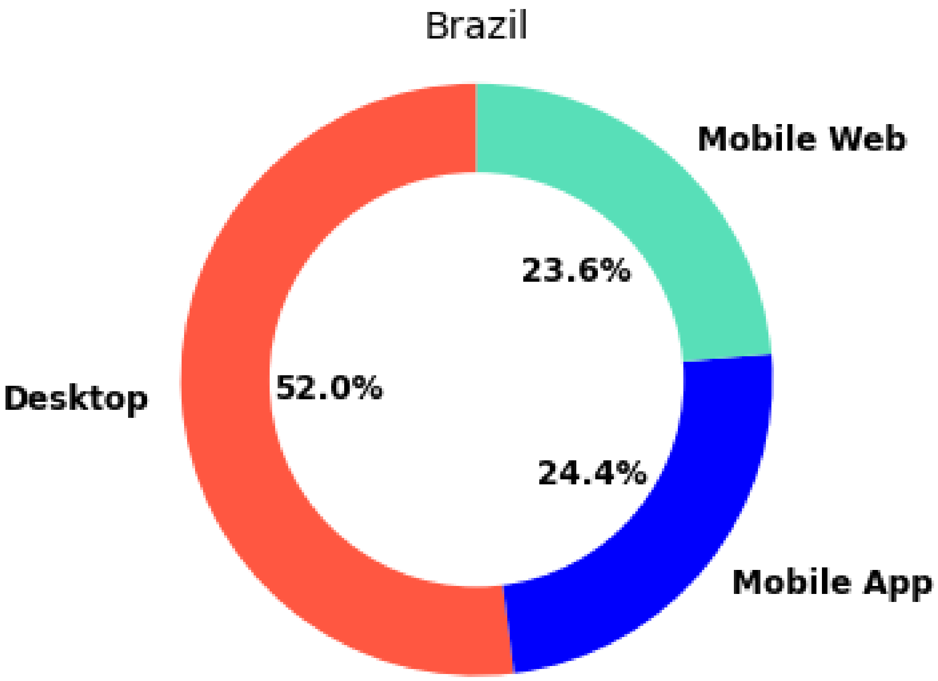
[ ]:

```
labels = ['Desktop', 'Mobile App', 'Mobile Web']
sizes = entire_data_2017_hk.groupby(by=["Platform Type Name"]).count()["Week"]
colors = ['#FF5741','#0000FD','#58DFB8']
plt.pie(sizes, colors = colors, labels=labels, autopct='%1.1f%%', pctdistance=0.5,startangle=90)
plt.title("Hong Kong")

centre_circle = plt.Circle((0,0),0.70,fc='white')
fig = plt.gcf()
fig.gca().add_artist(centre_circle)

plt.axis('equal')
plt.tight_layout()
plt.show()
```



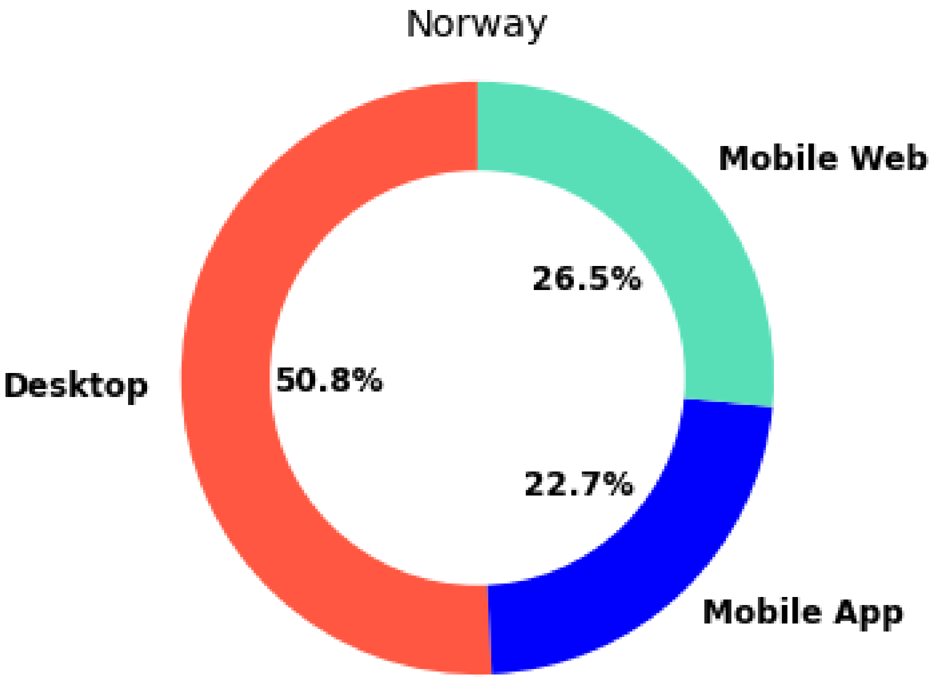
[ ]:

```
labels = ['Desktop', 'Mobile App', 'Mobile Web']
sizes = entire_data_2017_brazil.groupby(by=["Platform Type Name"]).
 ↪count()["Week"]
colors = ['#FF5741','#0000FD','#58DFB8']
explode = (0.1, 0, 0)
plt.pie(sizes, colors = colors, labels=labels, autopct='%1.1f%%', pctdistance=0.
 ↪5,startangle=90)
plt.title("Brazil")

centre_circle = plt.Circle((0,0),0.70,fc='white')
fig = plt.gcf()
fig.gca().add_artist(centre_circle)

plt.axis('equal')
plt.tight_layout()
plt.show()
```



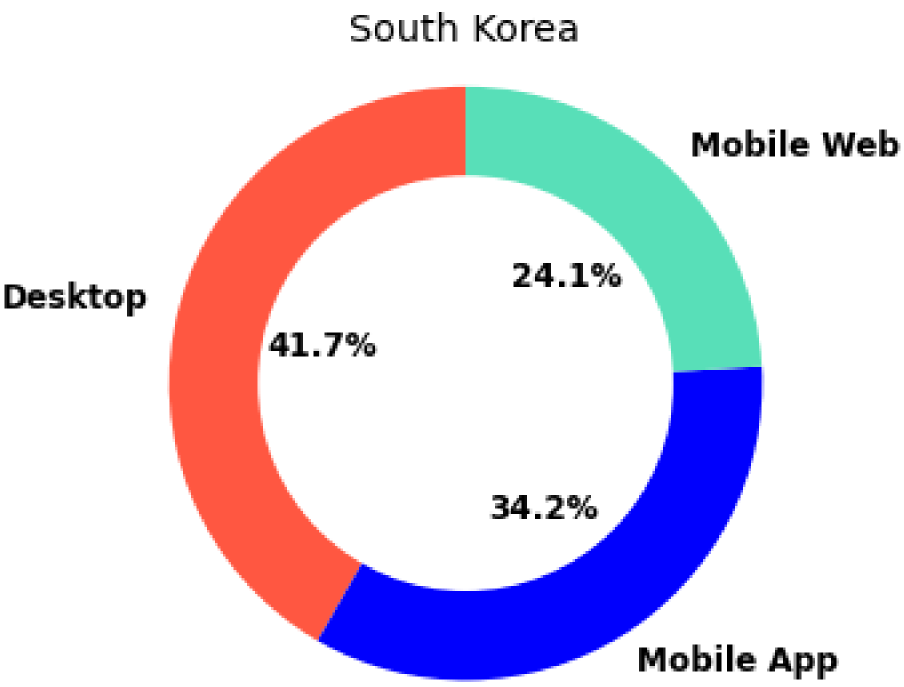
[ ]:

```
labels = ['Desktop', 'Mobile App', 'Mobile Web']
sizes = entire_data_2017_norway.groupby(by=["Platform Type Name"]).
 ↪count()["Week"]
colors = ['#FF5741','#0000FD','#58DFB8']
plt.pie(sizes, colors = colors, labels=labels, autopct='%1.1f%%', pctdistance=0.
 ↪5,startangle=90)
plt.title("Norway")

centre_circle = plt.Circle((0,0),0.70,fc='white')
fig = plt.gcf()
fig.gca().add_artist(centre_circle)

plt.axis('equal')
plt.tight_layout()
plt.show()
```

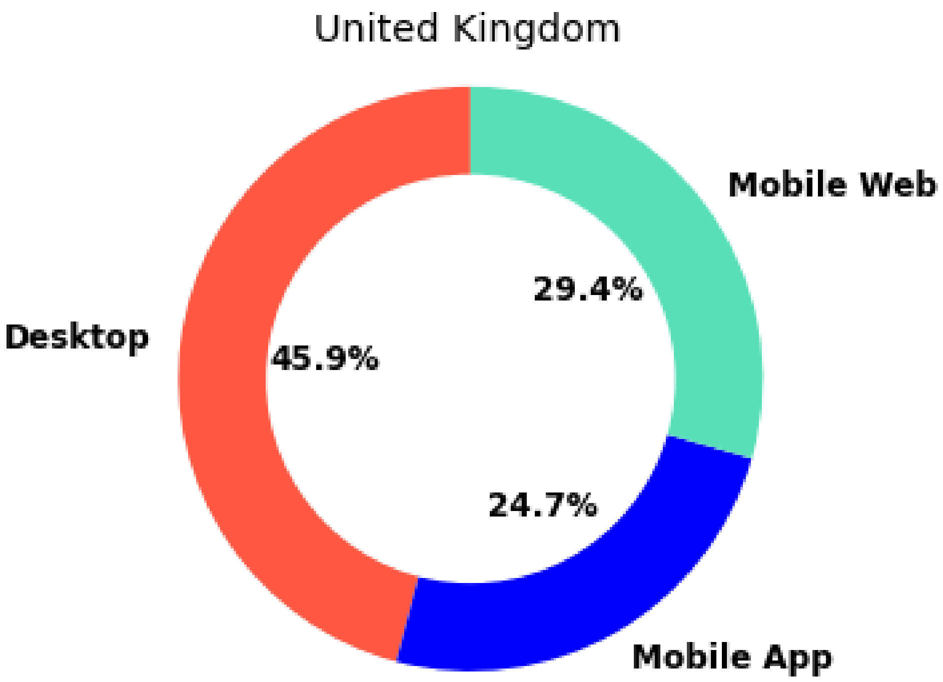


[ ]:

```
labels = ['Desktop', 'Mobile App', 'Mobile Web']
sizes = entire_data_2017_sk.groupby(by=["Platform Type Name"]).count()["Week"]
colors = ['#FF5741','#0000FD','#58DFB8']
plt.pie(sizes, colors = colors, labels=labels, autopct='%1.1f%%', pctdistance=0.
 ↪5,startangle=90)
plt.title("South Korea")

centre_circle = plt.Circle((0,0),0.70,fc='white')
fig = plt.gcf()
fig.gca().add_artist(centre_circle)

plt.axis('equal')
plt.tight_layout()
plt.show()
```



```
[ ]: labels = ['Desktop', 'Mobile App', 'Mobile Web']
     sizes = entire_data_2017_uk.groupby(by=["Platform Type Name"]).count()["Week"]
     colors = ['#FF5741','#0000FD','#58DFB8']
     plt.pie(sizes, colors = colors, labels=labels, autopct='%1.1f%%', pctdistance=0.
      ↪5,startangle=90)
     plt.title("United Kingdom")

     centre_circle = plt.Circle((0,0),0.70,fc='white')
     fig = plt.gcf()
     fig.gca().add_artist(centre_circle)

     plt.axis('equal')
     plt.tight_layout()
     plt.show()
```



2.5 Significant difference in booking windows? (will use both 2016 and 2017)

```
[ ]: # checking for na "Booking Window Group" values
     entire_data.groupby(by=["Booking Window Group"]).count()["Week"].sum() ==␣
      ↪len(entire_data)
```

```
[ ]: True
```

```
[ ]: len(desktop_data) + len(mobile_data) == len(entire_data)
```

```
[ ]: True
```

```
[ ]: # ignoring "post book"
     booking_window_labels = ["0-1 days", "2-3 days", "4-7 days", "8-14 days",␣
      ↪"15-30 days", "31-45 days", "46-60 days", "61-90 days", "+90 days"]
```

```
[ ]: desktop_data.groupby(by=["Booking Window Group"]).count()
```

```
[ ]:                       Week  Mobile Indicator Name  Platform Type Name  \
     Booking Window Group
     +90 days              3511                   3511                3511
     0-1 days              3446                   3446                3446
     15-30 days            4098                   4098                4098
```

```
2-3 days              3458                   3458                3458
31-45 days            3649                   3649                3649
4-7 days              3773                   3773                3773
46-60 days            3197                   3197                3197
61-90 days            3058                   3058                3058
8-14 days             3910                   3910                3910
Post Book               15                     15                  15

                      Super Region  Country Name  Property Country  \
Booking Window Group
+90 days                      3511          3511              3511
0-1 days                      3446          3446              3446
15-30 days                    4098          4098              4098
2-3 days                      3458          3458              3458
31-45 days                    3649          3649              3649
4-7 days                      3773          3773              3773
46-60 days                    3197          3197              3197
61-90 days                    3058          3058              3058
8-14 days                     3910          3910              3910
Post Book                       15            15                15

                      Net Gross Booking Value USD  Net Orders  Year
Booking Window Group
+90 days                                     3511        3511  3511
0-1 days                                     3446        3446  3446
15-30 days                                   4098        4098  4098
2-3 days                                     3458        3458  3458
31-45 days                                   3649        3649  3649
4-7 days                                     3773        3773  3773
46-60 days                                   3197        3197  3197
61-90 days                                   3058        3058  3058
8-14 days                                    3910        3910  3910
Post Book                                      15          15    15
```

[ ]:

```
desktop_booking_windows = [3446,3458,3773,3910,4098,3649,3197,3058,3511]
```

[ ]:

```
sum(desktop_booking_windows) == len(desktop_data) - 15
```

[ ]:

```
True
```

[ ]:

```

```

[ ]:

```
mobile_data.groupby(by=["Booking Window Group"]).count()
```

[ ]:

```
                      Week  Mobile Indicator Name  Platform Type Name  \
Booking Window Group
+90 days              3461                   3461                3461
```

```
0-1 days              5763                   5763                5763
15-30 days            4163                   4163                4163
2-3 days              4397                   4397                4397
31-45 days            3654                   3654                3654
4-7 days              4093                   4093                4093
46-60 days            2963                   2963                2963
61-90 days            2785                   2785                2785
8-14 days             3782                   3782                3782
Post Book               24                     24                  24

                      Super Region  Country Name  Property Country  \
Booking Window Group
+90 days                      3461          3461              3461
0-1 days                      5763          5763              5763
15-30 days                    4163          4163              4163
2-3 days                      4397          4397              4397
31-45 days                    3654          3654              3654
4-7 days                      4093          4093              4093
46-60 days                    2963          2963              2963
61-90 days                    2785          2785              2785
8-14 days                     3782          3782              3782
Post Book                       24            24                24

                      Net Gross Booking Value USD  Net Orders  Year
Booking Window Group
+90 days                                     3461        3461  3461
0-1 days                                     5763        5763  5763
15-30 days                                   4163        4163  4163
2-3 days                                     4397        4397  4397
31-45 days                                   3654        3654  3654
4-7 days                                     4093        4093  4093
46-60 days                                   2963        2963  2963
61-90 days                                   2785        2785  2785
8-14 days                                    3782        3782  3782
Post Book                                      24          24    24
```

```
[ ]: mobile_booking_windows = [5763,4397,4093,3782,4163,3654,2963,2785,3461]
```

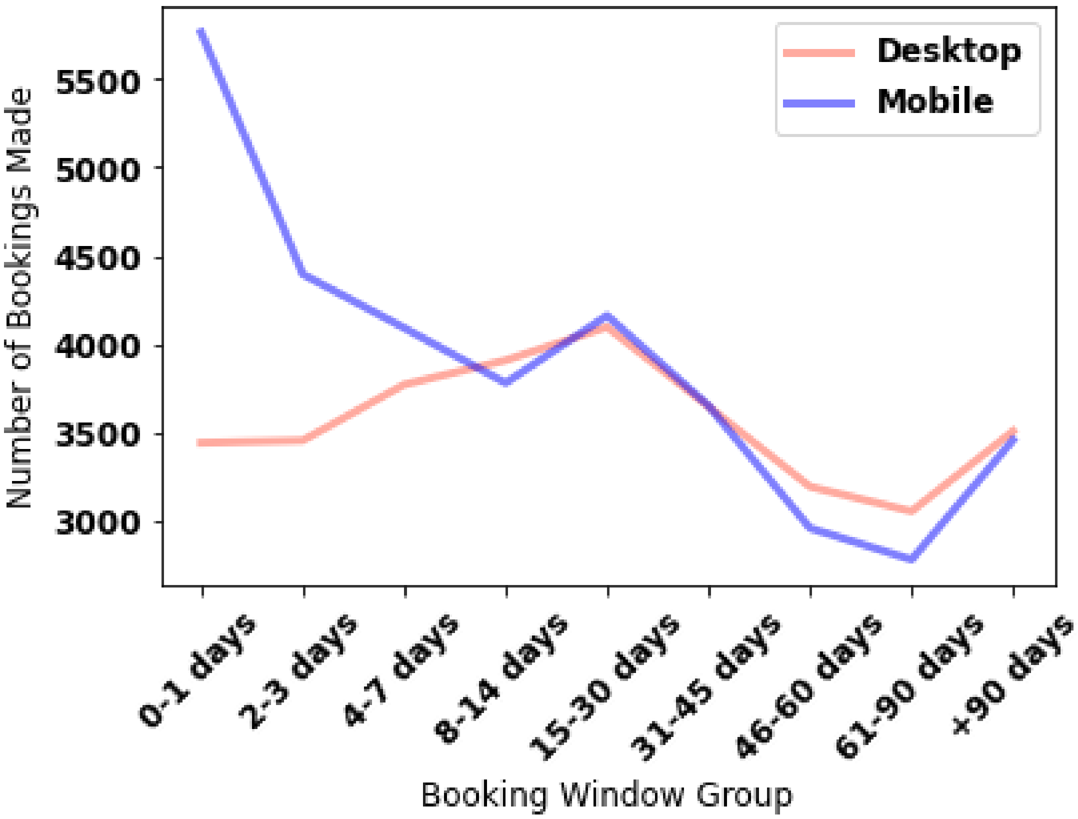
```
[ ]: sum(mobile_booking_windows) == len(mobile_data) - 24
```

```
[ ]: True
```

```
[ ]: rc('font', weight='bold')
     plt.plot(booking_window_labels, desktop_booking_windows, alpha=0.5,␣
      ↪label='Desktop', color='#FF5741', linewidth=3)
     plt.plot(booking_window_labels, mobile_booking_windows, alpha=0.5,␣
      ↪label='Mobile', color='#0000FD', linewidth=3)
```

```
plt.legend()
plt.xlabel("Booking Window Group")
plt.ylabel("Number of Bookings Made")
# plt.gca().yaxis.set_major_formatter(PercentFormatter(1))
# plt.title("Histogram of Correlation Coefficients of Variance of \n the Heart␣
 ↪Rates of Instances in Cohort 1 and Cohort 2")
plt.xticks(rotation = 45)
```

```
[ ]: ([0, 1, 2, 3, 4, 5, 6, 7, 8],
      [Text(0, 0, ''),
       Text(0, 0, ''),
       Text(0, 0, ''),
       Text(0, 0, ''),
       Text(0, 0, ''),
       Text(0, 0, ''),
       Text(0, 0, ''),
       Text(0, 0, ''),
       Text(0, 0, '')])
```



```
[ ]: mannwhitneyu(desktop_booking_windows, mobile_booking_windows)
[ ]: MannwhitneyuResult(statistic=29.0, pvalue=0.331387096247615)
```

```
[ ]: sum(desktop_booking_windows)
```

```
[ ]: 32100
```

```
[ ]: sum(mobile_booking_windows)
```

```
[ ]: 35061
```

2.6 Differences in average booking value?

First will create a column of “Net Gross Booking Value USD”/“Net Orders” to obtain average price paid per traveller:

```
[ ]: desktop_data_not_cancelled = desktop_data[desktop_data["Net Orders"]>0]
     mobile_data_not_cancelled = mobile_data[mobile_data["Net Orders"]>0]
```

```
[ ]: desktop_data_not_cancelled["Booking Value Per Person"] =␣
      ↪desktop_data_not_cancelled["Net Gross Booking Value USD"]/
      ↪desktop_data_not_cancelled["Net Orders"]
     mobile_data_not_cancelled["Booking Value Per Person"] =␣
      ↪mobile_data_not_cancelled["Net Gross Booking Value USD"]/
      ↪mobile_data_not_cancelled["Net Orders"]
```

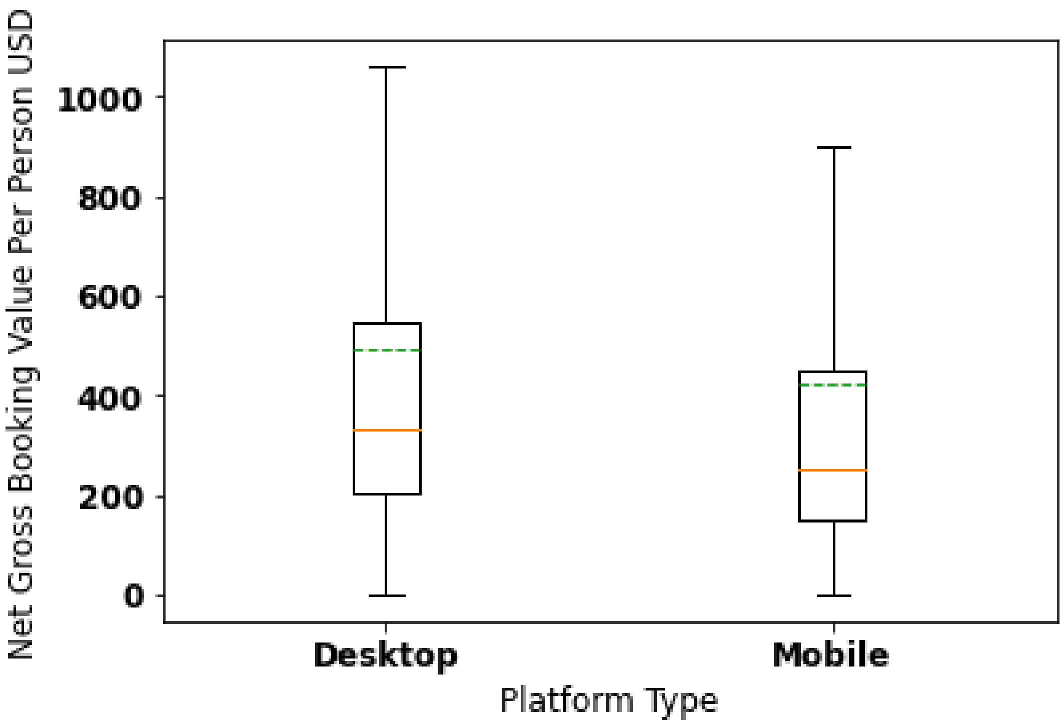
```
/var/folders/kc/f1zxp47n4qq72801tc5mdhtw0000gn/T/ipykernel_42742/3449700816.py:1
: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  desktop_data_not_cancelled["Booking Value Per Person"] =
desktop_data_not_cancelled["Net Gross Booking Value
USD"]/desktop_data_not_cancelled["Net Orders"]
/var/folders/kc/f1zxp47n4qq72801tc5mdhtw0000gn/T/ipykernel_42742/3449700816.py:2
: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  mobile_data_not_cancelled["Booking Value Per Person"] =
mobile_data_not_cancelled["Net Gross Booking Value
USD"]/mobile_data_not_cancelled["Net Orders"]
```

[ ]:

```
plt.boxplot([desktop_data_not_cancelled["Booking Value Per Person"],␣
 ↪mobile_data_not_cancelled["Booking Value Per Person"]], showfliers=False,␣
 ↪meanline=True, showmeans=True)
plt.xticks([1, 2], ["Desktop", "Mobile"])
# plt.legend()
# plt.boxplot(mobile_data_not_cancelled["Booking Value Per Person"])
plt.xlabel("Platform Type")
plt.ylabel("Net Gross Booking Value Per Person USD")
```

[ ]:

```
Text(0, 0.5, 'Net Gross Booking Value Per Person USD')
```

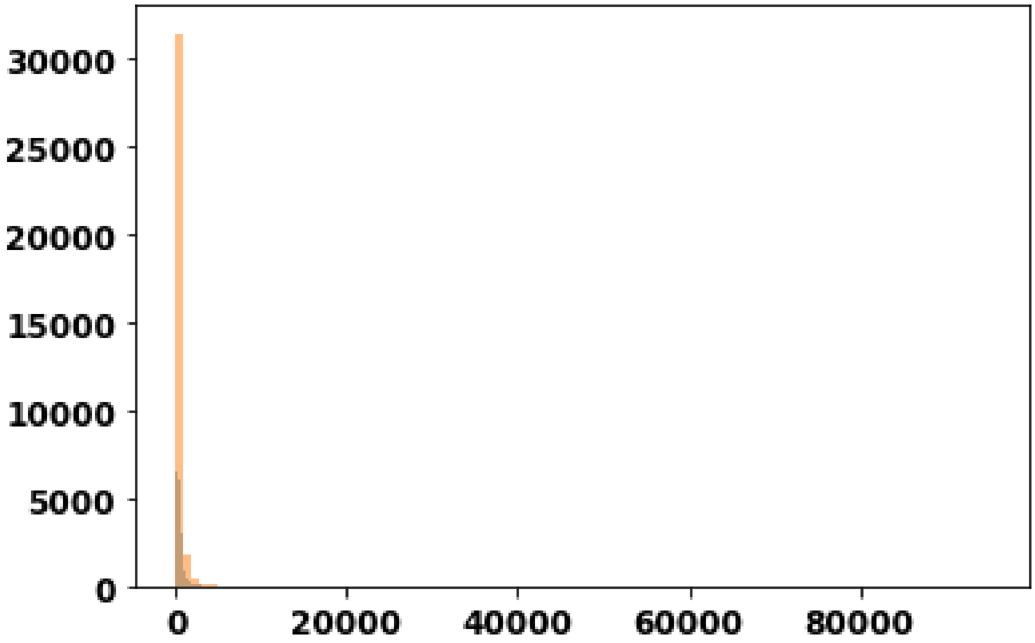


[ ]:

```
plt.hist(desktop_data_not_cancelled["Booking Value Per Person"], bins=100,␣
 ↪alpha=0.5)
plt.hist(mobile_data_not_cancelled["Booking Value Per Person"], bins=100,␣
 ↪alpha=0.5)
```

[ ]:

```
(array([3.1389e+04, 1.7550e+03, 3.7200e+02, 1.4400e+02, 5.4000e+01,
        3.1000e+01, 1.7000e+01, 7.0000e+00, 9.0000e+00, 8.0000e+00,
        3.0000e+00, 3.0000e+00, 3.0000e+00, 0.0000e+00, 0.0000e+00,
        0.0000e+00, 0.0000e+00, 0.0000e+00, 0.0000e+00, 0.0000e+00,
        0.0000e+00, 1.0000e+00, 2.0000e+00, 0.0000e+00, 0.0000e+00,
        1.0000e+00, 0.0000e+00, 0.0000e+00, 0.0000e+00, 1.0000e+00,
        1.0000e+00, 1.0000e+00, 0.0000e+00, 0.0000e+00, 0.0000e+00,
        2.0000e+00, 0.0000e+00, 0.0000e+00, 0.0000e+00, 2.0000e+00,
        1.0000e+00, 0.0000e+00, 0.0000e+00, 0.0000e+00, 1.0000e+00,
        2.0000e+00, 0.0000e+00, 0.0000e+00, 1.0000e+00, 0.0000e+00,
        1.0000e+00, 0.0000e+00, 0.0000e+00, 0.0000e+00, 0.0000e+00,
        0.0000e+00, 1.0000e+00, 0.0000e+00, 0.0000e+00, 0.0000e+00,
        0.0000e+00, 0.0000e+00, 0.0000e+00, 2.0000e+00, 0.0000e+00,
        0.0000e+00, 0.0000e+00, 0.0000e+00, 0.0000e+00, 0.0000e+00,
        0.0000e+00, 0.0000e+00, 0.0000e+00, 0.0000e+00, 0.0000e+00,
        0.0000e+00, 0.0000e+00, 0.0000e+00, 0.0000e+00, 0.0000e+00,
        0.0000e+00, 0.0000e+00, 0.0000e+00, 0.0000e+00, 0.0000e+00,
        0.0000e+00, 0.0000e+00, 0.0000e+00, 0.0000e+00, 0.0000e+00,
        0.0000e+00, 0.0000e+00, 0.0000e+00, 0.0000e+00, 0.0000e+00,
        0.0000e+00, 0.0000e+00, 0.0000e+00, 0.0000e+00, 1.0000e+00]),
 array([    0.      ,   949.800515,  1899.60103 ,  2849.401545,
         3799.20206 ,  4749.002575,  5698.80309 ,  6648.603605,
         7598.40412 ,  8548.204635,  9498.00515 , 10447.805665,
        11397.60618 , 12347.406695, 13297.20721 , 14247.007725,
        15196.80824 , 16146.608755, 17096.40927 , 18046.209785,
        18996.0103  , 19945.810815, 20895.61133 , 21845.411845,
        22795.21236 , 23745.012875, 24694.81339 , 25644.613905,
        26594.41442 , 27544.214935, 28494.01545 , 29443.815965,
        30393.61648 , 31343.416995, 32293.21751 , 33243.018025,
        34192.81854 , 35142.619055, 36092.41957 , 37042.220085,
        37992.0206  , 38941.821115, 39891.62163 , 40841.422145,
        41791.22266 , 42741.023175, 43690.82369 , 44640.624205,
        45590.42472 , 46540.225235, 47490.02575 , 48439.826265,
        49389.62678 , 50339.427295, 51289.22781 , 52239.028325,
        53188.82884 , 54138.629355, 55088.42987 , 56038.230385,
        56988.0309  , 57937.831415, 58887.63193 , 59837.432445,
        60787.23296 , 61737.033475, 62686.83399 , 63636.634505,
        64586.43502 , 65536.235535, 66486.03605 , 67435.836565,
        68385.63708 , 69335.437595, 70285.23811 , 71235.038625,
        72184.83914 , 73134.639655, 74084.44017 , 75034.240685,
        75984.0412  , 76933.841715, 77883.64223 , 78833.442745,
        79783.24326 , 80733.043775, 81682.84429 , 82632.644805,
        83582.44532 , 84532.245835, 85482.04635 , 86431.846865,
        87381.64738 , 88331.447895, 89281.24841 , 90231.048925,
        91180.84944 , 92130.649955, 93080.45047 , 94030.250985,
        94980.0515  ]),
 <BarContainer object of 100 artists>)
```



```
[ ]: ttest_ind(desktop_data_not_cancelled["Booking Value Per Person"],␣
      ↪mobile_data_not_cancelled["Booking Value Per Person"], equal_var=False)
```

```
[ ]: Ttest_indResult(statistic=9.494603755536438, pvalue=2.298665624263459e-21)
```

```
[ ]: print(len(mobile_data_not_cancelled), len(desktop_data_not_cancelled))
```

```
33816 31075
```

Now testing without the outliers

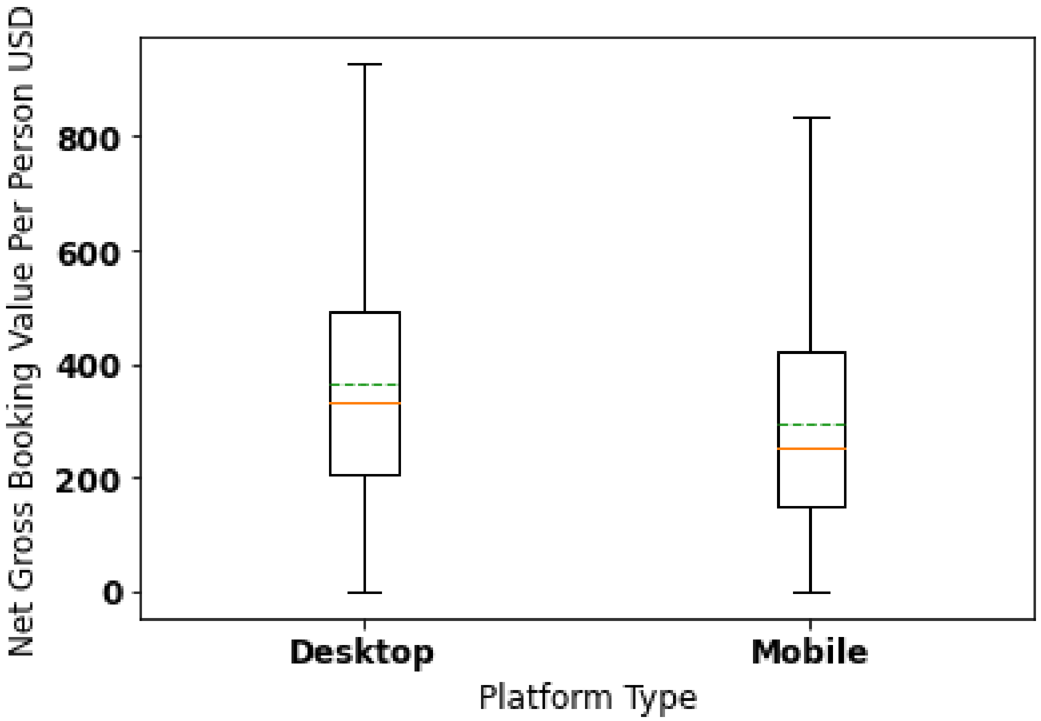
```
[ ]: desktop_data_not_cancelled_no_outliers =␣
      ↪list(desktop_data_not_cancelled["Booking Value Per Person"])
     mu = np.mean(desktop_data_not_cancelled_no_outliers)
     q3, q1 = np.percentile(desktop_data_not_cancelled_no_outliers, [75 ,25])
     iqr = q3 - q1
     desktop_outliers = []
     for i, x in enumerate(desktop_data_not_cancelled_no_outliers):
         if abs(x-mu) > 1.5*iqr:
             desktop_outliers.append(x)
             desktop_data_not_cancelled_no_outliers[i] = mu
```

```
[ ]: mobile_data_not_cancelled_no_outliers = list(mobile_data_not_cancelled["Booking␣
      ↪Value Per Person"])
     mu = np.mean(mobile_data_not_cancelled_no_outliers)
     q3, q1 = np.percentile(mobile_data_not_cancelled_no_outliers, [75 ,25])
```

```
iqr = q3 - q1
mobile_outliers = []
for i, x in enumerate(mobile_data_not_cancelled_no_outliers):
    if abs(x-mu) > 1.5*iqr:
        mobile_outliers.append(x)
        mobile_data_not_cancelled_no_outliers[i] = mu
```

```
[ ]: plt.boxplot([desktop_data_not_cancelled_no_outliers,␣
      ↪mobile_data_not_cancelled_no_outliers], showfliers=False, meanline=True,␣
      ↪showmeans=True)
     plt.xticks([1, 2], ["Desktop", "Mobile"])
     # plt.legend()
     # plt.boxplot(mobile_data_not_cancelled["Booking Value Per Person"])
     plt.xlabel("Platform Type")
     plt.ylabel("Net Gross Booking Value Per Person USD")
```

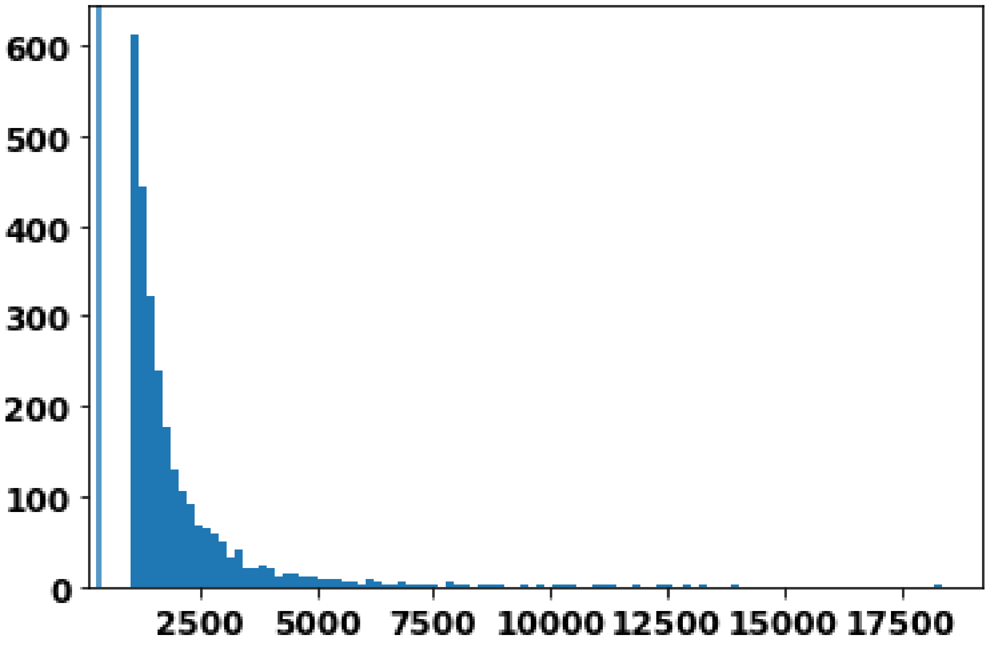
```
[ ]: Text(0, 0.5, 'Net Gross Booking Value Per Person USD')
```



```
[ ]: ttest_ind(desktop_data_not_cancelled_no_outliers,␣
      ↪mobile_data_not_cancelled_no_outliers, equal_var=False)
```

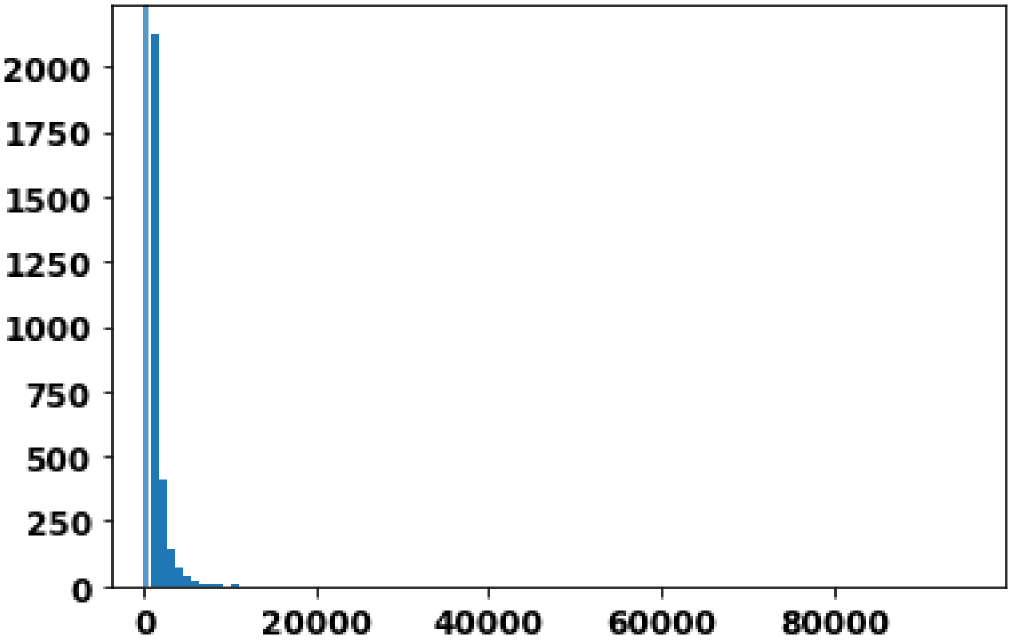
```
[ ]: Ttest_indResult(statistic=45.74706962831257, pvalue=0.0)
[ ]: plt.hist(desktop_outliers, bins=100)
     plt.axvline(np.mean(desktop_data_not_cancelled_no_outliers))
```

```
[ ]: <matplotlib.lines.Line2D at 0x7ffd491f9970>
```



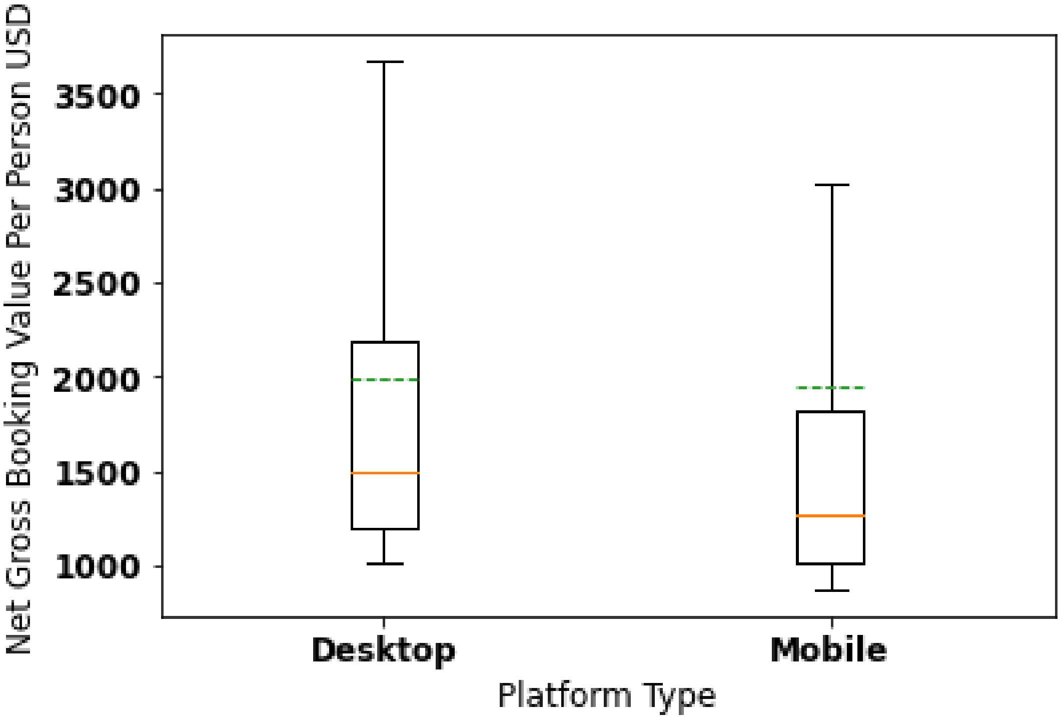
```
[ ]: plt.hist(mobile_outliers, bins=100)
     plt.axvline(np.mean(mobile_data_not_cancelled_no_outliers))
```

```
[ ]: <matplotlib.lines.Line2D at 0x7ffd42b3b0a0>
```



```
[ ]: plt.boxplot([desktop_outliers, mobile_outliers], showfliers=False,␣
      ↪meanline=True, showmeans=True)
     plt.xticks([1, 2], ["Desktop", "Mobile"])
     # plt.legend()
     # plt.boxplot(mobile_data_not_cancelled["Booking Value Per Person"])
     plt.xlabel("Platform Type")
     plt.ylabel("Net Gross Booking Value Per Person USD")
```

```
[ ]: Text(0, 0.5, 'Net Gross Booking Value Per Person USD')
```



2.7 Travelling within same country?

2.7.1 Data Quality Issue

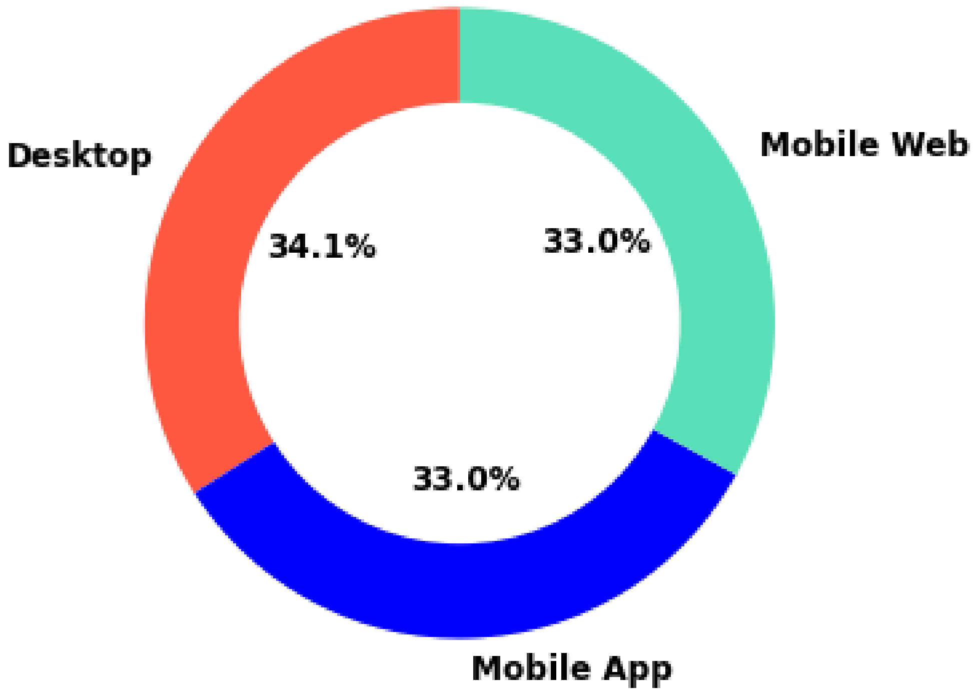
“Property Country” uses United States of America and United Kingdom whereas “Country Name” uses US and UK

```
[ ]: entire_data.replace(to_replace="United States of America", value="US",␣
     ↪inplace=True)
     entire_data.replace(to_replace="United Kingdom", value="UK", inplace=True)
```

```
[ ]: same_country = entire_data[entire_data["Country Name"] == entire_data["Property␣
     ↪Country"]]
```

```
[ ]: labels = ['Desktop', 'Mobile App', 'Mobile Web']
     sizes = same_country.groupby(by=["Platform Type Name"]).count()["Week"]
     colors = ['#FF5741','#0000FD','#58DFB8']
     plt.pie(sizes, colors = colors, labels=labels, autopct='%1.1f%%', pctdistance=0.
     ↪5,startangle=90)
     # plt.title("Norway")

     centre_circle = plt.Circle((0,0),0.70,fc='white')
     fig = plt.gcf()
     fig.gca().add_artist(centre_circle)
```

```
plt.axis('equal')
plt.tight_layout()
plt.show()
```



[ ]:
```
same_country.groupby(by=["Super Region"]).count()
```

[ ]:
```
              Week  Mobile Indicator Name  Platform Type Name  Country Name  \
Super Region
APAC           598                    598                 598           598
EMEA           427                    427                 427           427
LATAM          214                    214                 214           214
US             238                    238                 238           238

              Booking Window Group  Property Country  \
Super Region
APAC                           598               598
EMEA                           427               427
LATAM                          214               214
US                             238               238

              Net Gross Booking Value USD  Net Orders  Year
Super Region
```

```
APAC                                  598         598   598
EMEA                                  427         427   427
LATAM                                 214         214   214
US                                    238         238   238
```

2.7.2 Differences in net orders? (number of people being booked for)

```
[ ]: desktop_data.groupby(by=["Net Orders"]).count()
```

```
[ ]:            Week  Mobile Indicator Name  Platform Type Name  Super Region  \
     Net Orders
     0           1040                   1040                1040          1040
     1           7831                   7831                7831          7831
     2           3684                   3684                3684          3684
     3           2535                   2535                2535          2535
     4           1791                   1791                1791          1791
     …          …                    …                 …           …
     59226          1                      1                   1             1
     61181          1                      1                   1             1
     61232          1                      1                   1             1
     62494          1                      1                   1             1
     63230          1                      1                   1             1

                 Country Name  Booking Window Group  Property Country  \
     Net Orders
     0                   1040                  1040              1040
     1                   7831                  7831              7831
     2                   3684                  3684              3684
     3                   2535                  2535              2535
     4                   1791                  1791              1791
     …                  …                     …             …
     59226                  1                     1                 1
     61181                  1                     1                 1
     61232                  1                     1                 1
     62494                  1                     1                 1
     63230                  1                     1                 1

                 Net Gross Booking Value USD  Year
     Net Orders
     0                                  1040  1040
     1                                  7831  7831
     2                                  3684  3684
     3                                  2535  2535
     4                                  1791  1791
     …                                 …   …
     59226                                 1     1
     61181                                 1     1
```

```
61232                                        1      1
62494                                        1      1
63230                                        1      1

[639 rows x 9 columns]
```

2.7.3 Data Quality Issue

Some anomalous net order values of 10s of thousands

Will remove any instance with a net order size greater than 300

```
[ ]: desktop_data_net = desktop_data[desktop_data["Net Orders"] < 10]
     mobile_data_net = mobile_data[mobile_data["Net Orders"] < 10]

     desktop_data_net = desktop_data_net[desktop_data_net["Net Orders"] > 0]
     mobile_data_net = mobile_data_net[mobile_data_net["Net Orders"] > 0]
```

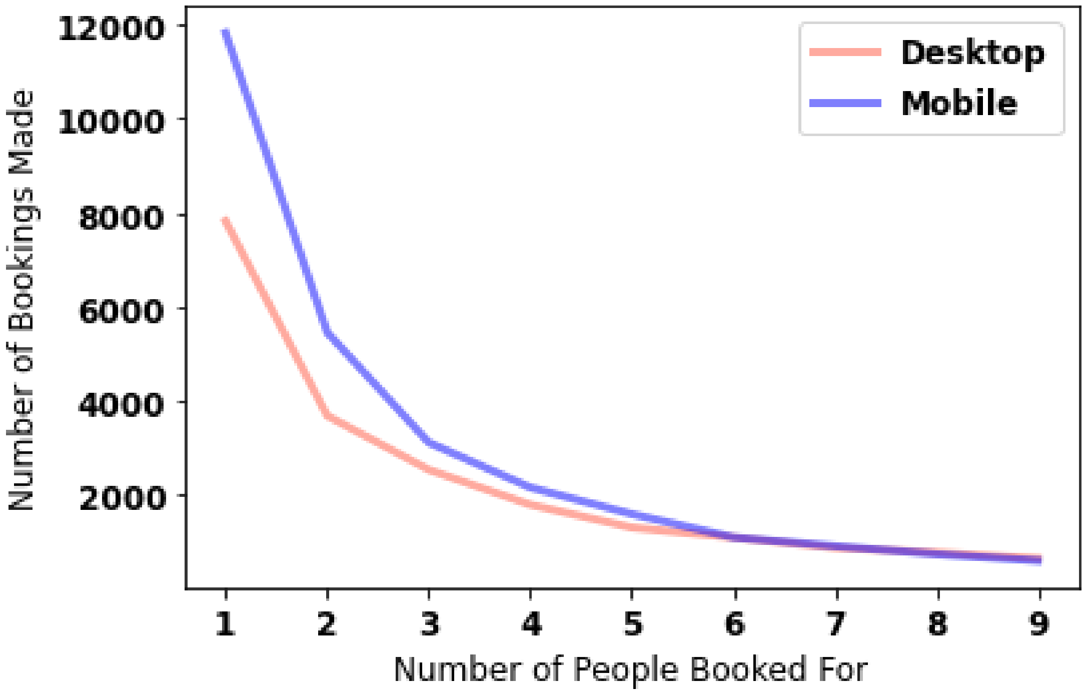
```
[ ]: desktop_data_net_large = desktop_data[desktop_data["Net Orders"] > 9]
     mobile_data_net_large = mobile_data[mobile_data["Net Orders"] > 9]

     desktop_data_net_large = desktop_data_net_large[desktop_data_net_large["Net␣
      ↪Orders"] < 100]
     mobile_data_net_large = mobile_data_net_large[mobile_data_net_large["Net␣
      ↪Orders"] < 100]
```

```
[ ]: desktop_data_net.groupby(by=["Net Orders"]).count()["Week"]
```

```
[ ]: Net Orders
     1    7831
     2    3684
     3    2535
     4    1791
     5    1306
     6    1097
     7     879
     8     775
     9     652
     Name: Week, dtype: int64
```

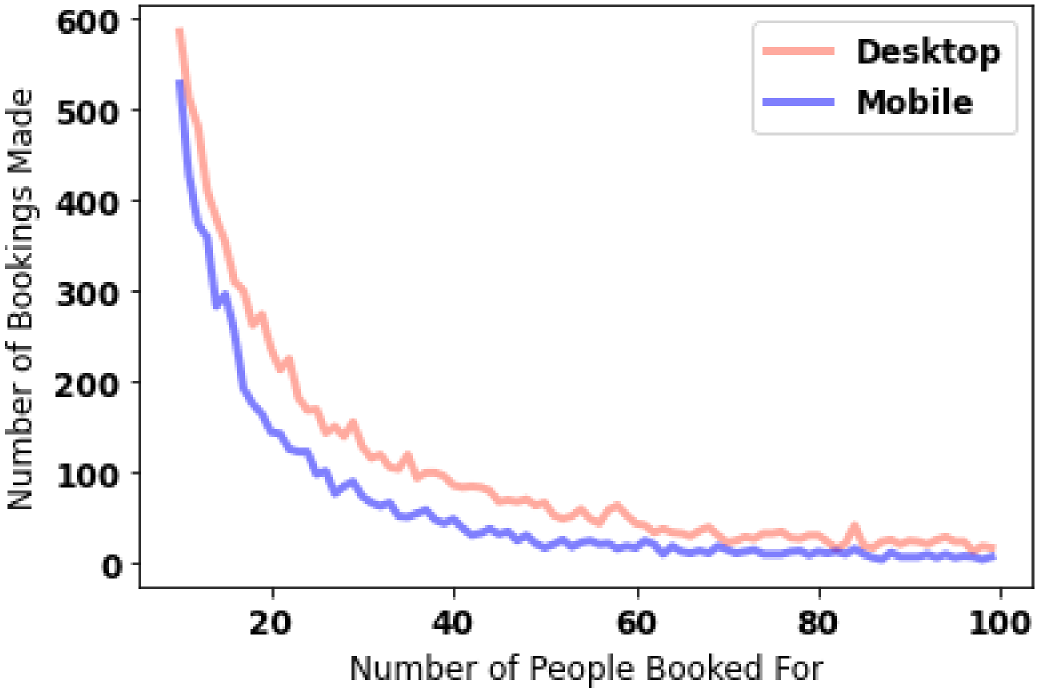
```
[ ]: rc('font', weight='bold')
     plt.plot(desktop_data_net.groupby(by=["Net Orders"]).count()["Week"], alpha=0.
      ↪5, label='Desktop', color='#FF5741', linewidth=3)
     plt.plot(mobile_data_net.groupby(by=["Net Orders"]).count()["Week"], alpha=0.5,␣
      ↪label='Mobile', color='#0000FD', linewidth=3)
     plt.legend()
     plt.xlabel("Number of People Booked For")
     plt.ylabel("Number of Bookings Made")
     # plt.gca().yaxis.set_major_formatter(PercentFormatter(1))
     # plt.title("Histogram of Correlation Coefficients of Variance of \n the Heart␣
      ↪Rates of Instances in Cohort 1 and Cohort 2")
     # plt.xticks(rotation = 45)
```

[ ]:
```
Text(0, 0.5, 'Number of Bookings Made')
```



[ ]:
```
rc('font', weight='bold')
plt.plot(desktop_data_net_large.groupby(by=["Net Orders"]).count()["Week"],␣
↪alpha=0.5, label='Desktop', color='#FF5741', linewidth=3)
plt.plot(mobile_data_net_large.groupby(by=["Net Orders"]).count()["Week"],␣
↪alpha=0.5, label='Mobile', color='#0000FD', linewidth=3)
plt.legend()
plt.xlabel("Number of People Booked For")
plt.ylabel("Number of Bookings Made")
# plt.gca().yaxis.set_major_formatter(PercentFormatter(1))
# plt.title("Histogram of Correlation Coefficients of Variance of \n the Heart␣
↪Rates of Instances in Cohort 1 and Cohort 2")
# plt.xticks(rotation = 45)
```

[ ]:
```
Text(0, 0.5, 'Number of Bookings Made')
```



[ ]:

[ ]:

[ ]:

```
with pd.ExcelWriter('separated_data.xlsx') as writer:
    desktop_data.to_excel(writer, sheet_name='desktop')
    mobile_data.to_excel(writer, sheet_name='mobile')
    mobile_web_data.to_excel(writer, sheet_name='mobile_web')
    mobile_app_data.to_excel(writer, sheet_name='mobile_app')
```

[ ]: