In [4]:

```
from google.colab import drive
drive.mount('/content/drive')
```

```
Mounted at /content/drive
```

In [ ]:

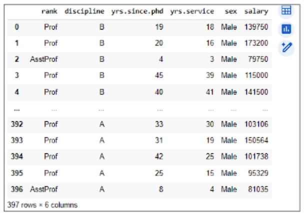
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
```

#Question 1

(3 points) This problem will use the Salaries dataset (review your own answers of the problem 8 of homework 1). The data has six variables, gender, title, years of services, years after Ph.D., and fields.

a. Use the mantra and Tableau to present an overview of the dataset with all six variables present on the same graph.

b. Then plot a boxplot to compare the salaries of faculty based on rank and gender



	rank	discipline	yrs.since.phd	yrs.service	sex	salary
0	Prof	B	19	18	Male	139750
1	Prof	B	20	16	Male	173200
2	AsstProf	B	4	3	Male	79750
3	Prof	B	45	39	Male	115000
4	Prof	B	40	41	Male	141500
...	...	...	...	...	...	...
392	Prof	A	33	30	Male	103106
393	Prof	A	31	19	Male	150564
394	Prof	A	42	25	Male	101738
395	Prof	A	25	15	Male	95329
396	AsstProf	A	8	4	Male	81035

397 rows × 6 columns

In [ ]:

```
#Answer 1
df = pd.read_csv('/content/drive/MyDrive/Colab Notebooks/M.S. Courses/DS 544 Data Viz/Datasets/Salaries.csv')
print(df.head())
```

```
       rank discipline  yrs.since.phd  yrs.service   sex  salary
0      Prof          B             19           18  Male  139750
1      Prof          B             20           16  Male  173200
2  AsstProf          B              4            3  Male   79750
3      Prof          B             45           39  Male  115000
4      Prof          B             40           41  Male  141500
```

In [ ]:

```
df.head()
```

Out[6]:

	rank	discipline	yrs.since.phd	yrs.service	sex	salary
0	Prof	B	19	18	Male	139750
1	Prof	B	20	16	Male	173200
2	AsstProf	B	4	3	Male	79750
3	Prof	B	45	39	Male	115000
4	Prof	B	40	41	Male	141500

In [ ]:

```
print('Mean:',df.groupby('rank').mean(numeric_only=True))
print('Median:', df.groupby('rank').median(numeric_only=True))
```

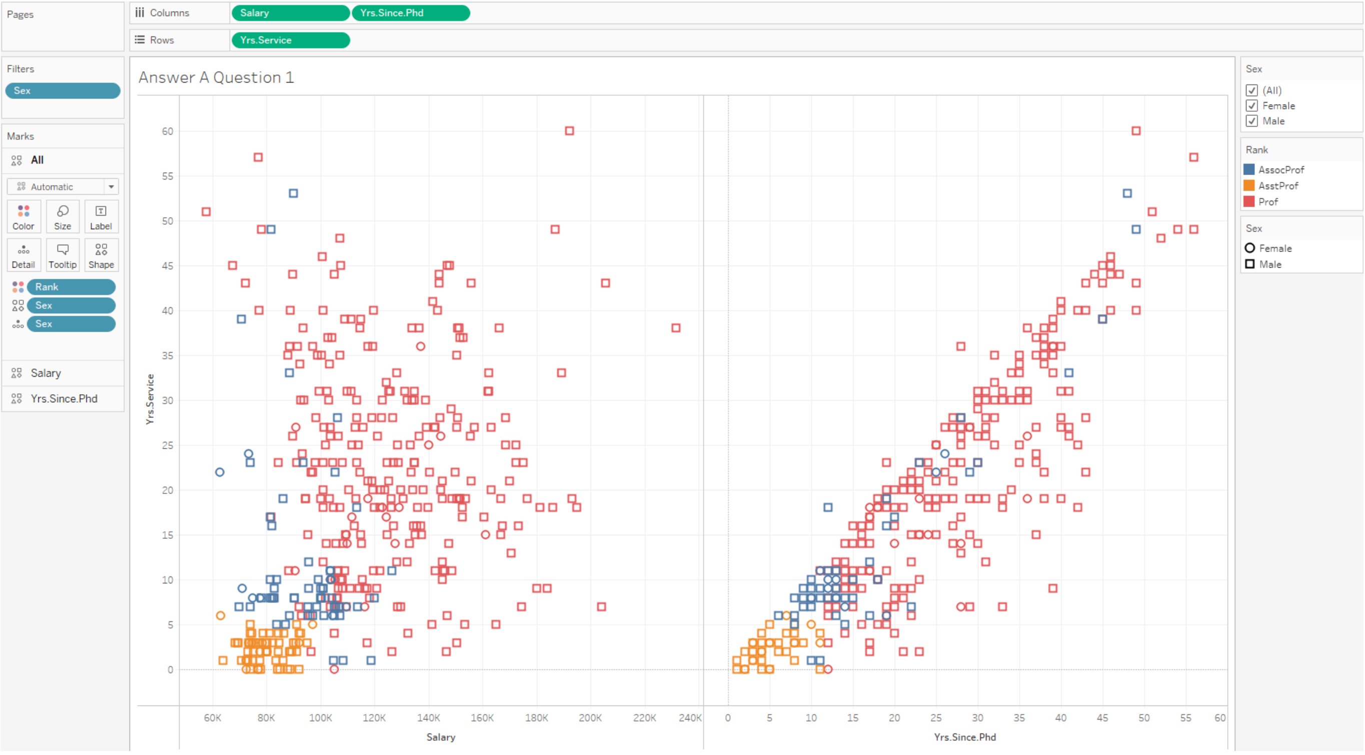
```
Mean:            yrs.since.phd  yrs.service         salary
rank
AssocProf      15.453125    11.953125   93876.437500
AsstProf        5.104478     2.373134   80775.985075
Prof           28.300752    22.815789  126772.109023
Median:            yrs.since.phd  yrs.service    salary
rank
AssocProf           12.0          8.0   95626.5
AsstProf             4.0          3.0   79800.0
Prof                28.0         21.0  123321.5
```

In [ ]:

```
# Filter for professors only
professors = df[df['rank'] == 'Prof']

# Group by sex and calculate the mean and median salary
print('Mean:', professors.groupby('sex').mean(numeric_only=True))
print('Median:', professors.groupby('sex').median(numeric_only=True))
```

```
Mean:         yrs.since.phd  yrs.service         salary
sex
Female      23.722222    17.111111  121967.611111
Male        28.633065    23.229839  127120.822581
Median:         yrs.since.phd  yrs.service    salary
sex
Female           23.0         17.0  120257.5
Male             28.0         22.0  123996.0
```

#Answer A


Pages
Columns
Salary
Yrs.Since.Phd
Rows
Yrs.Service
Filters
Sex
Marks
All
Automatic
Color
Size
Label
Detail
Tooltip
Shape
Rank
Sex
Sex
Salary
Yrs.Since.Phd
Answer A Question 1
Yrs.Service
60
55
50
45
40
35
30
25
20
15
10
5
0
60K
80K
100K
120K
140K
160K
180K
200K
220K
240K
Salary
0
5
10
15
20
25
30
35
40
45
50
55
60
Yrs.Since.Phd
Sex
☑ (All)
☑ Female
☑ Male
Rank
🟦 AssocProf
🟧 AsstProf
🟥 Prof
Sex
○ Female
□ Male

#Answer B

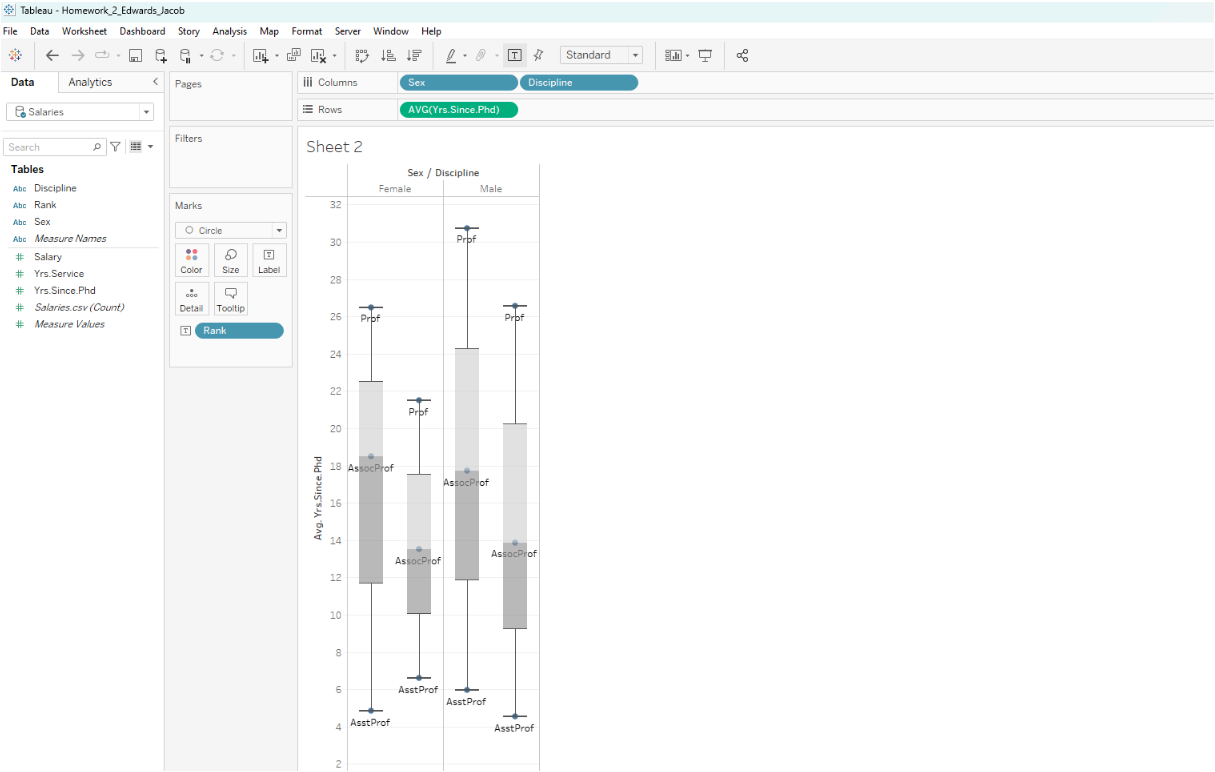


Tableau - Homework_2_Edwards_Jacob
File
Data
Worksheet
Dashboard
Story
Analysis
Map
Format
Server
Window
Help
Standard
Data
Analytics
Salaries
Search
Tables
Discipline
Rank
Sex
Measure Names
Salary
Yrs.Service
Yrs.Since.Phd
Salaries.csv (Count)
Measure Values
Pages
Columns
Sex
Discipline
Rows
AVG(Yrs.Since.Phd)
Filters
Marks
Circle
Color
Size
Label
Detail
Tooltip
Rank
Sheet 2
Sex / Discipline
Female
Male
Avg. Yrs.Since.Phd
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
Prof
AssocProf
AsstProf
Prof
AssocProf
AsstProf
Prof
AssocProf
AsstProf
Prof
AssocProf
AsstProf

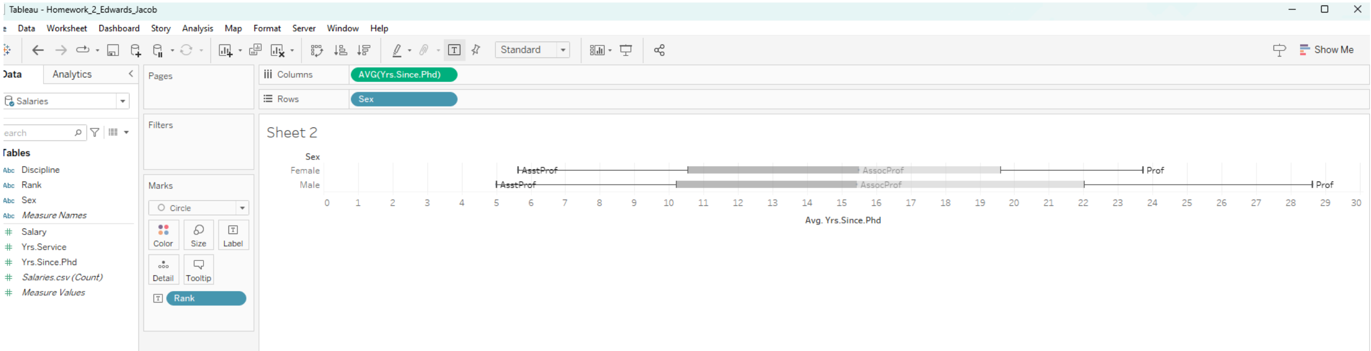


Tableau - Homework_2_Edwards_Jacob
Data
Worksheet
Dashboard
Story
Analysis
Map
Format
Server
Window
Help
Standard
Show Me
Data
Analytics
Salaries
earch
Tables
Discipline
Rank
Sex
Measure Names
Salary
Yrs.Service
Yrs.Since.Phd
Salaries.csv (Count)
Measure Values
Pages
Columns
AVG(Yrs.Since.Phd)
Rows
Sex
Filters
Marks
Circle
Color
Size
Label
Detail
Tooltip
Rank
Sheet 2
Sex
Female
Male
AsstProf
AssocProf
Prof
AsstProf
AssocProf
Prof
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
Avg. Yrs.Since.Phd

#Question 2

4 (points) This problem will use the Salaries dataset again to practice data wrangling by Pandas. The data has six variables, gender, title, years of services, years after Ph.D., and fields.

a. Sort the data based on salary, then use loc or iloc to select the rows from the 25% to 75% for the female full professors and assign the data as Med_female_full_prof_salaries, and do the same to the male full professors and assign the data as Med_male_full_prof_salaries.

b. Drop the professors of the two datasets above who have earned phd more than 30 years and have yrs.service more than 20 years, and assign the same names.

c. Use describe function to compare the two data sets above and Use boxplot to compare their salary distribution side by side

In [ ]:

```
df.head()
```

Out[10]:

	rank	discipline	yrs.since.phd	yrs.service	sex	salary
0	Prof	B	19	18	Male	139750
1	Prof	B	20	16	Male	173200
2	AsstProf	B	4	3	Male	79750
3	Prof	B	45	39	Male	115000
4	Prof	B	40	41	Male	141500

In [ ]:

```
df = df.sort_values(by='salary', ascending = False)
df
```

Out[11]:

	rank	discipline	yrs.since.phd	yrs.service	sex	salary
43	Prof	B	38	38	Male	231545
364	Prof	A	43	43	Male	205500
249	Prof	A	29	7	Male	204000
271	Prof	A	42	18	Male	194800
77	Prof	B	26	19	Male	193000
...	...	...	...	...	...	...
317	Prof	B	46	45	Male	67559
226	AsstProf	A	3	1	Male	63900
237	AsstProf	A	7	6	Female	63100
123	AssocProf	A	25	22	Female	62884
282	Prof	A	51	51	Male	57800

397 rows × 6 columns

#Part A & B)

In [ ]:

```
# Filter for female full professors and find the 25th and 75th percentiles
female_full_prof = df[(df['sex'] == 'Female') & (df['rank'] == 'Prof')]
female_full_prof_25th = female_full_prof['salary'].quantile(0.25)
female_full_prof_75th = female_full_prof['salary'].quantile(0.75)

# Select rows within the 25th to 75th percentiles for female full professors using loc
Med_female_full_prof_salaries = female_full_prof.loc[(female_full_prof['salary'] >= female_full_prof_25th) & (female_full_prof['salary'] <= female_full_prof_75th)]
Med_female_full_prof_salaries = Med_female_full_prof_salaries[(Med_female_full_prof_salaries['yrs.service'] <= 20) | (Med_female_full_prof_salaries['yrs.since.phd'] <= 30)]

# Print the result
print(Med_female_full_prof_salaries)

# Repeat for male full professors
male_full_prof = df[(df['sex'] == 'Male') & (df['rank'] == 'Prof')]
male_full_prof_25th = male_full_prof['salary'].quantile(0.25)
male_full_prof_75th = male_full_prof['salary'].quantile(0.75)

Med_male_full_prof_salaries = male_full_prof.loc[(male_full_prof['salary'] >= male_full_prof_25th) & (male_full_prof['salary'] <= male_full_prof_75th)]

# Drop professors with PhD more than 30 years and service more than 20 years
Med_male_full_prof_salaries = Med_male_full_prof_salaries[(Med_male_full_prof_salaries['yrs.service'] <= 20) | (Med_male_full_prof_salaries['yrs.since.phd'] <= 30)]
```

```
     rank discipline  yrs.since.phd  yrs.service     sex  salary
9    Prof          B             18           18  Female  129000
103  Prof          B             20           14  Female  127512
341  Prof          B             17           17  Female  124312
84   Prof          B             17           18  Female  122960
233  Prof          A             36           19  Female  117555
254  Prof          A             28            7  Female  116450
68   Prof          B             17           17  Female  111512
358  Prof          A             28           14  Female  109954
```

In [ ]:

```
print(Med_male_full_prof_salaries)
```

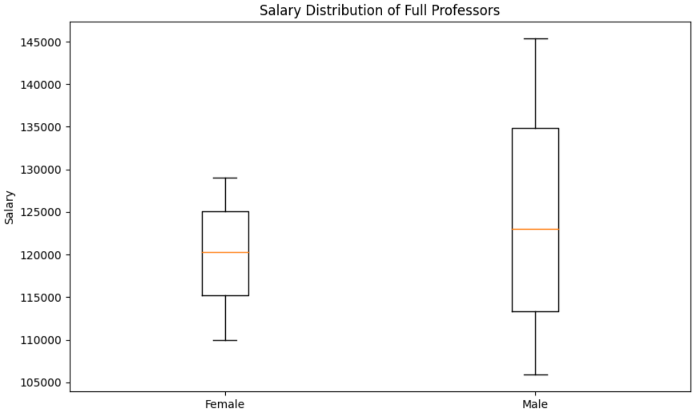
```
     rank discipline  yrs.since.phd  yrs.service   sex  salary
215  Prof          B             16           11  Male  145350
221  Prof          B             23           10  Male  145200
333  Prof          B             33           19  Male  145098
355  Prof          B             25           21  Male  145028
337  Prof          B             13           12  Male  145000
..    ...        ...            ...          ...   ...     ...
53   Prof          B             16            9  Male  106639
142  Prof          A             19           11  Male  106608
25   Prof          A             21            8  Male  106294
340  Prof          B             13           11  Male  106231
165  Prof          B             21            8  Male  105890

[84 rows x 6 columns]
```

In [ ]:

#Part C)

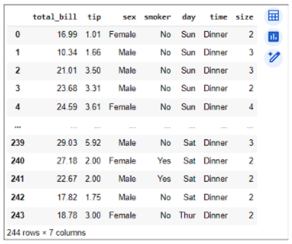
```
In [ ]: print("Female Full Professors:")
        print(Med_female_full_prof_salaries['salary'].describe())
        print("\nMale Full Professors:")
        print(Med_male_full_prof_salaries['salary'].describe())

        # Create box plots
        plt.figure(figsize=(10, 6))
        plt.boxplot([Med_female_full_prof_salaries['salary'], Med_male_full_prof_salaries['salary']], labels=['Female', 'Male'])
        plt.title('Salary Distribution of Full Professors')
        plt.ylabel('Salary')
        plt.show()
```

```
Female Full Professors:
count         8.000000
mean     119906.875000
std        7134.068113
min      109954.000000
25%      115215.500000
50%      120257.500000
75%      125112.000000
max      129000.000000
Name: salary, dtype: float64

Male Full Professors:
count        84.000000
mean     124083.226190
std       12398.685376
min      105890.000000
25%      113315.500000
50%      123041.500000
75%      134840.250000
max      145350.000000
Name: salary, dtype: float64
```



#Question 3

5 points) This problem will use the Tips dataset that includes 7 variables and 244 observations. Pretend that you are the waiter or waitress and try to figure out how to select the best days and time of maximize your serving income, and estimate the tips based on the size of the table and the total bill. You may use Tableau to help explore the answers, but need to use Pandas and Matplotlib to find out your answers to the following questions.



	total_bill	tip	sex	smoker	day	time	size
0	16.99	1.01	Female	No	Sun	Dinner	2
1	10.34	1.66	Male	No	Sun	Dinner	3
2	21.01	3.50	Male	No	Sun	Dinner	3
3	23.68	3.31	Male	No	Sun	Dinner	2
4	24.59	3.61	Female	No	Sun	Dinner	4
...	...	...	...	...	...	...	...
239	29.03	5.92	Male	No	Sat	Dinner	3
240	27.18	2.00	Female	Yes	Sat	Dinner	2
241	22.67	2.00	Male	Yes	Sat	Dinner	2
242	17.82	1.75	Male	No	Sat	Dinner	2
243	18.78	3.00	Female	No	Thur	Dinner	2

244 rows × 7 columns

a. Import pandas as pd and matplotlib.pyplot as plt, then read the tip dataset into df, and call df.head() to check the 7 data features first.

b. Find the mean of tips groupby the ‘day’ feature and assign it as ave_tip_by_day, then use ave_tip_by_day.plot(kind = “bar”) to observe the mean tips of the 7 days.

c. Use summative statistics to find the mean, median or total_bill and tip groupby both the day and time features. Which day and what time is the best time to serve in order to earn more tip?

d. Use df.plot(x = ‘totol_bill”, y = ‘tip’, kind = ‘scatter’) to visualize the correlation between total_bill and tip.

e. Add a new column ratio_tip_bill and sort in decreasing order of the ratio of tip over the total_bill.

f. Use boxplot to find the distribution of ratio_tip_bill for waiters and waitress

g. Plot a bar chart of the ration_tip_bill with 8 bins to compare side by side with blue color for waiter and green for waitress.

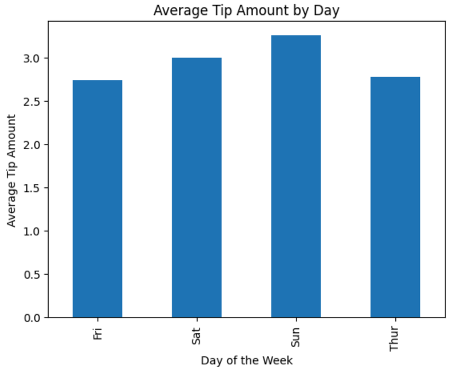
h. Plot bar chart to find which type of customers are more generous, smokers or nonsmokers in general?

#Part A & B)

In [ ]:

```
df = pd.read_csv('/content/drive/MyDrive/Colab Notebooks/M.S. Courses/DS 544 Data Viz/Datasets/tips.csv')
print(df.head())
ave_tip_by_day = df.groupby('day').mean(numeric_only=True)['tip']

# Create a bar plot to visualize the average tip amounts
ave_tip_by_day.plot(kind='bar')

# Add labels and a title to the plot
plt.xlabel('Day of the Week')
plt.ylabel('Average Tip Amount')
plt.title('Average Tip Amount by Day')

# Show the plot
plt.show()
```

```
   total_bill   tip     sex smoker  day    time  size
0       16.99  1.01  Female     No  Sun  Dinner     2
1       10.34  1.66    Male     No  Sun  Dinner     3
2       21.01  3.50    Male     No  Sun  Dinner     3
3       23.68  3.31    Male     No  Sun  Dinner     2
4       24.59  3.61  Female     No  Sun  Dinner     4
```



#Part C)

In [ ]:

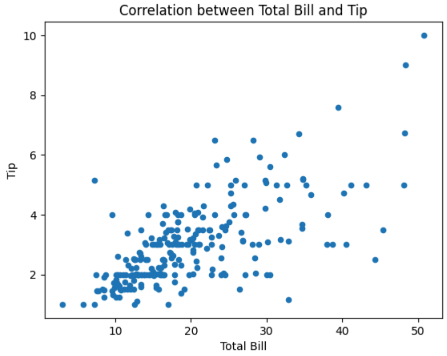
```
# Calculate summary statistics for total_bill and tip, grouped by day and time
summary_stats = df.groupby(['day', 'time'])[['total_bill', 'tip']].agg(['mean', 'median'])

# Find the day and time with the highest average tip
best_day_time = summary_stats['tip']['mean'].idxmax()

print(summary_stats)
print(f'\nBest day and time to serve for higher tips: {best_day_time}')
```

```
            total_bill               tip       
                  mean  median      mean median
day  time                                      
Fri  Dinner  19.663333  18.665  2.940000   3.00
     Lunch   12.845714  13.420  2.382857   2.20
Sat  Dinner  20.441379  18.240  2.993103   2.75
Sun  Dinner  21.410000  19.630  3.255132   3.15
Thur Dinner  18.780000  18.780  3.000000   3.00
     Lunch   17.664754  16.000  2.767705   2.30

Best day and time to serve for higher tips: ('Sun', 'Dinner')
```

#Part D & E)

In [ ]:

```

df.plot(x='total_bill', y='tip', kind='scatter')
plt.xlabel('Total Bill')
plt.ylabel('Tip')
plt.title('Correlation between Total Bill and Tip')
plt.show()
# Add a new column 'ratio_tip_bill'
df['ratio_tip_bill'] = df['tip'] / df['total_bill']
print()
print()
print()
# Sort the DataFrame in descending order of 'ratio_tip_bill'
df_sorted = df.sort_values('ratio_tip_bill', ascending=False)

print(df_sorted)
```

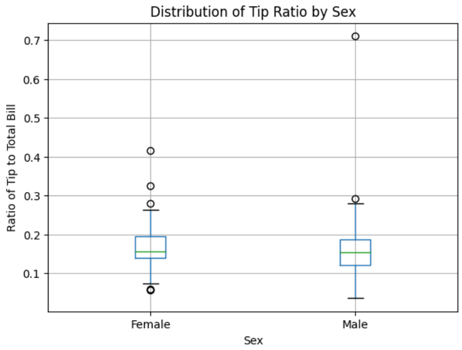


```
     total_bill   tip     sex smoker  day    time  size  ratio_tip_bill
172        7.25  5.15    Male    Yes  Sun  Dinner     2        0.710345
178        9.60  4.00  Female    Yes  Sun  Dinner     2        0.416667
67         3.07  1.00  Female    Yes  Sat  Dinner     1        0.325733
232       11.61  3.39    Male     No  Sat  Dinner     2        0.291990
183       23.17  6.50    Male    Yes  Sun  Dinner     4        0.280535
..          ...   ...     ...    ...  ...     ...   ...             ...
187       30.46  2.00    Male    Yes  Sun  Dinner     5        0.065660
0         16.99  1.01  Female     No  Sun  Dinner     2        0.059447
57        26.41  1.50  Female     No  Sat  Dinner     2        0.056797
102       44.30  2.50  Female    Yes  Sat  Dinner     3        0.056433
237       32.83  1.17    Male    Yes  Sat  Dinner     2        0.035638

[244 rows x 8 columns]
```

#Part F)

In [ ]:

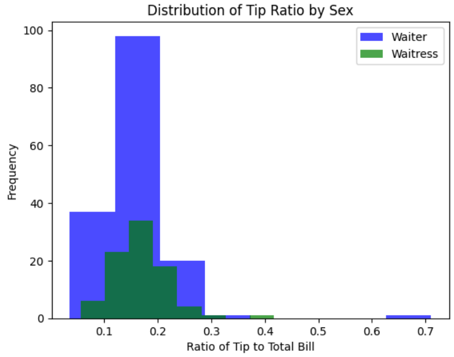
```
# Create a boxplot to visualize the distribution of ratio_tip_bill for waiters and waitresses
df.boxplot(column='ratio_tip_bill', by='sex')
plt.xlabel('Sex')
plt.ylabel('Ratio of Tip to Total Bill')
plt.title('Distribution of Tip Ratio by Sex')
plt.suptitle('')  # Remove the automatic title above the plot
plt.show()
```



#Part G)

In [ ]:

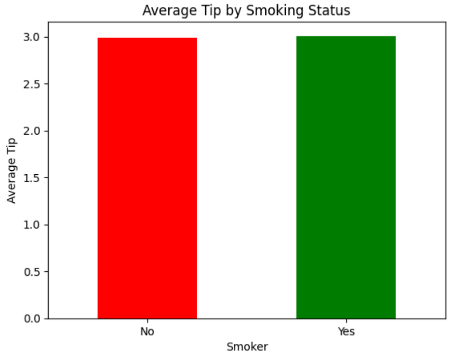
```
plt.hist(df[df['sex'] == 'Male']['ratio_tip_bill'], bins=8, color='blue', alpha=0.7, label='Waiter')
plt.hist(df[df['sex'] == 'Female']['ratio_tip_bill'], bins=8, color='green', alpha=0.7, label='Waitress')

plt.xlabel('Ratio of Tip to Total Bill')
plt.ylabel('Frequency')
plt.title('Distribution of Tip Ratio by Sex')
plt.legend()
plt.show()
```



#Part H)

In [ ]:

```
avg_tip = df.groupby('smoker')['tip'].mean()

# Create a bar plot
avg_tip.plot(kind='bar', color=['red', 'green'])
plt.xlabel('Smoker')
plt.ylabel('Average Tip')
plt.title('Average Tip by Smoking Status')
plt.xticks(rotation=0)  # Keep x-axis labels horizontal
plt.show()
```



In [ ]:

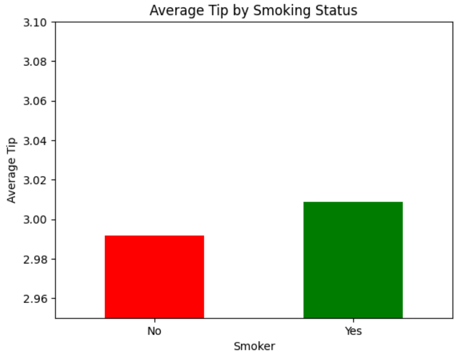
```
avg_tip = df.groupby('smoker')['tip'].mean()
avg_tip
#Technically the smokers are more generous based on this dataset. However, the graph doesn't show that well since it's so close in comparison.
#The view below shows it a little better.
```

Out[32]:

```
                tip
smoker
    No     2.991854
   Yes     3.008710

dtype: float64
```

In [ ]:

```
# Create a bar plot with adjusted y-axis limits
avg_tip.plot(kind='bar', color=['red', 'green'])
plt.xlabel('Smoker')
plt.ylabel('Average Tip')
plt.title('Average Tip by Smoking Status')
plt.xticks(rotation=0)  # Keep x-axis labels horizontal

# Set y-axis limits for a tighter view
plt.ylim(2.95, 3.1)

plt.show()
```



#Question 4)

In [16]:

```
#Part A
#Question: Import Data


import pandas as pd
faang = pd.read_csv('/content/drive/MyDrive/Colab Notebooks/M.S. Courses/DS 544 Data Viz/faang.csv', index_col=False)
faang
```

Out[16]:

	ticker	date	open	high	low	close	volume
0	FB	2018-01-02	177.68	181.58	177.5500	181.42	18151903
1	FB	2018-01-03	181.88	184.78	181.3300	184.67	16886563
2	FB	2018-01-04	184.90	186.21	184.0996	184.33	13880896
3	FB	2018-01-05	185.59	186.90	184.9300	186.85	13574535
4	FB	2018-01-08	187.20	188.90	186.3300	188.28	17994726
...	...	...	...	...	...	...	...
1250	GOOG	2018-12-24	973.90	1003.54	970.1100	976.22	1590328
1251	GOOG	2018-12-26	989.01	1040.00	983.0000	1039.46	2373270
1252	GOOG	2018-12-27	1017.15	1043.89	997.0000	1043.88	2109777
1253	GOOG	2018-12-28	1049.62	1055.56	1033.1000	1037.08	1413772
1254	GOOG	2018-12-31	1050.96	1052.70	1023.5900	1035.61	1493722

1255 rows × 7 columns

In [17]:

```
#Part B
#Question: With faang, use type conversion to change the date column to datetime and the volume column to integers. Then sort by date and ticker.


faang = faang.assign(
    date=pd.to_datetime(faang.date),
    volume=faang.volume.astype(int)
).sort_values(
    ['date', 'ticker']
)
faang.head()
```

Out[17]:

	ticker	date	open	high	low	close	volume
251	AAPL	2018-01-02	166.9271	169.0264	166.0442	168.9872	25555934
502	AMZN	2018-01-02	1172.0000	1190.0000	1170.5100	1189.0100	2694494
0	FB	2018-01-02	177.6800	181.5800	177.5500	181.4200	18151903
1004	GOOG	2018-01-02	1048.3400	1066.9400	1045.2300	1065.0000	1237564
753	NFLX	2018-01-02	196.1000	201.6500	195.4200	201.0700	10966889

In [18]:

```
#Part C

#Question: Find the 7 rows with the highest value for volume.


faang.nlargest(7, 'volume')
```

Out[18]:

	ticker	date	open	high	low	close	volume
142	FB	2018-07-26	174.8900	180.1300	173.7500	176.2600	169803668
53	FB	2018-03-20	167.4700	170.2000	161.9500	168.1500	129851768
57	FB	2018-03-26	160.8200	161.1000	149.0200	160.0600	126116634
54	FB	2018-03-21	164.8000	173.4000	163.3000	169.3900	106598834
433	AAPL	2018-09-21	219.0727	219.6482	215.6097	215.9768	96246748
496	AAPL	2018-12-21	156.1901	157.4845	148.9909	150.0862	95744384
463	AAPL	2018-11-02	207.9295	211.9978	203.8414	205.8755	91328654

In [21]:

```
#Part D

#Question: Right now, the data is somewhere between long and wide format. Use melt() to make it completely long format.


melted_faang = faang.melt(
    id_vars=['ticker', 'date'],
    value_vars=['open', 'high', 'low', 'close', 'volume']
)
melted_faang.head()
```

Out[21]:

	ticker	date	variable	value
0	AAPL	2018-01-02	open	166.9271
1	AMZN	2018-01-02	open	1172.0000
2	FB	2018-01-02	open	177.6800
3	GOOG	2018-01-02	open	1048.3400
4	NFLX	2018-01-02	open	196.1000

#Part E

Question: Suppose we found out there was a glitch in how the data was recorded on July 26, 2018. How should we handle this?

Answer: Since this is a substantial data set spanning about a year, the instinct might be to discard that specific date and fill in the gaps through interpolation. However, a quick look into that data for FAANG stocks shows that Facebook experienced a significant drop on that day.

#Part F

#Question: The European Centre for Disease Prevention and Control (ECDC) provides an open dataset on COVID-19 cases called daily number of new reported cases of COVID-19 by country worldwide (https://www.ecdc.europa.eu/en/publications-data/download-todays-data-geographic-distribution-covid-19-cases-worldwide (https://www.ecdc.europa.eu/en/publications-data/download-todays-data-geographic-distribution-covid-19-cases-worldwide)). This dataset is updated daily, but we will use a snapshot that contains data from January 1, 2020 through September 18, 2020. Clean and pivot the data so that it is in wide format:

a) Read in the covid19_cases.csv file.

b) Create a date column using the data in the dateRep column and the pd.to_datetime() function.

c) Set the date column as the index and sort the index.

d) Replace all occurrences of United_States_of_America and United_Kingdom with USA and UK, respectively. Hint: the replace() method can be run on the dataframe as a whole.

e) Using the countriesAndTerritories column, filter the cleaned COVID-19 cases data down to Argentina, Brazil, China, Colombia, India, Italy, Mexico, Peru, Russia, Spain, Turkey, the UK, and the USA.

f) Pivot the data so that the index contains the dates, the columns contain the country names, and the values are the case counts (the cases column). Be sure to fill in NaN values with 0.

In [41]:
```
#Part A
df = pd.read_csv('/content/drive/MyDrive/Colab Notebooks/M.S. Courses/DS 544 Data Viz/covid19_cases.csv')
df.head()
```

Out[41]:

	dateRep	day	month	year	cases	deaths	countriesAndTerritories	geoId	countryterritoryCode	popData2019	continentExp	Cumulative_number_for_14_days_of_COVID-19_cases_per_100000
0	14/12/2020	14	12	2020	746	6	Afghanistan	AF	AFG	38041757.0	Asia	9.013779
1	13/12/2020	13	12	2020	298	9	Afghanistan	AF	AFG	38041757.0	Asia	7.052776
2	12/12/2020	12	12	2020	113	11	Afghanistan	AF	AFG	38041757.0	Asia	6.868768
3	11/12/2020	11	12	2020	63	10	Afghanistan	AF	AFG	38041757.0	Asia	7.134266
4	10/12/2020	10	12	2020	202	16	Afghanistan	AF	AFG	38041757.0	Asia	6.968658

In [42]:
```
#Part B
df['date'] = pd.to_datetime(df['dateRep'], format='%d/%m/%Y', errors='coerce')
df
```

Out[42]:

	dateRep	day	month	year	cases	deaths	countriesAndTerritories	geoId	countryterritoryCode	popData2019	continentExp	Cumulative_number_for_14_days_of_COVID-19_cases_per_100000	date
0	14/12/2020	14	12	2020	746	6	Afghanistan	AF	AFG	38041757.0	Asia	9.013779	2020-12-14
1	13/12/2020	13	12	2020	298	9	Afghanistan	AF	AFG	38041757.0	Asia	7.052776	2020-12-13
2	12/12/2020	12	12	2020	113	11	Afghanistan	AF	AFG	38041757.0	Asia	6.868768	2020-12-12
3	11/12/2020	11	12	2020	63	10	Afghanistan	AF	AFG	38041757.0	Asia	7.134266	2020-12-11
4	10/12/2020	10	12	2020	202	16	Afghanistan	AF	AFG	38041757.0	Asia	6.968658	2020-12-10
...	...	...	...	...	...	...	...	...	...	...	...	...	...
61895	25/03/2020	25	3	2020	0	0	Zimbabwe	ZW	ZWE	14645473.0	Africa	NaN	2020-03-25
61896	24/03/2020	24	3	2020	0	1	Zimbabwe	ZW	ZWE	14645473.0	Africa	NaN	2020-03-24
61897	23/03/2020	23	3	2020	0	0	Zimbabwe	ZW	ZWE	14645473.0	Africa	NaN	2020-03-23
61898	22/03/2020	22	3	2020	1	0	Zimbabwe	ZW	ZWE	14645473.0	Africa	NaN	2020-03-22
61899	21/03/2020	21	3	2020	1	0	Zimbabwe	ZW	ZWE	14645473.0	Africa	NaN	2020-03-21

61900 rows × 13 columns

In [43]:
```
#Part C
df = df.set_index('date').sort_index()
df
```

Out[43]:

	dateRep	day	month	year	cases	deaths	countriesAndTerritories	geoId	countryterritoryCode	popData2019	continentExp	Cumulative_number_for_14_days_of_COVID-19_cases_per_100000
date												
2019-12-31	31/12/2019	31	12	2019	0	0	Iraq	IQ	IRQ	39309789.0	Asia	NaN
2019-12-31	31/12/2019	31	12	2019	0	0	Netherlands	NL	NLD	17282163.0	Europe	NaN
2019-12-31	31/12/2019	31	12	2019	0	0	Israel	IL	ISR	8519373.0	Asia	NaN
2019-12-31	31/12/2019	31	12	2019	0	0	New_Zealand	NZ	NZL	4783062.0	Oceania	NaN
2019-12-31	31/12/2019	31	12	2019	0	0	Dominican_Republic	DO	DOM	10738957.0	America	NaN
...	...	...	...	...	...	...	...	...	...	...	...	...
2020-12-14	14/12/2020	14	12	2020	316	1	Honduras	HN	HND	9746115.0	America	66.395687
2020-12-14	14/12/2020	14	12	2020	0	0	Holy_See	VA	VAT	815.0	Europe	0.000000
2020-12-14	14/12/2020	14	12	2020	74	1	Haiti	HT	HTI	11263079.0	America	2.672449
2020-12-14	14/12/2020	14	12	2020	6189	166	Indonesia	ID	IDN	270625567.0	Asia	30.874393
2020-12-14	14/12/2020	14	12	2020	746	6	Afghanistan	AF	AFG	38041757.0	Asia	9.013779

61900 rows × 12 columns

In [44]:
```
#Part D
df = df.replace('United_States_of_America', 'USA').replace('United_Kingdom', 'UK')
df
```

Out[44]:

	dateRep	day	month	year	cases	deaths	countriesAndTerritories	geoId	countryterritoryCode	popData2019	continentExp	Cumulative_number_for_14_days_of_COVID-19_cases_per_100000
date												
2019-12-31	31/12/2019	31	12	2019	0	0	Iraq	IQ	IRQ	39309789.0	Asia	NaN
2019-12-31	31/12/2019	31	12	2019	0	0	Netherlands	NL	NLD	17282163.0	Europe	NaN
2019-12-31	31/12/2019	31	12	2019	0	0	Israel	IL	ISR	8519373.0	Asia	NaN
2019-12-31	31/12/2019	31	12	2019	0	0	New_Zealand	NZ	NZL	4783062.0	Oceania	NaN
2019-12-31	31/12/2019	31	12	2019	0	0	Dominican_Republic	DO	DOM	10738957.0	America	NaN
...	...	...	...	...	...	...	...	...	...	...	...	...
2020-12-14	14/12/2020	14	12	2020	316	1	Honduras	HN	HND	9746115.0	America	66.395687
2020-12-14	14/12/2020	14	12	2020	0	0	Holy_See	VA	VAT	815.0	Europe	0.000000
2020-12-14	14/12/2020	14	12	2020	74	1	Haiti	HT	HTI	11263079.0	America	2.672449
2020-12-14	14/12/2020	14	12	2020	6189	166	Indonesia	ID	IDN	270625567.0	Asia	30.874393
2020-12-14	14/12/2020	14	12	2020	746	6	Afghanistan	AF	AFG	38041757.0	Asia	9.013779

61900 rows × 12 columns

In [45]:

```python
#Part E

countries_to_keep = ['Argentina', 'Brazil', 'China', 'Colombia', 'India', 'Italy', 'Mexico',
                     'Peru', 'Russia', 'Spain', 'Turkey', 'United_Kingdom', 'United_States_of_America']

# Filter the DataFrame
filtered_df = df[df['countriesAndTerritories'].isin(countries_to_keep)]

# Display the filtered DataFrame
filtered_df
```

Out[45]:

	dateRep	day	month	year	cases	deaths	countriesAndTerritories	geoId	countryterritoryCode	popData2019	continentExp	Cumulative_number_for_14_days_of_COVID-19_cases_per_100000
date												
2019-12-31	31/12/2019	31	12	2019	0	0	Brazil	BR	BRA	2.110495e+08	America	NaN
2019-12-31	31/12/2019	31	12	2019	0	0	Spain	ES	ESP	4.693706e+07	Europe	NaN
2019-12-31	31/12/2019	31	12	2019	0	0	Italy	IT	ITA	6.035955e+07	Europe	NaN
2019-12-31	31/12/2019	31	12	2019	0	0	Russia	RU	RUS	1.458723e+08	Europe	NaN
2019-12-31	31/12/2019	31	12	2019	0	0	Mexico	MX	MEX	1.275755e+08	America	NaN
...	...	...	...	...	...	...	...	...	...	...	...	...
2020-12-14	14/12/2020	14	12	2020	21825	279	Brazil	BR	BRA	2.110495e+08	America	278.234228
2020-12-14	14/12/2020	14	12	2020	8608	249	Mexico	MX	MEX	1.275755e+08	America	112.069298
2020-12-14	14/12/2020	14	12	2020	29136	222	Turkey	TR	TUR	8.200388e+07	Europe	499.220269
2020-12-14	14/12/2020	14	12	2020	17937	484	Italy	IT	ITA	6.035955e+07	Europe	428.323301
2020-12-14	14/12/2020	14	12	2020	27071	336	India	IN	IND	1.366418e+09	Asia	33.109128

3568 rows × 12 columns

In [49]:

```python
#Part F
filtered_df = filtered_df.reset_index()
pivoted_df = filtered_df.pivot(index='date',
                               columns='countriesAndTerritories',
                               values='cases').fillna(0)

pivoted_df
```

Out[49]:

countriesAndTerritories	Argentina	Brazil	China	Colombia	India	Italy	Mexico	Peru	Russia	Spain	Turkey
date											
2019-12-31	0.0	0.0	27.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2020-01-01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2020-01-02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2020-01-03	0.0	0.0	17.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2020-01-04	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
...	...	...	...	...	...	...	...	...	...	...	...
2020-12-10	5303.0	53453.0	12.0	7523.0	31521.0	12755.0	21974.0	691.0	26190.0	7955.0	31712.0
2020-12-11	6994.0	53347.0	15.0	7778.0	29398.0	16998.0	11897.0	1799.0	27927.0	10519.0	30424.0
2020-12-12	7112.0	54428.0	13.0	8998.0	30006.0	18726.0	12253.0	1832.0	28585.0	0.0	0.0
2020-12-13	5274.0	43900.0	24.0	8163.0	30254.0	19902.0	12057.0	2102.0	28137.0	0.0	32106.0
2020-12-14	3558.0	21825.0	12.0	8702.0	27071.0	17937.0	8608.0	1928.0	28080.0	0.0	29136.0

350 rows × 11 columns

#Question 5)

Run the Juypter program, then do the five problems in Chapter 4, page 257 in Molin's book.

a. Problem #3 (1 points)

b. Problem #5 (1 points)

c. Problem #6 (1 points)

d. Problem #8 (3 points

In [52]:

```python
#Part A
#Question: Using the exercises/faang.csv file, group by the ticker and resample to monthly frequency.
# Aggregate the open and close prices with the mean, the high price with the max, the low price with the min, and the volume with the sum.
import numpy as np
faang = pd.read_csv('/content/drive/MyDrive/Colab Notebooks/M.S. Courses/DS 544 Data Viz/faang.csv')

# Convert the 'date' column to DatetimeIndex
faang['date'] = pd.to_datetime(faang['date']) # Convert the 'date' column to DatetimeIndex
faang = faang.set_index('date') # Set the 'date' column as the index


faang.groupby('ticker').resample('1M').agg(
    {
        'open' : np.mean,
        'high' : np.max,
        'low' : np.min,
        'close' : np.mean,
        'volume' : np.sum
    }
)
```

```
<ipython-input-52-76cc1e00f735>:12: FutureWarning: 'M' is deprecated and will be removed in a future version, please use 'ME' instead.
  faang.groupby('ticker').resample('1M').agg(
<ipython-input-52-76cc1e00f735>:12: FutureWarning: The provided callable <function mean at 0x7e4bcc718280> is currently using DatetimeIndexResamplerGroupby.mean. In a future version of pandas, the provided callable will
be used directly. To keep current behavior pass the string "mean" instead.
  faang.groupby('ticker').resample('1M').agg(
<ipython-input-52-76cc1e00f735>:12: FutureWarning: The provided callable <function max at 0x7e4bcc6f7910> is currently using DatetimeIndexResamplerGroupby.max. In a future version of pandas, the provided callable will be
used directly. To keep current behavior pass the string "max" instead.
  faang.groupby('ticker').resample('1M').agg(
<ipython-input-52-76cc1e00f735>:12: FutureWarning: The provided callable <function min at 0x7e4bcc6f7a30> is currently using DatetimeIndexResamplerGroupby.min. In a future version of pandas, the provided callable will be
used directly. To keep current behavior pass the string "min" instead.
  faang.groupby('ticker').resample('1M').agg(
<ipython-input-52-76cc1e00f735>:12: FutureWarning: The provided callable <function mean at 0x7e4bcc718280> is currently using DatetimeIndexResamplerGroupby.mean. In a future version of pandas, the provided callable will
be used directly. To keep current behavior pass the string "mean" instead.
  faang.groupby('ticker').resample('1M').agg(
<ipython-input-52-76cc1e00f735>:12: FutureWarning: The provided callable <function sum at 0x7e4bcc6f72e0> is currently using DatetimeIndexResamplerGroupby.sum. In a future version of pandas, the provided callable will be
used directly. To keep current behavior pass the string "sum" instead.
  faang.groupby('ticker').resample('1M').agg(
```

Out[52]:

	open	high	low	close	volume

In [53]:

```
#Part B
#Question: Calculate the rolling 60-day aggregations of OHLC data by ticker for the FAANG data. Use the same aggregations as exercise 3.
faang.groupby('ticker').rolling('60D').agg(
    {
        'open' : np.mean,
        'high' : np.max,
        'low' : np.min,
        'close' : np.mean,
        'volume' : np.sum
    }
)
```

```
<ipython-input-53-527359942acd>:3: FutureWarning: The provided callable <function mean at 0x7e4bcc718280> is currently using RollingGroupby.mean. In a future version of pandas, the provided callable will be used directly.
To keep current behavior pass the string "mean" instead.
  faang.groupby('ticker').rolling('60D').agg(
<ipython-input-53-527359942acd>:3: FutureWarning: The provided callable <function max at 0x7e4bcc6f7910> is currently using RollingGroupby.max. In a future version of pandas, the provided callable will be used directly. To
keep current behavior pass the string "max" instead.
  faang.groupby('ticker').rolling('60D').agg(
<ipython-input-53-527359942acd>:3: FutureWarning: The provided callable <function min at 0x7e4bcc6f7a30> is currently using RollingGroupby.min. In a future version of pandas, the provided callable will be used directly. To
keep current behavior pass the string "min" instead.
  faang.groupby('ticker').rolling('60D').agg(
<ipython-input-53-527359942acd>:3: FutureWarning: The provided callable <function mean at 0x7e4bcc718280> is currently using RollingGroupby.mean. In a future version of pandas, the provided callable will be used directly.
To keep current behavior pass the string "mean" instead.
  faang.groupby('ticker').rolling('60D').agg(
<ipython-input-53-527359942acd>:3: FutureWarning: The provided callable <function sum at 0x7e4bcc6f72e0> is currently using RollingGroupby.sum. In a future version of pandas, the provided callable will be used directly. To
keep current behavior pass the string "sum" instead.
  faang.groupby('ticker').rolling('60D').agg(
```

Out[53]:

		open	high	low	close	volume
ticker	**date**					
AAPL	**2018-01-02**	166.927100	169.0264	166.0442	168.987200	25555934.0
	2018-01-03	168.089600	171.2337	166.0442	168.972500	55073833.0
	2018-01-04	168.480367	171.2337	166.0442	169.229200	77508430.0
	2018-01-05	168.896475	172.0381	166.0442	169.840675	101168448.0
	2018-01-08	169.324680	172.2736	166.0442	170.080040	121736214.0
...	**...**	...	...	...	...	...
NFLX	**2018-12-24**	283.509250	332.0499	233.6800	281.931750	525657894.0
	2018-12-26	281.844500	332.0499	231.2300	280.777750	520444588.0
	2018-12-27	281.070488	332.0499	231.2300	280.162805	532679805.0
	2018-12-28	279.916341	332.0499	231.2300	279.461341	521968250.0
	2018-12-31	278.430769	332.0499	231.2300	277.451410	476309676.0

1255 rows × 5 columns

In [54]:

```
#Part C
#Question: Create a pivot table of the FAANG data that compares the stocks.

faang.pivot_table(index='ticker')
```

Out[54]:

	close	high	low	open	volume
ticker					
AAPL	186.986218	188.906858	185.135729	187.038674	3.402145e+07
AMZN	1641.726175	1662.839801	1619.840398	1644.072669	5.649563e+06
FB	171.510936	173.615298	169.303110	171.454424	2.768798e+07
GOOG	1113.225139	1125.777649	1101.001594	1113.554104	1.742645e+06
NFLX	319.290299	325.224583	313.187273	319.620533	1.147030e+07

#Part D #Question:

Adding event descriptions:

Create a dataframe with three columns: ticker, date, and event. ticker will be 'FB'. date will be datetimes ['2018-07-25', '2018-03-19', '2018-03-20'] event will be ['Disappointing user growth announced after close.', 'Cambridge Analytica story', 'FTC investigation']. Merge this data to the FAANG data with a outer join.

In [56]:

```
events = pd.DataFrame({
    'ticker' : 'FB',
    'date' : pd.to_datetime(
         ['2018-07-25', '2018-03-19', '2018-03-20']
    ), 'event' : [
         'Disappointing user growth announced after close.',
         'Cambridge Analytica story',
         'FTC investigation'
    ]
}).set_index(['date', 'ticker'])
faang.reset_index().set_index(['date', 'ticker']).join(
    events, how='outer'
).sample(10, random_state=0)
```

Out[56]:

		open	high	low	close	volume	event
date	**ticker**						
2018-01-03	**AAPL**	169.2521	171.2337	168.6929	168.9578	29517899	NaN
2018-05-23	**NFLX**	329.0400	345.0000	328.0900	344.7200	10049147	NaN
2018-01-17	**FB**	179.2600	179.3200	175.8000	177.6000	27992376	NaN
2018-10-17	**AMZN**	1842.7900	1845.0000	1807.0000	1831.7300	5295177	NaN
2018-02-26	**AMZN**	1509.2000	1522.8400	1507.0000	1521.9500	4954988	NaN
2018-01-05	**GOOG**	1094.0000	1104.2500	1092.0000	1102.2300	1279123	NaN
2018-04-04	**FB**	152.0250	155.5600	150.5100	155.1000	49885584	NaN
2018-05-30	**AMZN**	1618.1000	1626.0000	1612.9300	1624.8900	2907357	NaN
2018-04-17	**NFLX**	329.6600	338.6200	323.7700	336.0600	33866456	NaN
2018-06-15	**AMZN**	1714.0000	1720.8700	1708.5200	1715.9700	4777646	NaN

In [60]:

```
events = pd.DataFrame({
    'ticker' : 'FB',
    'date' : pd.to_datetime(
         ['2018-07-25', '2018-03-19', '2018-03-20']
    ), 'event' : [
         'Disappointing user growth announced after close.',
         'Cambridge Analytica story',
         'FTC investigation'
    ]
}).set_index(['date', 'ticker'])

merged_df = faang.reset_index().set_index(['date', 'ticker']).join(events, how='outer')
display(merged_df)
```

		open	high	low	close	volume	event
date	**ticker**						
2018-01-02	**AAPL**	166.9271	169.0264	166.0442	168.9872	25555934	NaN
	AMZN	1172.0000	1190.0000	1170.5100	1189.0100	2694494	NaN
	FB	177.6800	181.5800	177.5500	181.4200	18151903	NaN
	GOOG	1048.3400	1066.9400	1045.2300	1065.0000	1237564	NaN
	NFLX	196.1000	201.6500	195.4200	201.0700	10966889	NaN
...	**...**	...	...	...	...	...	...
2018-12-31	**AAPL**	157.8529	158.6794	155.8117	157.0663	35003466	NaN
	AMZN	1510.8000	1520.7600	1487.0000	1501.9700	6954507	NaN
	FB	134.4500	134.6400	129.9500	131.0900	24625308	NaN
	GOOG	1050.9600	1052.7000	1023.5900	1035.6100	1493722	NaN
	NFLX	260.1600	270.1001	260.0000	267.6600	13508920	NaN

1255 rows × 6 columns

In [61]:

```
#Proof of above code working
dates = ['2018-07-25', '2018-03-19', '2018-03-20']
filtered_df = merged_df[merged_df.index.get_level_values('date').isin(dates)]
display(filtered_df)
```

```
<ipython-input-61-61cf9e9950f8>:2: FutureWarning: The behavior of 'isin' with dtype=datetime64[ns] and castable values (e.g. strings) is deprecated. In a future version, these will not be considered matching by isin. Expli
citly cast to the appropriate dtype before calling isin instead.
  filtered_df = merged_df[merged_df.index.get_level_values('date').isin(dates)]
```

		open	high	low	close	volume	event
date	**ticker**						
2018-03-19	**AAPL**	174.6604	174.8081	171.0553	172.6707	33446771	NaN
	AMZN	1554.5300	1561.6600	1525.3500	1544.9300	6580766	NaN
	FB	177.0100	177.1700	170.0600	172.5600	88140060	Cambridge Analytica story
	GOOG	1120.0100	1121.9900	1089.0100	1099.8200	2805937	NaN
	NFLX	315.8000	317.0000	307.3400	313.4800	9925162	NaN
2018-03-20	**AAPL**	172.6116	174.1482	172.3161	172.6116	19649350	NaN
	AMZN	1550.3400	1587.0000	1545.4100	1586.5100	4581568	NaN
	FB	167.4700	170.2000	161.9500	168.1500	129851768	FTC investigation
	GOOG	1099.0000	1105.2000	1083.4600	1097.7100	1831896	NaN
	NFLX	313.2600	319.5000	312.8000	317.5000	5991945	NaN
2018-07-25	**AAPL**	190.8977	192.6675	190.2746	192.6378	16826483	NaN
	AMZN	1829.3000	1863.8400	1822.6400	1863.6100	3836333	NaN
	FB	215.7150	218.6200	214.2700	217.5000	64592585	Disappointing user growth announced after close.
	GOOG	1239.1300	1265.8600	1239.1300	1263.7000	2139999	NaN
	NFLX	357.5700	363.2800	355.6500	362.8700	8516248	NaN

#References

https://g.co/gemini/share/bdb7a54b9cb5 (https://g.co/gemini/share/bdb7a54b9cb5)

https://stackoverflow.com/questions/69115428/merge-rows-based-on-date-range (https://stackoverflow.com/questions/69115428/merge-rows-based-on-date-range)

https://stackoverflow.com/questions/66937685/how-to-combine-rows-in-pandas-with-matching-dates-while-not-combining-the-values (https://stackoverflow.com/questions/66937685/how-to-combine-rows-in-pandas-with-matching-dates-while-not-combining-the-values)

https://www.geeksforgeeks.org/merge-two-pandas-dataframes-based-on-closest-datetime/ (https://www.geeksforgeeks.org/merge-two-pandas-dataframes-based-on-closest-datetime/)

In [2]:

```
pip install nbconvert[webpdf]
```

```
Requirement already satisfied: nbconvert[webpdf] in c:\users\campk\anaconda3\lib\site-packages (7.10.0)
Requirement already satisfied: beautifulsoup4 in c:\users\campk\anaconda3\lib\site-packages (from nbconvert[webpdf]) (4.12.2)
Requirement already satisfied: bleach!=5.0.0 in c:\users\campk\anaconda3\lib\site-packages (from nbconvert[webpdf]) (4.1.0)
Requirement already satisfied: defusedxml in c:\users\campk\anaconda3\lib\site-packages (from nbconvert[webpdf]) (0.7.1)
Requirement already satisfied: jinja2>=3.0 in c:\users\campk\anaconda3\lib\site-packages (from nbconvert[webpdf]) (3.1.3)
Requirement already satisfied: jupyter-core>=4.7 in c:\users\campk\anaconda3\lib\site-packages (from nbconvert[webpdf]) (5.5.0)
Requirement already satisfied: jupyterlab-pygments in c:\users\campk\anaconda3\lib\site-packages (from nbconvert[webpdf]) (0.1.2)
Requirement already satisfied: markupsafe>=2.0 in c:\users\campk\anaconda3\lib\site-packages (from nbconvert[webpdf]) (2.1.3)
Requirement already satisfied: mistune<4,>=2.0.3 in c:\users\campk\anaconda3\lib\site-packages (from nbconvert[webpdf]) (2.0.4)
Requirement already satisfied: nbclient>=0.5.0 in c:\users\campk\anaconda3\lib\site-packages (from nbconvert[webpdf]) (0.8.0)
Requirement already satisfied: nbformat>=5.7 in c:\users\campk\anaconda3\lib\site-packages (from nbconvert[webpdf]) (5.9.2)
Requirement already satisfied: packaging in c:\users\campk\anaconda3\lib\site-packages (from nbconvert[webpdf]) (23.1)
Requirement already satisfied: pandocfilters>=1.4.1 in c:\users\campk\anaconda3\lib\site-packages (from nbconvert[webpdf]) (1.5.0)
Requirement already satisfied: pygments>=2.4.1 in c:\users\campk\anaconda3\lib\site-packages (from nbconvert[webpdf]) (2.15.1)
Requirement already satisfied: tinycss2 in c:\users\campk\anaconda3\lib\site-packages (from nbconvert[webpdf]) (1.2.1)
Requirement already satisfied: traitlets>=5.1 in c:\users\campk\anaconda3\lib\site-packages (from nbconvert[webpdf]) (5.7.1)
Collecting playwright (from nbconvert[webpdf])
  Downloading playwright-1.47.0-py3-none-win_amd64.whl.metadata (3.5 kB)
Requirement already satisfied: six>=1.9.0 in c:\users\campk\anaconda3\lib\site-packages (from bleach!=5.0.0->nbconvert[webpdf]) (1.16.0)
```

In [ ]: