Workbook

Use this notebook to complete the exercises throughout the workshop.

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Section 1

Exercise 1.1

Create a DataFrame by reading in the `2019_Yellow_Taxi_Trip_Data.csv` file. Examine the first 5 rows.

In [ ]:

```python
import pandas as pd

df = pd.read_csv('../data/2019_Yellow_Taxi_Trip_Data.csv')
```

Exercise 1.2

Find the dimensions (number of rows and number of columns) in the data.

In [ ]:

```python
import pandas as pd

df = pd.read_csv('../data/2019_Yellow_Taxi_Trip_Data.csv')

df.shape
```

Out[ ]:

```
(10000, 18)
```

Exercise 1.3

Using the data in the `2019_Yellow_Taxi_Trip_Data.csv` file, calculate summary statistics for the `fare_amount`, `tip_amount`, `tolls_amount`, and `total_amount` columns.

In [ ]:

```python
import pandas as pd

df = pd.read_csv('../data/2019_Yellow_Taxi_Trip_Data.csv')

df[['fare_amount','tip_amount','tolls_amount','total_amount']].describe()
```

Out[ ]:

	fare_amount	tip_amount	tolls_amount	total_amount
count	10000.000000	10000.000000	10000.000000	10000.000000
mean	15.106313	2.634494	0.623447	22.564659
std	13.954762	3.409800	6.437507	19.209255
min	-52.000000	0.000000	-6.120000	-65.920000
25%	7.000000	0.000000	0.000000	12.375000
50%	10.000000	2.000000	0.000000	16.300000
75%	16.000000	3.250000	0.000000	22.880000
max	176.000000	43.000000	612.000000	671.800000

Exercise 1.4

Isolate the `fare_amount`, `tip_amount`, `tolls_amount`, and `total_amount` for the longest trip by distance (`trip_distance`).

In [ ]:

```python
import pandas as pd

df = pd.read_csv('../data/2019_Yellow_Taxi_Trip_Data.csv')

df.loc[df['trip_distance'].idxmax(), ['fare_amount','tip_amount','tolls_a
```

Out[ ]:

```
fare_amount      176.0
tip_amount       18.29
tolls_amount      6.12
total_amount    201.21
Name: 8338, dtype: object
```

Section 2

Exercise 2.1

Read in the meteorite data from the `Meteorite_Landings.csv` file, rename the `mass (g)` column to `mass`, and drop all the latitude and longitude columns. Sort the result by mass in descending order.

In [ ]:

```python
import pandas as pd

df = pd.read_csv('../data/Meteorite_Landings.csv')

df.rename(columns={'mass (g)': 'mass'}, inplace=True)

df.drop(['reclat','reclong'], axis=1, inplace=True)

df.sort_values(['mass'], ascending=False, inplace=True)

df.head()
```

Out[ ]:

	name	id	nametype	recclass	mass	fall	year	GeoLc
16392	Hoba	11890	Valid	Iron, IVB	60000000.0	Found	01/01/1920 12:00:00 AM	(-19. 17.
5373	Cape York	5262	Valid	Iron, IIIAB	58200000.0	Found	01/01/1818 12:00:00 AM	(76. -64.(
5365	Campo del Cielo	5247	Valid	Iron, IAB-MG	50000000.0	Found	12/22/1575 12:00:00 AM	(-27. -60.!
5370	Canyon Diablo	5257	Valid	Iron, IAB-MG	30000000.0	Found	01/01/1891 12:00:00 AM	-111.(
3455	Armanty	2335	Valid	Iron, IIIE	28000000.0	Found	01/01/1898 12:00:00 AM	(47.(

Exercise 2.2

Using the meteorite data from the `Meteorite_Landings.csv` file, update the `year` column to only contain the year, convert it to a numeric data type, and create a new column indicating whether the meteorite was observed falling before 1970. Set the index to the `id` column and extract all the rows with IDs between 10,036 and 10,040 (inclusive) with `loc[]`.

Hint 1: Use `year.str.slice()` to grab a substring.

Hint 2: Make sure to sort the index before using `loc[]` to select the range.

Bonus: There's a data entry error in the `year` column. Can you find it? (Don't spend too much time on this.)

In [ ]:

```
import pandas as pd

df = pd.read_csv('../data/Meteorite_Landings.csv')

df['year']=df['year'].str.slice(start=6, stop=10)

df.dropna(subset = ['year'],inplace = True)

df['year']=df['year'].astype('int64')

df = df.assign(before1970=lambda x: x.year < 1970)

df.set_index('id')

df.sort_index()

between = df.loc[10036:10040]

between.head()
```

Out[ ]:

	name	id	nametype	recclass	mass (g)	fall	year	reclat	recl
10036	Elephant Moraine 90022	8432	Valid	CK5	15.5	Found	1990	-76.28573	156.45
10037	Elephant Moraine 90023	8433	Valid	CK5	31.5	Found	1990	-76.27507	156.41
10038	Elephant Moraine 90024	8434	Valid	Eucrite-br	22.8	Found	1990	-76.28843	156.47
10039	Elephant Moraine 90025	8435	Valid	CK5	45.8	Found	1990	-76.28200	156.39
10040	Elephant Moraine 90026	8436	Valid	CK5	61.5	Found	1990	-76.29226	156.45

Exercise 2.3

Using the meteorite data from the `Meteorite_Landings.csv` file, create a pivot table that shows both the number of meteorites and the 95th percentile of meteorite mass for those that were found versus observed falling per year from 2005 through 2009 (inclusive). Hint: Be sure to convert the `year` column to a number as we did in the previous exercise.

In [ ]:

```python
import pandas as pd

df = pd.read_csv('../data/Meteorite_Landings.csv')

df['year'] = df['year'].str.slice(start=6, stop=10)
df.dropna(subset=['year'], inplace=True)
df['year'] = df['year'].astype('int64')

df_filtered = df.query('2005 <= year <= 2009')

count_df = df_filtered.groupby(['year', 'fall'])['id'].count().unstack()

p95_df = df_filtered.groupby(['year', 'fall'])['mass (g)'].apply(lambda x

final_df = pd.merge(count_df, p95_df, left_index=True, right_index=True,

final_df.head()
```

Out[ ]:

fall	Fell_count	Found_count	Fell_p95_mass	Found_p95_mass
year				
2005	NaN	875.0	NaN	4500.00
2006	5.0	2451.0	25008.0	1600.50
2007	8.0	1181.0	89675.0	1126.90
2008	9.0	948.0	106000.0	2274.80
2009	5.0	1492.0	8333.4	1397.25

Exercise 2.4

Using the meteorite data from the `Meteorite_Landings.csv` file, compare summary statistics of the mass column for the meteorites that were found versus observed falling.

In [ ]:

```python
import pandas as pd

df = pd.read_csv('../data/Meteorite_Landings.csv')

print(df.groupby('fall')['mass (g)'].describe())
```

```
         count          mean            std  min     25%     50%      75%
fall
Fell    1075.0  47070.715023  717067.125826  0.1  686.00  2800.0  10450.0
\
Found  44510.0  12461.922983  571105.752311  0.0    6.94    30.5    178.0

              max
fall
Fell   23000000.0
Found  60000000.0
```

Exercise 2.5

Using the taxi trip data in the `2019_Yellow_Taxi_Trip_Data.csv` file, resample the data to an hourly frequency based on the dropoff time. Calculate the total `trip_distance`, `fare_amount`, `tolls_amount`, and `tip_amount`, then find the 5 hours with the most tips.

In [ ]:

```python
import pandas as pd

df = pd.read_csv('../data/2019_Yellow_Taxi_Trip_Data.csv')

df['tpep_dropoff_datetime'] = pd.to_datetime(df['tpep_dropoff_datetime'])

df.set_index('tpep_dropoff_datetime', inplace = True)

df = df.resample('H').agg({'trip_distance': 'sum', 'fare_amount': 'sum',

print(df.nlargest(5, 'tip_amount'))

#df.head()
```

```
                       trip_distance  fare_amount  tolls_amount  tip_amoun
t
tpep_dropoff_datetime
2019-10-23 16:00:00         10676.95     67797.76        699.04    12228.6
4
2019-10-23 17:00:00         16052.83     70131.91       4044.04    12044.0
3
2019-10-23 18:00:00          3104.56     11565.56       1454.67     1907.6
4
2019-10-23 15:00:00            14.34       213.50          0.00       51.7
5
2019-10-23 19:00:00            98.59       268.00         24.48       25.7
4
```

Out[ ]:

	trip_distance	fare_amount	tolls_amount	tip_amount
tpep_dropoff_datetime				
2019-10-23 07:00:00	0.67	4.5	0.0	0.0
2019-10-23 08:00:00	17.07	62.5	0.0	4.0
2019-10-23 09:00:00	1.58	58.0	0.0	0.0
2019-10-23 10:00:00	0.00	0.0	0.0	0.0
2019-10-23 11:00:00	0.00	0.0	0.0	0.0

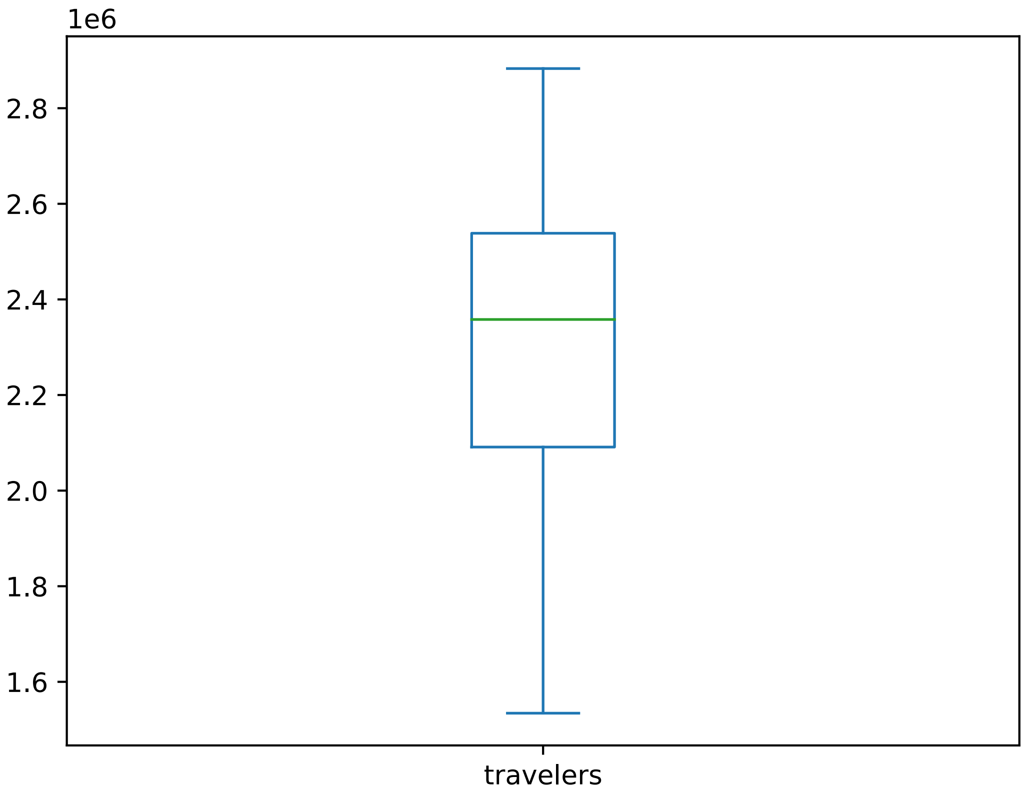
Section 3

Exercise 3.1

Using the TSA traveler throughput data in the `tsa_melted_holiday_travel.csv` file, create box plots for traveler throughput for each year in the data. Hint: Pass `kind='box'` into the `plot()` method to generate box plots.

In [ ]:

```
import pandas as pd
import matplotlib_inline
from utils import mpl_svg_config

matplotlib_inline.backend_inline.set_matplotlib_formats(
    'svg',
    **mpl_svg_config('section-3')

)

df = pd.read_csv('../data/tsa_melted_holiday_travel.csv',parse_dates=True

box2019 = df.query('year == 2019').travelers.plot(kind='box')

#box2020 = df.query('year == 2020').travelers.plot(kind='box')

#box2021 = df.query('year == 2021').travelers.plot(kind='box')
```

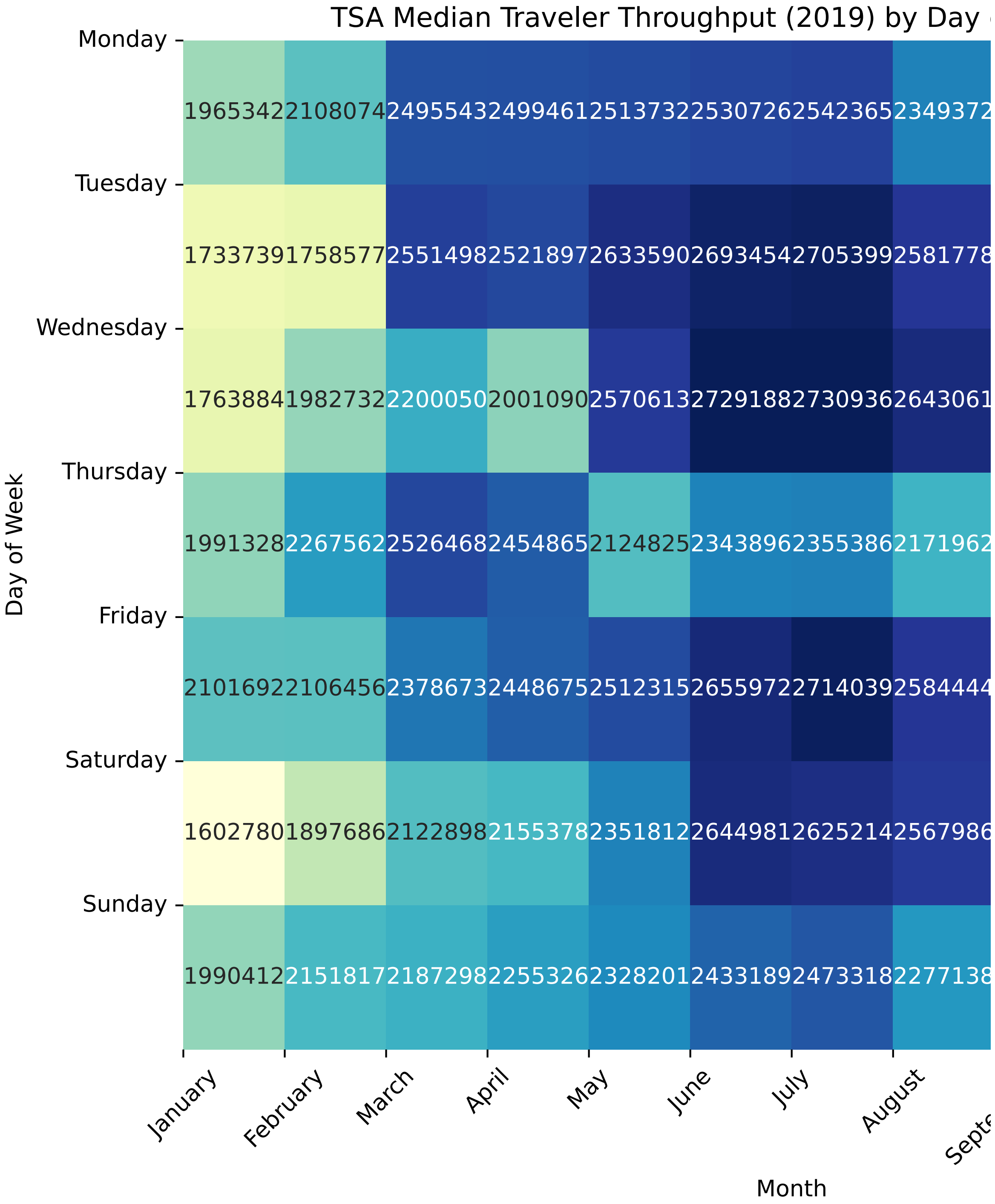


Exercise 3.2

Using the TSA traveler throughput data in the `tsa_melted_holiday_travel.csv` file, create a heatmap that shows the 2019 TSA median traveler throughput by day of week and month.

In [ ]:
```
import pandas as pd
import matplotlib_inline
from utils import mpl_svg_config
import matplotlib.pyplot as plt
import seaborn as sns

matplotlib_inline.backend_inline.set_matplotlib_formats(
    'svg', # output images using SVG format
    **mpl_svg_config('section-3') # optional: configure metadata

)



# Load the TSA traveler throughput data
df = pd.read_csv('../data/tsa_melted_holiday_travel.csv', parse_dates=Tru

# Extract year, month, and day of week from the 'date' column
df['Year'] = df.index.year
df['Month'] = df.index.month
df['DayOfWeek'] = df.index.dayofweek

df_2019 = df[df['Year'] == 2019]

pivot_table = pd.pivot_table(df_2019, values='travelers', index='DayOfWee

month_order = ['January', 'February', 'March', 'April', 'May', 'June', 'J
day_order = ['Monday', 'Tuesday', 'Wednesday', 'Thursday', 'Friday', 'Sat
```

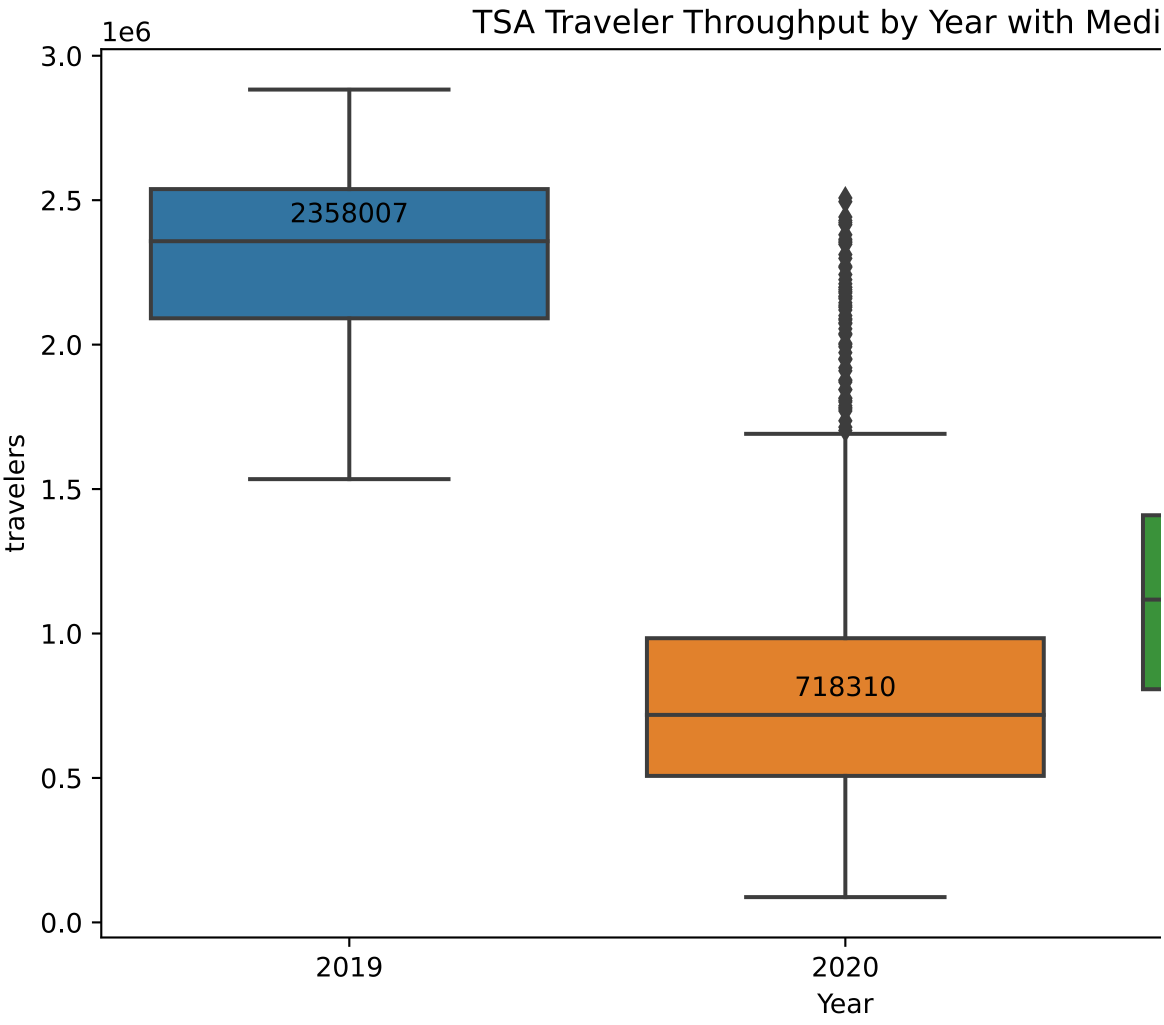
```
plt.figure(figsize=(12, 8))
sns.heatmap(pivot_table, cmap='YlGnBu', annot=True, fmt=".0f", cbar_kws={
plt.title('TSA Median Traveler Throughput (2019) by Day of Week and Month
plt.xlabel('Month')
plt.ylabel('Day of Week')

plt.xticks(ticks=range(12), labels=month_order, rotation=45)
plt.yticks(ticks=range(7), labels=day_order, rotation=0)

plt.show()
```



Exercise 3.3

Annotate the medians in the box plot from *Exercise 3.1*. Hint: The `x` coordinates will be 1, 2, and 3 for 2019, 2020, and 2021, respectively. Alternatively, to avoid hardcoding values, you can use the `Axes.get_xticklabels()` method, in which case you should look at the documentation for the `Text` class.

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

df = pd.read_csv('../data/tsa_melted_holiday_travel.csv')

df['date'] = pd.to_datetime(df['date'])

df['Year'] = df['date'].dt.year

plt.figure(figsize=(10, 6))
ax = sns.boxplot(x='Year', y='travelers', data=df)

medians = df.groupby(['Year'])['travelers'].median()

for x_tick, (year, median) in enumerate(medians.items()):
    ax.annotate(f'{median:.0f}', xy=(x_tick, median),
                xytext=(0,5),
                textcoords='offset points',
                ha='center', va='bottom')

plt.title('TSA Traveler Throughput by Year with Medians')
plt.show()
```



In [ ]: