Assignment 3: Understanding Customer Tipping Behavior

The dataset contains information about restaurant bills and tips. Each row represents one dining group.

Key variables:

- total_bill : total cost of the meal
- tip : tip amount
- sex : gender of the person paying
- smoker : whether the group included smokers
- day : day of the week
- time : lunch or dinner
- size : group size

You are a data analyst working for a restaurant chain. Management is curious about customer tipping behavior and wants data-driven insights:

- Do people tip more on weekends?
- Does gender or smoking status affect tips?
- How does the total bill influence tipping?

To answer these questions, you will analyze the famous Tips dataset from Seaborn and gradually clean, explore, and visualize the data until you reach a meaningful conclusion.

Q1: Loading and Understanding the Dataset (10 marks)

In [200…

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import warnings
warnings.filterwarnings('ignore')
```

In [201…

```
df = sns.load_dataset('tips')
df.head()
```

Out[201…

	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

In [202…

```
print(df.shape)
print(df.columns)
```

```
(244, 7)
Index(['total_bill', 'tip', 'sex', 'smoker', 'day', 'time', 'size'], dtype='object')
```

Q2: Basic Filtering – Who Tips More? (25 marks)

In [203…

```
df
```

Out[203…

	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

In [204…

```
weekend = df[(df.day == 'Sat') | (df.day == 'Sun')]
weekdays = df[(df.day != 'Sat') & (df.day != 'Sun')]
print("weekend:", weekend.tip.mean(), weekend.total_bill.mean())
print("weekdays:", weekdays.tip.mean(), weekdays.total_bill.mean())
```

```
weekend: 3.115276073619632 20.893006134969326
weekdays: 2.7628395061728392 17.558148148148148
```

By comparing I can say that in weekend the average tip and average total bill is higher which shows that the customers are more likely to come on **weekends**

Q3: Sorting and Identifying High-Value Customers

In [205…

```
df.sort_values(by='total_bill', ascending = False, inplace=True)
df.head(10)
```

Out[205…

	total_bill	tip	sex	smoker	day	time	size
170	50.81	10.00	Male	Yes	Sat	Dinner	3
212	48.33	9.00	Male	No	Sat	Dinner	4
59	48.27	6.73	Male	No	Sat	Dinner	4
156	48.17	5.00	Male	No	Sun	Dinner	6
182	45.35	3.50	Male	Yes	Sun	Dinner	3
102	44.30	2.50	Female	Yes	Sat	Dinner	3
197	43.11	5.00	Female	Yes	Thur	Lunch	4
142	41.19	5.00	Male	No	Thur	Lunch	5
184	40.55	3.00	Male	Yes	Sun	Dinner	2
95	40.17	4.73	Male	Yes	Fri	Dinner	4

Most of the high value customers come in groups of 3 or 4 or 6 people. This shows that larger bill often came from a group rather than induviduals.

In [206…

```
df.head(10)['size'].value_counts()
```

Out[206…

```
size
4    4
3    3
6    1
5    1
2    1
Name: count, dtype: int64
```

In [207…

```
df.head(10).groupby('size')['total_bill'].mean()
```

```
Out[207…
size
2    40.55
3    46.82
4    44.97
5    41.19
6    48.17
Name: total_bill, dtype: float64
```

Q4: Data Quality Check & Cleaning (10 marks)

```
In [208…
df.isna().sum()
```

```
Out[208…
total_bill    0
tip           0
sex           0
smoker        0
day           0
time          0
size          0
dtype: int64
```

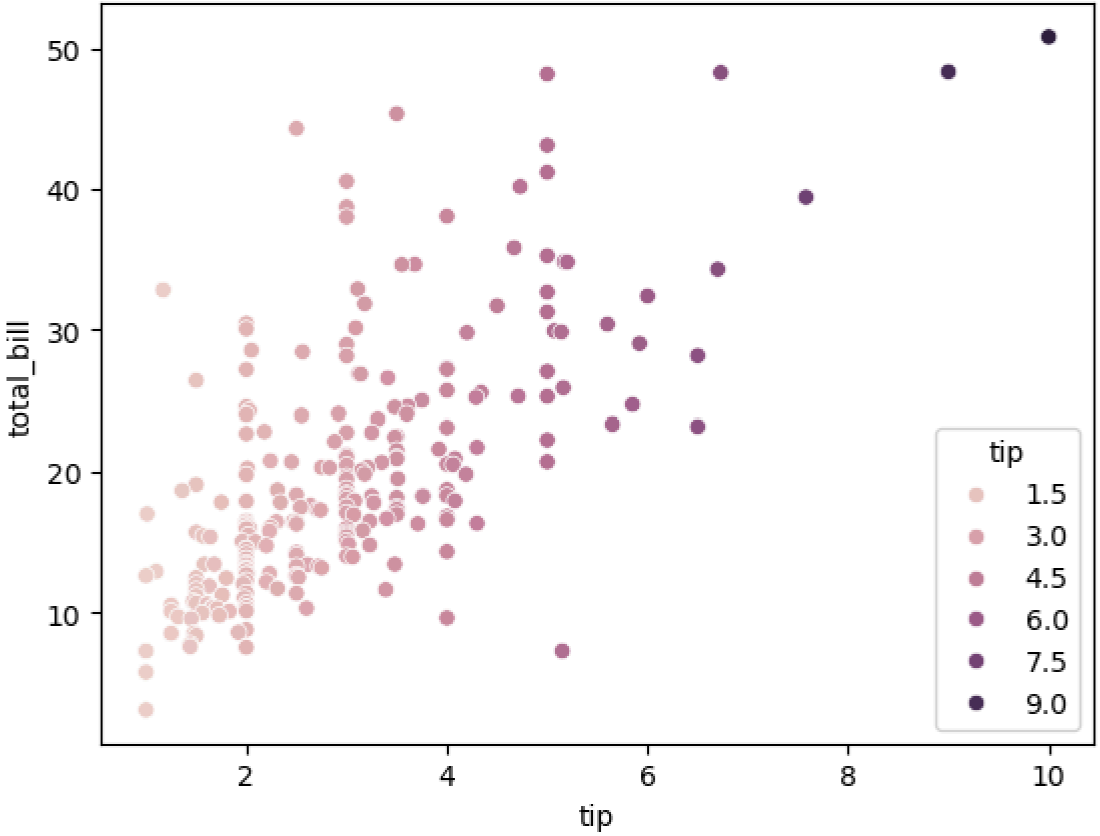
Missing values can change our mathematical values or cause error. Can give incorrect answers due to the lost data.

Q5: Visualization – What Influences Tips?

Tip vs Total Bill (scatter plot)

```
In [209…
sns.scatterplot(df, x="tip", y="total_bill", hue="tip")
```

```
Out[209…
<Axes: xlabel='tip', ylabel='total_bill'>
```

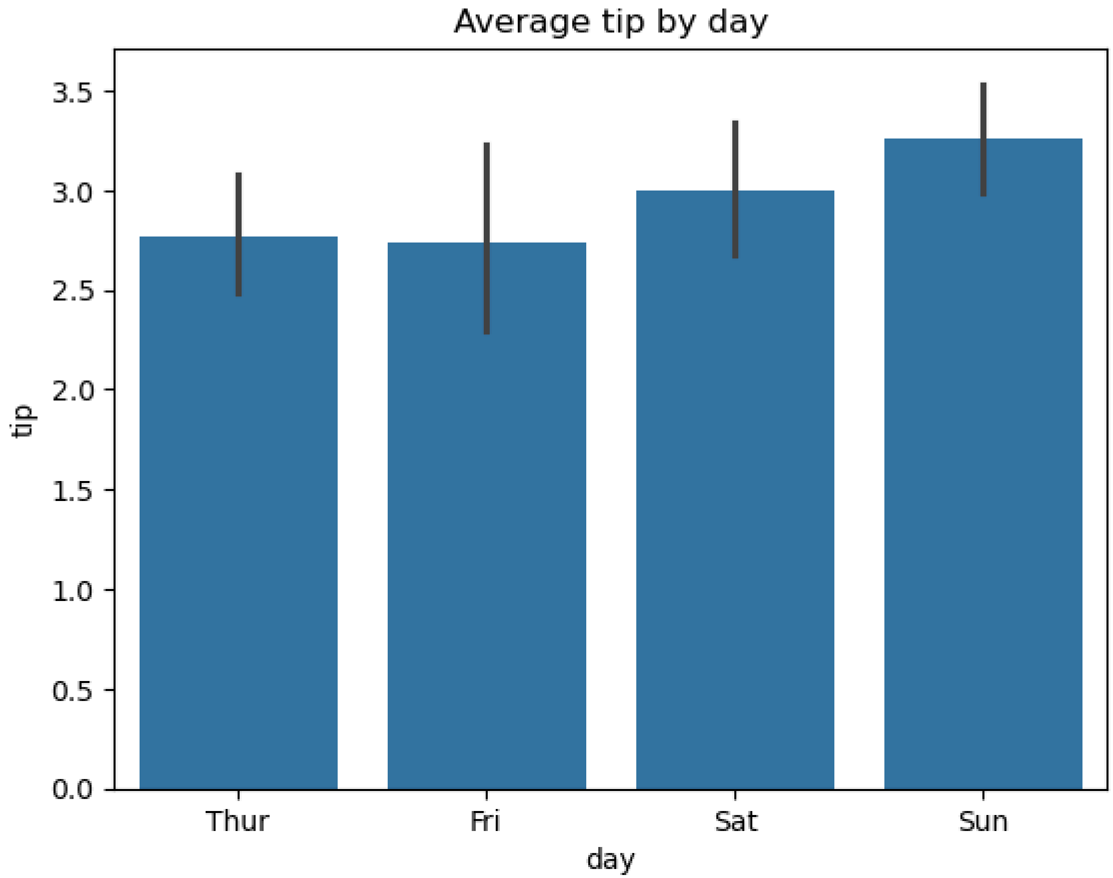


Plot shows that if the total_bill is high, the tip is also will be high. They are interconnected.

Average tip by day (bar plot)

```
In [210…
plt.title("Average tip by day")
sns.barplot(df, x="day", y="tip")
```

```
Out[210… <Axes: title={'center': 'Average tip by day'}, xlabel='day', ylabel='tip'>
```

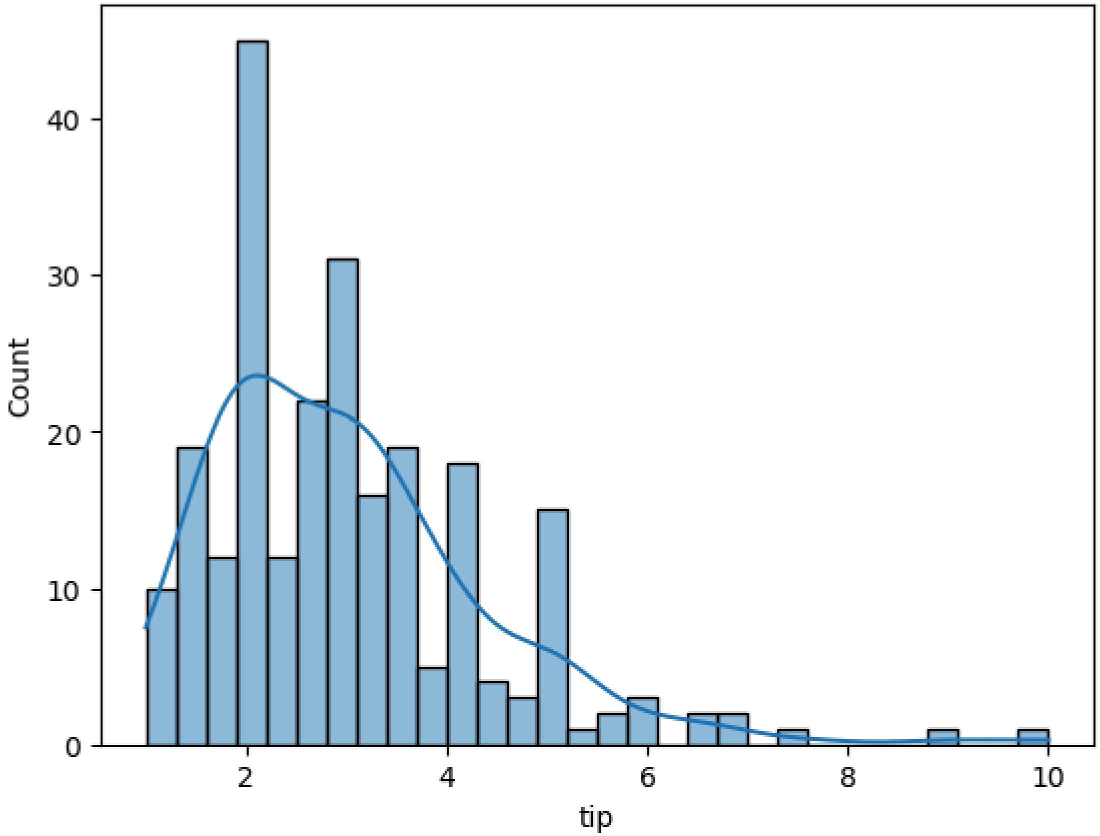


Tips on weekends slightly more than weekdays.

Tip distribution (histogram)

```
In [211…  sns.histplot(data=df, x='tip', bins=30, kde=True)
```

```
Out[211…  <Axes: xlabel='tip', ylabel='Count'>
```



Usually tip is between 2 and 4 dollars and it is skewed to the right, meaning that high tips are rare.

Q6: Final Insight & Conclusion (25 marks)

My meaning:

- the dataset doesn't have missing values, that gives chance for more accurate results;
- If the total bill is higher, the tip is also will be higher;
- The larger bill gets from the group of 3 to 6 people, rather than individuals;
- Tips are highest on weekends.

This helps restaurant to focus on staffing on weekend days to accomodate the larger groups.

Own Observation

Gender

In [212…

```
print("10people\n", df.head(10).groupby('sex')[['total_bill', 'tip']].sum(), '\n')
print("100people\n",df.head(100).groupby('sex')[['total_bill', 'tip']].sum(), '\n')
print("All people\n", df.groupby('sex')[['total_bill', 'tip']].sum(), '\n')
num_males = df[df['sex'] == 'Male'].shape[0]
num_fem = 244 - num_males
print(num_males, num_fem)
```

```
10people
         total_bill    tip
sex
Male         362.84  46.96
Female        87.41   7.50

100people
         total_bill     tip
sex
Male        2048.22  283.73
Female       768.43  106.80

All people
         total_bill     tip
sex
Male        3256.82  485.07
Female      1570.95  246.51

157 87
```

This restaurant attracts more male customers than female customers, and they give more total_bill and tip.

Time

In [213…

```
print(df.head(10).groupby('time')[['total_bill','tip']].mean())
print(df.head(100).groupby('time')[['total_bill','tip']].mean())
print(df.groupby('time')[['total_bill','tip']].mean())
```

```
        total_bill     tip
time                      
Lunch     42.15000  5.0000
Dinner    45.74375  5.5575
        total_bill       tip
time                        
Lunch    27.925882  4.152941
Dinner   28.215783  3.854578
        total_bill       tip
time                        
Lunch    17.168676  2.728088
Dinner   20.797159  3.102670
```

Dinner service gets higher average tips and total bills compared to Lunch. This shows that customers spend more during dinner hours.

Smoker

In [214…

```
print("10people\n", df.head(10).groupby('smoker')[['total_bill', 'tip']].mean(), '\n')
print("100people\n", df.head(100).groupby('smoker')[['total_bill', 'tip']].mean(), '\n')
print("All people\n", df.groupby('smoker')[['total_bill', 'tip']].mean())
```

```
10people
         total_bill       tip
smoker
Yes      44.048333  4.788333
No       46.490000  6.432500

100people
         total_bill       tip
smoker
Yes      29.461190  3.668333
No       27.228966  4.076897

All people
         total_bill       tip
smoker
Yes      20.756344  3.008710
No       19.188278  2.991854
```

Rich costumers that gives higher total_bill and tip, tends to not smoke.

But **generally people** who smoke gives slightly more total_bill and tip, and *difference* between not smokers is *minimal*

Result:

In the result of my observation:

Most of the customers are male in all categories.

General People:

- Usually come to Dinner
- Smokers spend slightly more, but the difference is minimal

Rich People, Top 10:

- Usually come to Dinner
- Non-smokers give significantly higher total bills and tips

Medium, Top 100:

- Lunch customers tip slightly more on average
- Smokers have higher bills, but non-smokers tip more

Conclusion

The main target is male and dinner-focused people.

Smoking has a minimal impact on the average customer,
but slightly different for high-value,non-smoker customers.

In the mid range, smokers might spend more on food,
but non-smokers are spend more on tip.

Restaurant should target dinner service and
non smoking environments to attract the highest spenders.