RAJALAKSHMI ENGINEERING COLLEGE

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Department of Computer Science and Engineering

CS23334 Fundamentals of Data Science Lab

III semester II Year (2023R)

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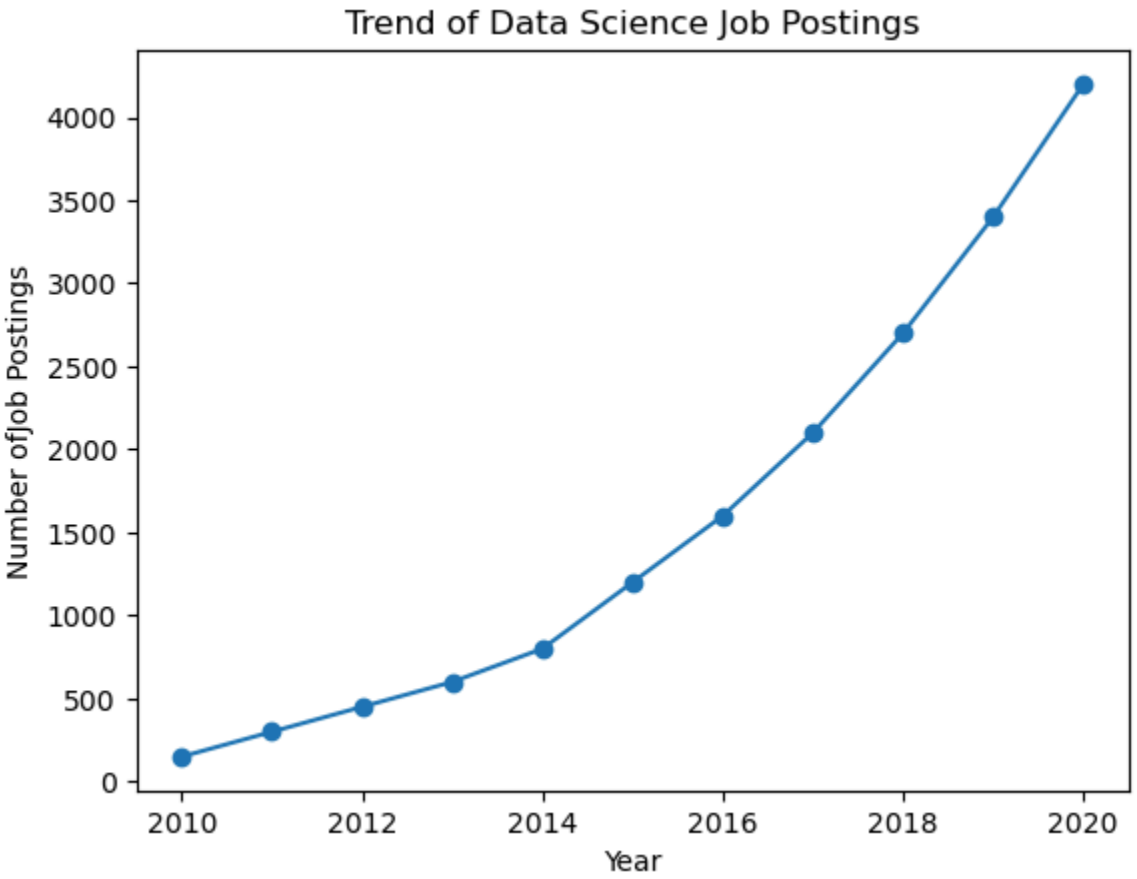
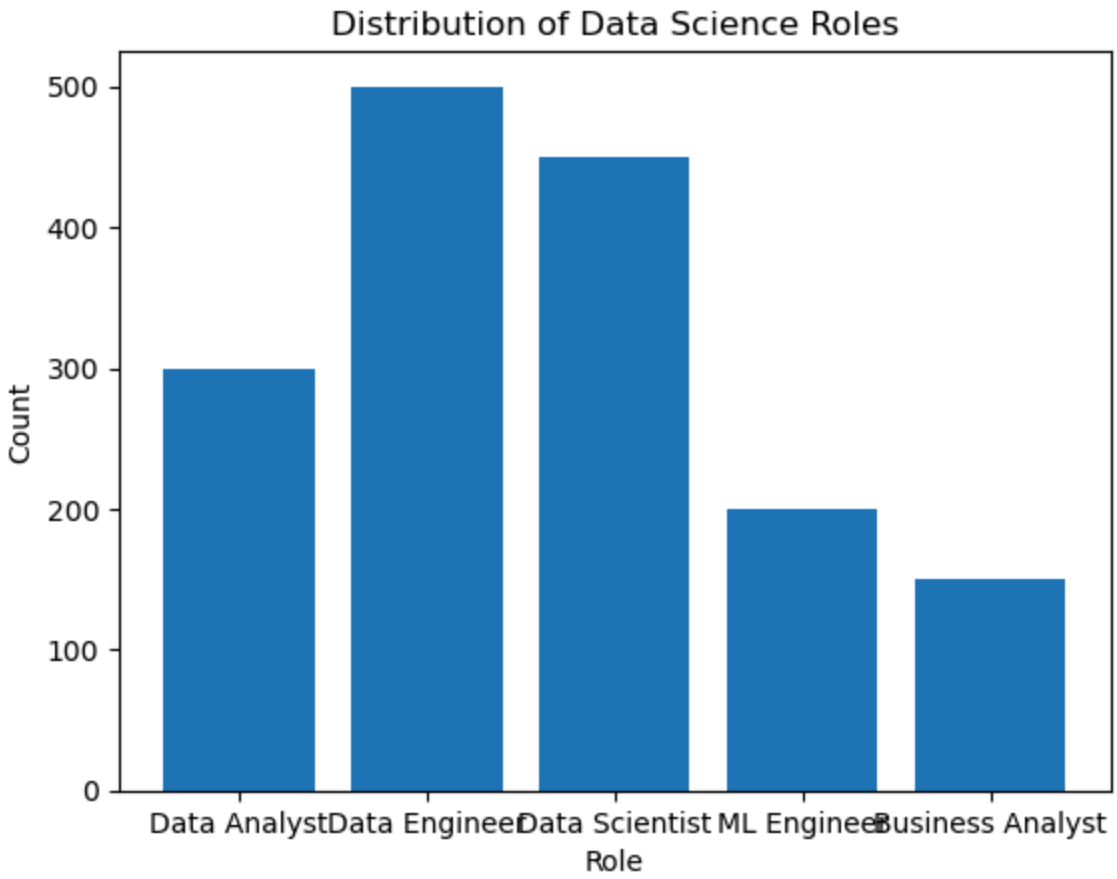
In [2]:
```
import pandas as pd
import matplotlib.pyplot as plt
data = {'Year': list(range(2010, 2021)),
'Job Postings': [150, 300, 450, 600, 800, 1200, 1600, 2100, 2700, 3400, 4200]}

df = pd.DataFrame(data)
plt.plot(df['Year'], df['Job Postings'], marker='o')
plt.title('Trend of Data Science Job Postings')
plt.xlabel('Year')
plt.ylabel('Number ofJob Postings')
plt.show()
```



In [4]:
```
roles = ['Data Analyst', 'Data Engineer', 'Data Scientist', 'ML Engineer',
'Business Analyst']
counts = [300, 500, 450, 200, 150]
plt.bar(roles, counts)
plt.title('Distribution of Data Science Roles')
plt.xlabel('Role')
plt.ylabel('Count')
plt.show()
```



In [8]:
```
structured_data = pd.DataFrame({
'ID': [1, 2, 3],
'Name': ['Alice', 'Bob', 'Charlie'],
'Age': [25, 30, 35]
})
print("Structured Data:\n", structured_data)
unstructured_data = "This is an example of unstructured data. It can be a piec
print("\nUnstructured Data:\n", unstructured_data)
semi_structured_data = {'ID': 1, 'Name': 'Alice', 'Attributes': {'Height': 165
print("\nSemi-structured Data:\n", semi_structured_data)
```

```
Structured Data:
    ID     Name  Age
0   1    Alice   25
1   2      Bob   30
2   3  Charlie   35

Unstructured Data:
 This is an example of unstructured data. It can be a piece of text, an image,
or a video file.

Semi-structured Data:
 {'ID': 1, 'Name': 'Alice', 'Attributes': {'Height': 165, 'Weight': 68}}
```

In [9]:
```
from cryptography.fernet import Fernet
key = Fernet.generate_key()
```

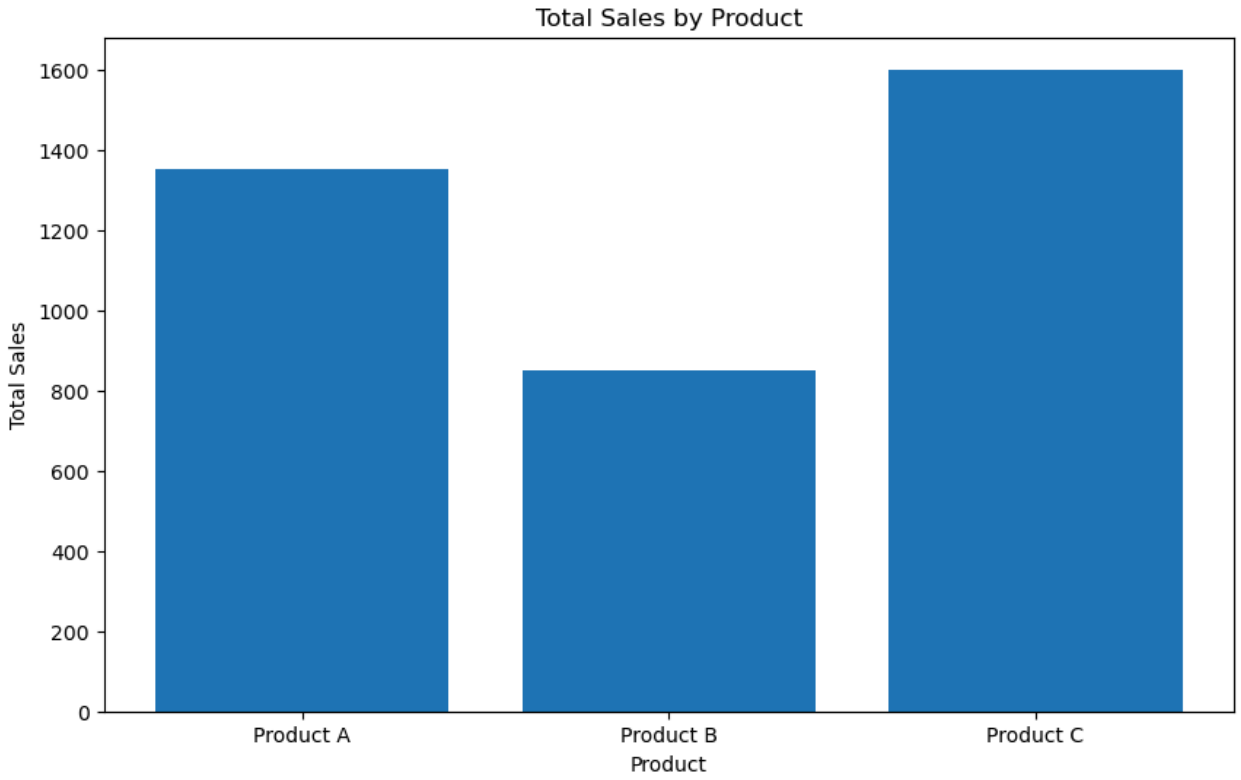
```
f = Fernet(key)
token = f.encrypt(b"Rajalakshmi Engineering College")
token
b'...'
f.decrypt(token)
b'Rajalakshmi Engineering College'
key = Fernet.generate_key()
cipher_suite = Fernet(key)
plain_text = b"Rajalakshmi Engineering College."
cipher_text = cipher_suite.encrypt(plain_text)
decrypted_text = cipher_suite.decrypt(cipher_text)
print("Original Data:", plain_text)
print("Encrypted Data:", cipher_text)
print("Decrypted Data:", decrypted_text)
```

```
Original Data: b'Rajalakshmi Engineering College.'
Encrypted Data: b'gAAAAABoy36qv8K3SP9FFkL2oRrpeWkWLVEvk63Dqp-w35qlyqsA9NQQVIm1k
Oj7v4oGW8PCYvo5jxuF7ZKg5sguSI5uilUWsdXEeEMAWg1hJIjaOZeOWzGSkTkI7p40qIUIthzL8e6
x'
Decrypted Data: b'Rajalakshmi Engineering College.'
```

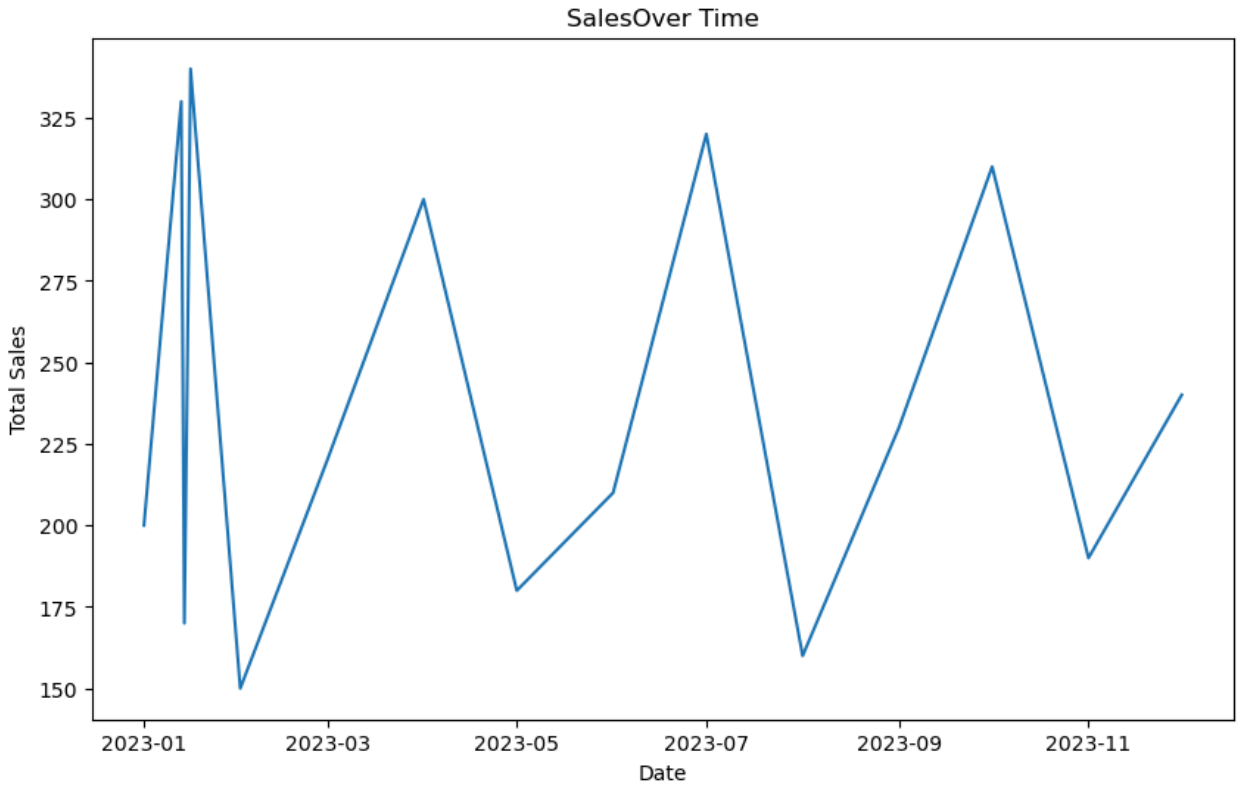
In [3]:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
# Load the data into a pandas DataFrame
file_path='D:\sales_data.csv'
df = pd.read_csv(file_path)
# Display the first few rows of the DataFrame
print(df.head())
# Check for missing values
print(df.isnull().sum())
# Fill or drop missing values if necessary
df['Sales'].fillna(df['Sales'].mean(), inplace=True)
df.dropna(subset=['Product', 'Quantity', 'Region'], inplace=True)
# Summary statistics
print(df.describe())
product_summary = df.groupby('Product').agg({
'Sales': 'sum',
'Quantity': 'sum'
}).reset_index()
print(product_summary)
plt.figure(figsize=(10, 6))
plt.bar(product_summary['Product'], product_summary['Sales'])
plt.xlabel('Product')
plt.ylabel('Total Sales')
plt.title('Total Sales by Product')
plt.show()
df['Date'] = pd.to_datetime(df['Date'])
sales_over_time = df.groupby('Date').agg({'Sales': 'sum'}).reset_index()
plt.figure(figsize=(10, 6))
plt.plot(sales_over_time['Date'],sales_over_time['Sales'])
plt.xlabel('Date')
plt.ylabel('Total Sales')
plt.title('SalesOver Time')
plt.show()
pivot_table = df.pivot_table(values='Sales', index='Region', columns='Product'
aggfunc=np.sum, fill_value=0)
print(pivot_table)
# Correlation matrix
correlation_matrix = df.corr()
print(correlation_matrix)
# Heatmap of the correlation matrix
import seaborn as sns
plt.figure(figsize=(8, 6))
sns.heatmap(correlation_matrix, annot=True, cmap='coolwarm')
plt.title('Correlation Matrix')
plt.show()
```

```
         Date    Product  Sales  Quantity Region
0  01-01-2023  Product A    200         4  North
1  02-01-2023  Product B    150         3  South
2  03-01-2023  Product A    220         5  North
3  04-01-2023  Product C    300         6   East
4  05-01-2023  Product B    180         4   West
Date        0
Product     0
Sales       0
Quantity    0
Region      0
dtype: int64
            Sales   Quantity
count   16.000000  16.000000
mean   237.500000   5.375000
std     64.031242   1.746425
min    150.000000   3.000000
25%    187.500000   4.000000
50%    225.000000   5.500000
75%    302.500000   7.000000
max    340.000000   8.000000
     Product  Sales  Quantity
0  Product A   1350        33
1  Product B    850        17
2  Product C   1600        36
```

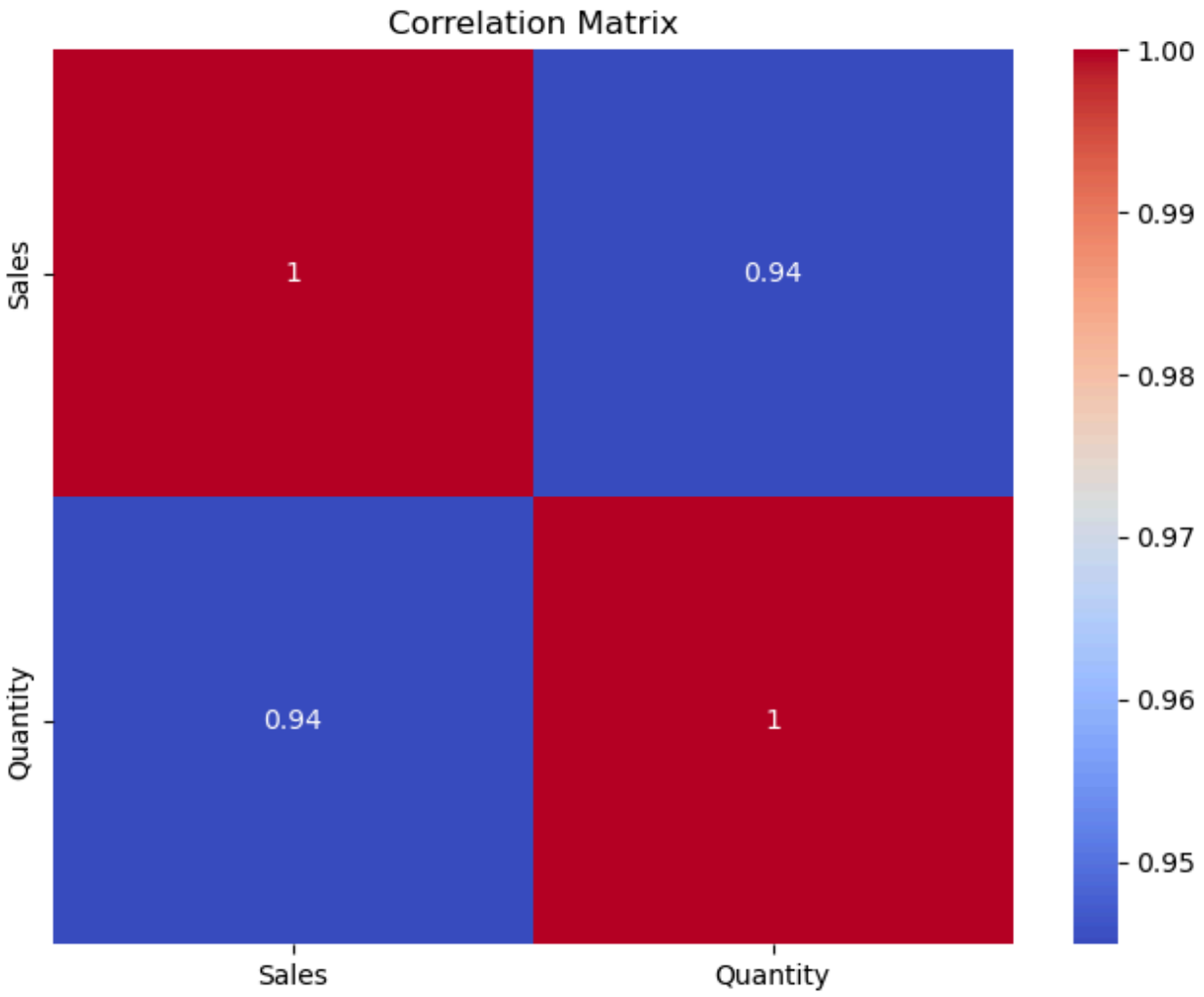



```
C:\Users\REC\AppData\Local\Temp\ipykernel_15972\889183971.py:27: UserWarning: P
arsing dates in DD/MM/YYYY format when dayfirst=False (the default) was specifi
ed. This may lead to inconsistently parsed dates! Specify a format to ensure co
nsistent parsing.
  df['Date'] = pd.to_datetime(df['Date'])
```



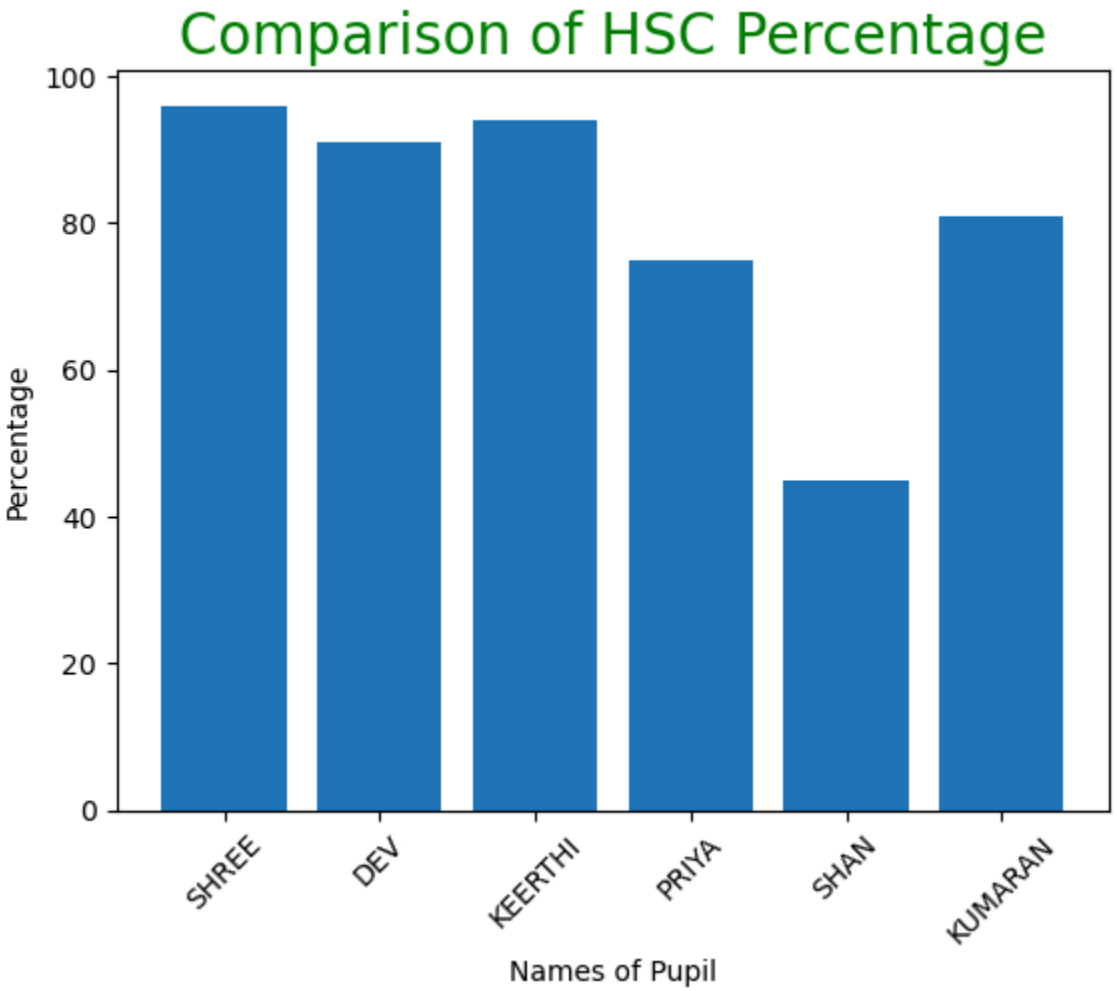

```
Product  Product A  Product B  Product C
Region
East             0          0       1600
North         1350          0          0
South            0        480          0
West             0        370          0
              Sales  Quantity
Sales      1.000000  0.944922
Quantity   0.944922  1.000000
```

```
C:\Users\REC\AppData\Local\Temp\ipykernel_15972\889183971.py:39: FutureWarning:
The default value of numeric_only in DataFrame.corr is deprecated. In a future
version, it will default to False. Select only valid columns or specify the val
ue of numeric_only to silence this warning.
  correlation_matrix = df.corr()
```


Correlation Matrix
Sales
Quantity
1
0.94
0.94
1
Sales
Quantity
1.00
0.99
0.98
0.97
0.96
0.95

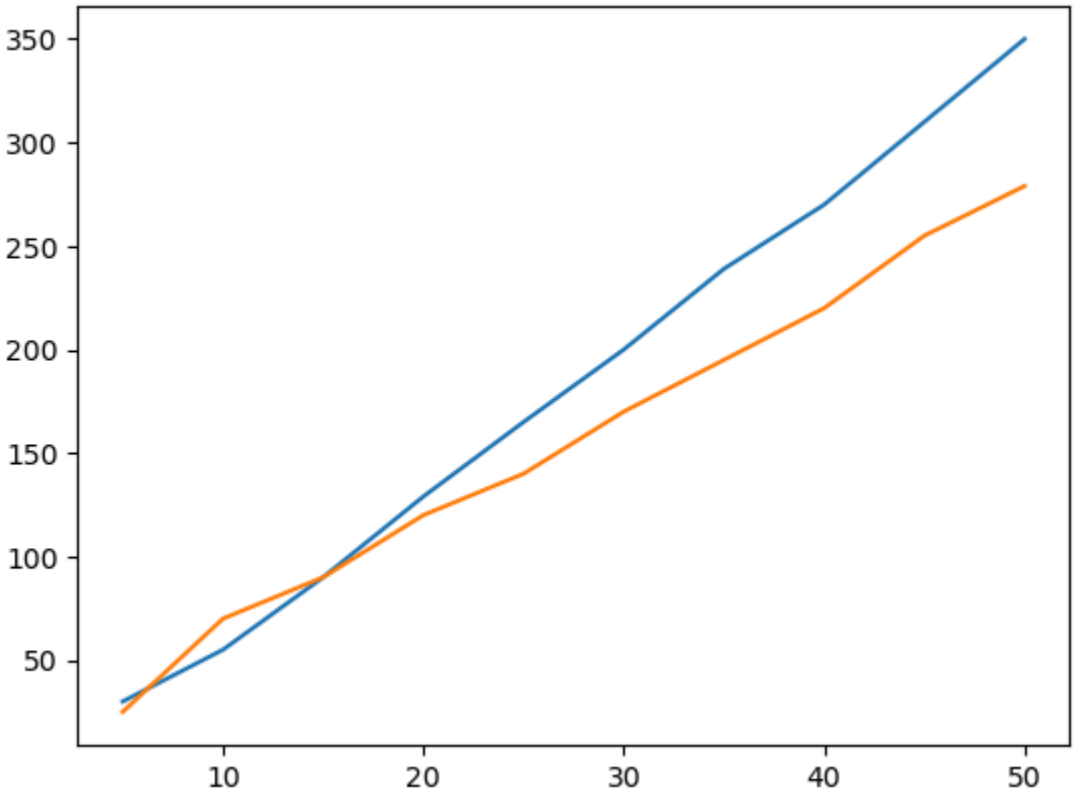
In [ ]:

In [3]:
```
import matplotlib.pyplot as hscmark
import numpy as np
Names = ['SHREE', 'DEV', 'KEERTHI', 'PRIYA', 'SHAN', 'KUMARAN']
xaxis = np.arange(len(Names))
Percentage_hsc = [96, 91, 94, 75, 45, 81]
hscmark.bar(Names, Percentage_hsc)
hscmark.xticks(xaxis, Names, rotation=45)
hscmark.xlabel("Names of Pupil")
hscmark.ylabel("Percentage")
hscmark.title("Comparison of HSC Percentage", fontsize=20, color="green")
hscmark.show()
```



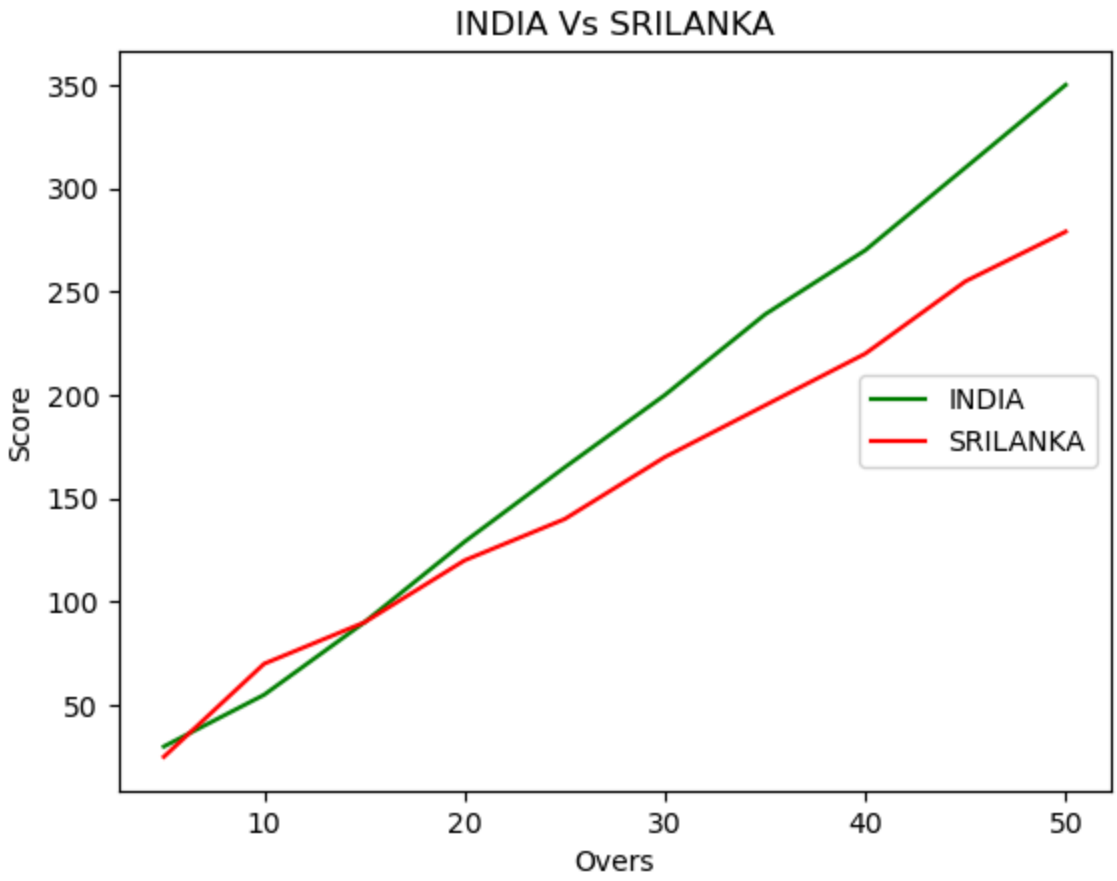
In [5]:
```
import matplotlib.pyplot as cricket
Overs=list(range(5,51,5))
Indian_Score=[30,55,90,129,165,200,239,270,310,350]
Srilankan_Score=[25,70,90,120,140,170,195,220,255,279]
cricket.plot(Overs,Indian_Score)
cricket.plot(Overs,Srilankan_Score)
cricket.show()
cricket.title("INDIA Vs SRILANKA")
cricket.xlabel("Overs")
cricket.ylabel("Score")
cricket.legend()
```

```
cricket.plot(Overs,Indian_Score,color="green",label="INDIA")
cricket.plot(Overs,Srilankan_Score,color="red",label="SRILANKA")
cricket.legend(loc="center right")
```

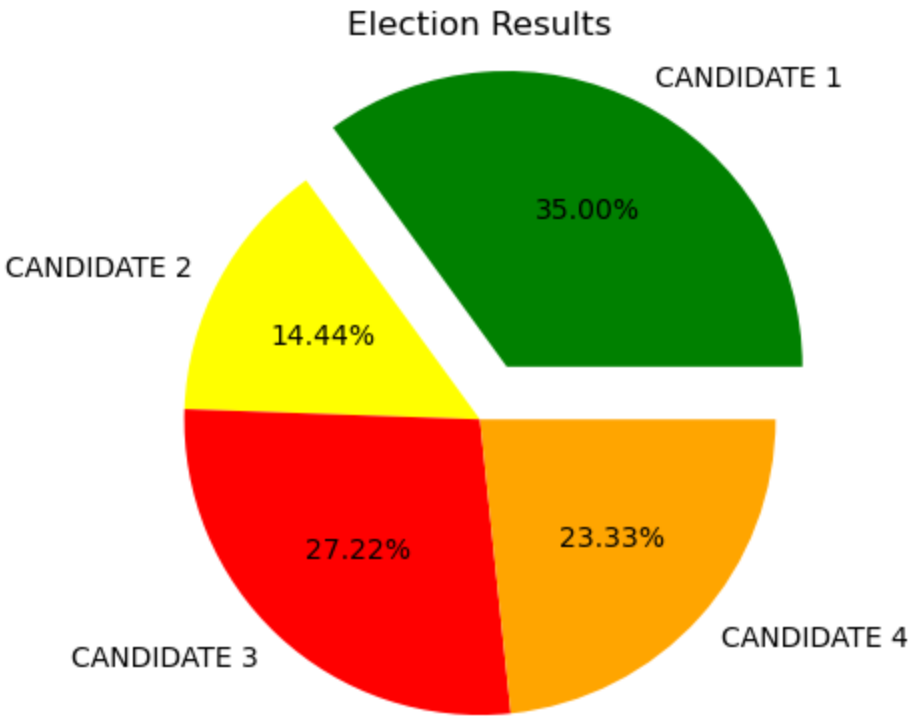



```
No artists with labels found to put in legend.  Note that artists whose label s
tart with an underscore are ignored when legend() is called with no argument.
```

Out[5]: <matplotlib.legend.Legend at 0x1f79da80e80>



In [6]:
```
import matplotlib.pyplot as election
labels = ['CANDIDATE 1', 'CANDIDATE 2', 'CANDIDATE 3', 'CANDIDATE 4']
Votes = [315, 130, 245, 210]
colors = ['green', 'yellow', 'red', 'orange']
explode = (0.2, 0, 0, 0)
election.pie(Votes, labels=labels, colors=colors, explode=explode, autopct='%0
election.title('Election Results')
election.show()
```


Election Results
CANDIDATE 1
35.00%
CANDIDATE 2
14.44%
27.22%
23.33%
CANDIDATE 3
CANDIDATE 4

In [6]:
```
import nltk
from nltk.tokenize import word_tokenize
from nltk.corpus import gutenberg
nltk.download('gutenberg')
nltk.download('punkt')
sample = gutenberg.raw("austen-emma.txt")
token = word_tokenize(sample)
wlist = []
for i in range(50):
    wlist.append(token[i])
wordfreq = [wlist.count(w) for w in wlist]
print("Pairs\n" + str(list(zip(wlist, wordfreq))))
```

```
[nltk_data] Downloading package gutenberg to
[nltk_data]     C:\Users\REC\AppData\Roaming\nltk_data...
[nltk_data]   Package gutenberg is already up-to-date!
[nltk_data] Downloading package punkt to
[nltk_data]     C:\Users\REC\AppData\Roaming\nltk_data...
[nltk_data]   Package punkt is already up-to-date!
Pairs
[('[', 1), ('Emma', 2), ('by', 1), ('Jane', 1), ('Austen', 1), ('1816', 1),
(']', 1), ('VOLUME', 1), ('I', 2), ('CHAPTER', 1), ('I', 2), ('Emma', 2), ('Woo
dhouse', 1), (',', 5), ('handsome', 1), (',', 5), ('clever', 1), (',', 5), ('an
d', 3), ('rich', 1), (',', 5), ('with', 2), ('a', 1), ('comfortable', 1), ('hom
e', 1), ('and', 3), ('happy', 1), ('disposition', 1), (',', 5), ('seemed', 1),
('to', 1), ('unite', 1), ('some', 1), ('of', 2), ('the', 2), ('best', 1), ('ble
ssings', 1), ('of', 2), ('existence', 1), (';', 1), ('and', 3), ('had', 1), ('l
ived', 1), ('nearly', 1), ('twenty-one', 1), ('years', 1), ('in', 1), ('the',
2), ('world', 1), ('with', 2)]
```

In [ ]:

In [ ]:

In [3]:
```
import pandas as pd
db = pd.read_csv("D:\diabetes.csv")
print(db.head())
print(db.info())
print(db.describe())
import matplotlib.pyplot as plt
import seaborn as sns
db.hist(bins=50,figsize=(20,15))
plt.show()
sns.pairplot(db)
plt.show()
```

```
Empty DataFrame
Columns: [Pregnancies, Glucose, BloodPressure, SkinThickness, Insulin, BMI, Dia
betesPedigreeFunction, Age, Outcome]
Index: []
<class 'pandas.core.frame.DataFrame'>
Index: 0 entries
Data columns (total 9 columns):
 #   Column                    Non-Null Count  Dtype
---  ------                    --------------  -----
 0   Pregnancies               0 non-null      object
 1   Glucose                   0 non-null      object
 2   BloodPressure             0 non-null      object
 3   SkinThickness             0 non-null      object
 4   Insulin                   0 non-null      object
 5   BMI                       0 non-null      object
 6   DiabetesPedigreeFunction  0 non-null      object
 7   Age                       0 non-null      object
 8   Outcome                   0 non-null      object
dtypes: object(9)
memory usage: 0.0+ bytes
None
       Pregnancies Glucose BloodPressure SkinThickness Insulin  BMI  \
count            0       0             0             0       0    0
unique           0       0             0             0       0    0
top            NaN     NaN           NaN           NaN     NaN  NaN
freq           NaN     NaN           NaN           NaN     NaN  NaN

       DiabetesPedigreeFunction  Age Outcome
count                         0    0       0
unique                        0    0       0
top                         NaN  NaN     NaN
freq                        NaN  NaN     NaN
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
Cell In[3], line 8
      6 import matplotlib.pyplot as plt
      7 import seaborn as sns
----> 8 db.hist(bins=50,figsize=(20,15))
      9 plt.show()
     10 sns.pairplot(db)

File C:\ProgramData\anaconda3\lib\site-packages\pandas\plotting\_core.py:231, i
n hist_frame(data, column, by, grid, xlabelsize, xrot, ylabelsize, yrot, ax, sh
arex, sharey, figsize, layout, bins, backend, legend, **kwargs)
    140 """
    141 Make a histogram of the DataFrame's columns.
    142
   (...)
    228     >>> hist = df.hist(bins=3)
    229 """
    230 plot_backend = _get_plot_backend(backend)
--> 231 return plot_backend.hist_frame(
    232     data,
    233     column=column,
    234     by=by,
    235     grid=grid,
    236     xlabelsize=xlabelsize,
    237     xrot=xrot,
    238     ylabelsize=ylabelsize,
    239     yrot=yrot,
    240     ax=ax,
    241     sharex=sharex,
    242     sharey=sharey,
    243     figsize=figsize,
    244     layout=layout,
    245     legend=legend,
    246     bins=bins,
    247     **kwargs,
    248 )

File C:\ProgramData\anaconda3\lib\site-packages\pandas\plotting\_matplotlib\his
t.py:499, in hist_frame(data, column, by, grid, xlabelsize, xrot, ylabelsize, y
rot, ax, sharex, sharey, figsize, layout, bins, legend, **kwds)
    496 naxes = len(data.columns)
    498 if naxes == 0:
--> 499     raise ValueError(
    500         "hist method requires numerical or datetime columns, nothing to
plot."
    501     )
    503 fig, axes = create_subplots(
    504     naxes=naxes,
    505     ax=ax,
   (...)
    510     layout=layout,
    511 )
    512 _axes = flatten_axes(axes)
```

```
ValueError: hist method requires numerical or datetime columns, nothing to plo
t.
```

In [1]:

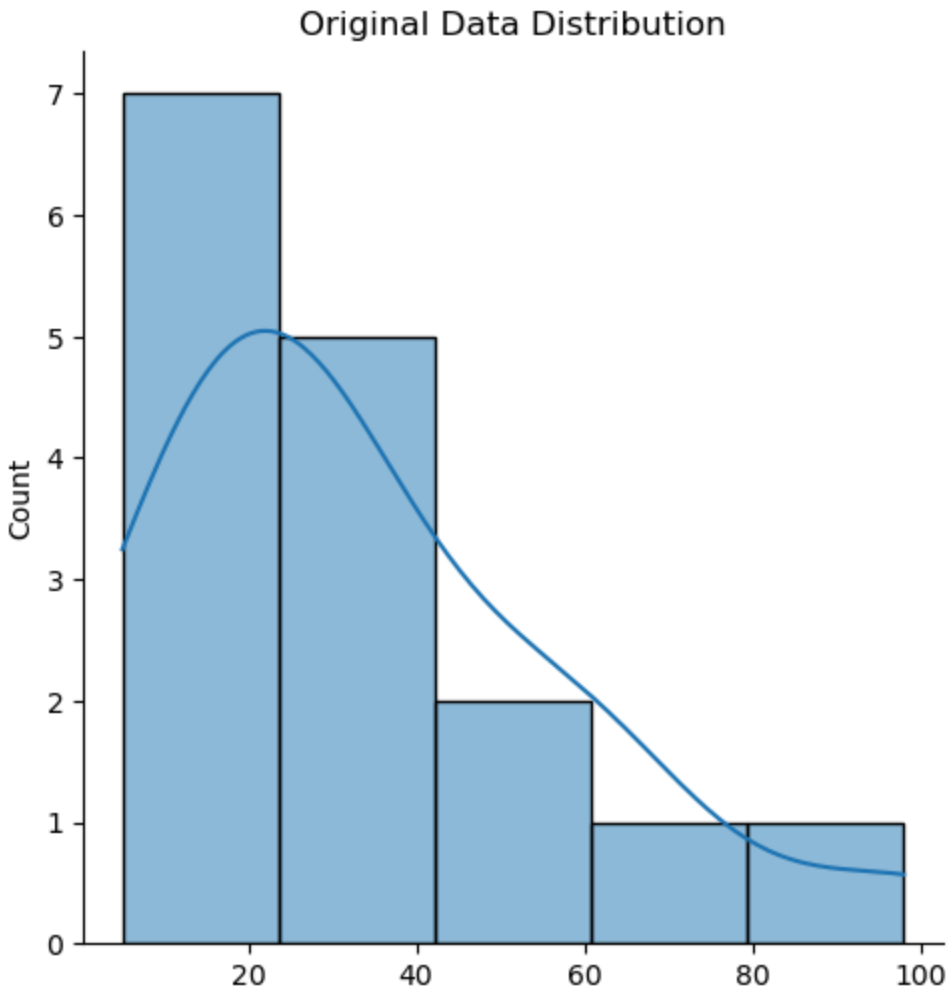
```
import numpy as np
import pandas as pd

df = pd.read_csv("D:\Hotel_Dataset.csv")

print(df.duplicated())

df.drop_duplicates(inplace=True)

index = np.array(list(range(0, len(df))))
df.set_index(index, inplace=True)

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

df.loc[df.CustomerID < 0, 'CustomerID'] = np.nan
df.loc[df.Bill < 0, 'Bill'] = np.nan
df.loc[df.EstimatedSalary < 0, 'EstimatedSalary'] = np.nan
df.loc[(df.NoOfPax < 1) | (df.NoOfPax > 20), 'NoOfPax'] = np.nan

df.Hotel.replace(['Ibys'], 'Ibis', inplace=True)
df.FoodPreference.replace(['Vegetarian', 'veg'], 'Veg', inplace=True)
df.FoodPreference.replace(['non-Veg'], 'Non-Veg', inplace=True)

df.EstimatedSalary.fillna(round(df.EstimatedSalary.mean()), inplace=True)
df.NoOfPax.fillna(round(df.NoOfPax.median()), inplace=True)
df['Rating(1-5)'].fillna(round(df['Rating(1-5)'].median()), inplace=True)
df.Bill.fillna(round(df.Bill.mean()), inplace=True)

print(df)
```

```
0     False
1     False
2     False
3     False
4     False
5     False
6     False
7     False
8     False
9      True
10    False
dtype: bool
   CustomerID Age_Group  Rating(1-5)      Hotel FoodPreference    Bill  \
0         1.0     20-25            4       Ibis            Veg  1300.0
1         2.0     30-35            5  LemonTree        Non-Veg  2000.0
2         3.0     25-30            6    RedFox            Veg  1322.0
3         4.0     20-25           -1  LemonTree            Veg  1234.0
4         5.0       35+            3       Ibis            Veg   989.0
5         6.0       35+            3       Ibis        Non-Veg  1909.0
6         7.0       35+            4    RedFox            Veg  1000.0
7         8.0     20-25            7  LemonTree            Veg  2999.0
8         9.0     25-30            2       Ibis        Non-Veg  3456.0
9        10.0     30-35            5    RedFox        Non-Veg  6755.0

   NoOfPax  EstimatedSalary
0      2.0          40000.0
1      3.0          59000.0
2      2.0          30000.0
3      2.0         120000.0
4      2.0          45000.0
5      2.0         122220.0
6      2.0          21122.0
7      2.0         345673.0
8      3.0          96755.0
9      4.0          87777.0
```

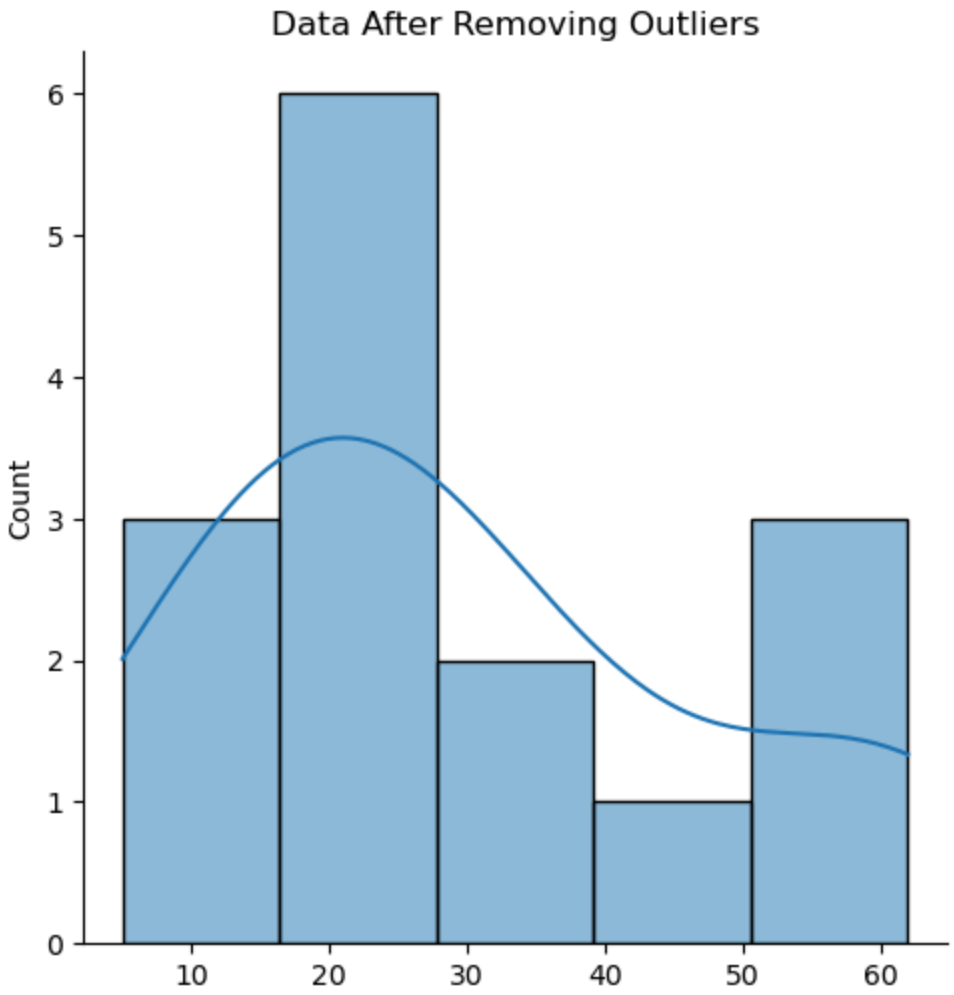
In [3]:

```
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
array = np.random.randint(1, 100, 16)
print("Original Array:", array)
print("Mean:", array.mean())
print("Q1 (25%):", np.percentile(array, 25))
print("Median (50%):", np.percentile(array, 50))
print("Q3 (75%):", np.percentile(array, 75))
print("Max:", np.percentile(array, 100))
def outDetection(array):
    Q1, Q3 = np.percentile(array, [25, 75])
    IQR = Q3 - Q1
    lr = Q1 - (1.5 * IQR)
    ur = Q3 + (1.5 * IQR)
    return lr, ur

lr, ur = outDetection(array)
print("Lower Range:", lr, "Upper Range:", ur)
sns.displot(array, kde=True)
plt.title("Original Data Distribution")
plt.show()
new_array = array[(array > lr) & (array < ur)]
print("Array without outliers:", new_array)

sns.displot(new_array, kde=True)
plt.title("Data After Removing Outliers")
plt.show()
lr1, ur1 = outDetection(new_array)
final_array = new_array[(new_array > lr1) & (new_array < ur1)]
print("Final Cleaned Array:", final_array)

sns.displot(final_array, kde=True)
plt.title("Final Cleaned Data Distribution")
plt.show()
```

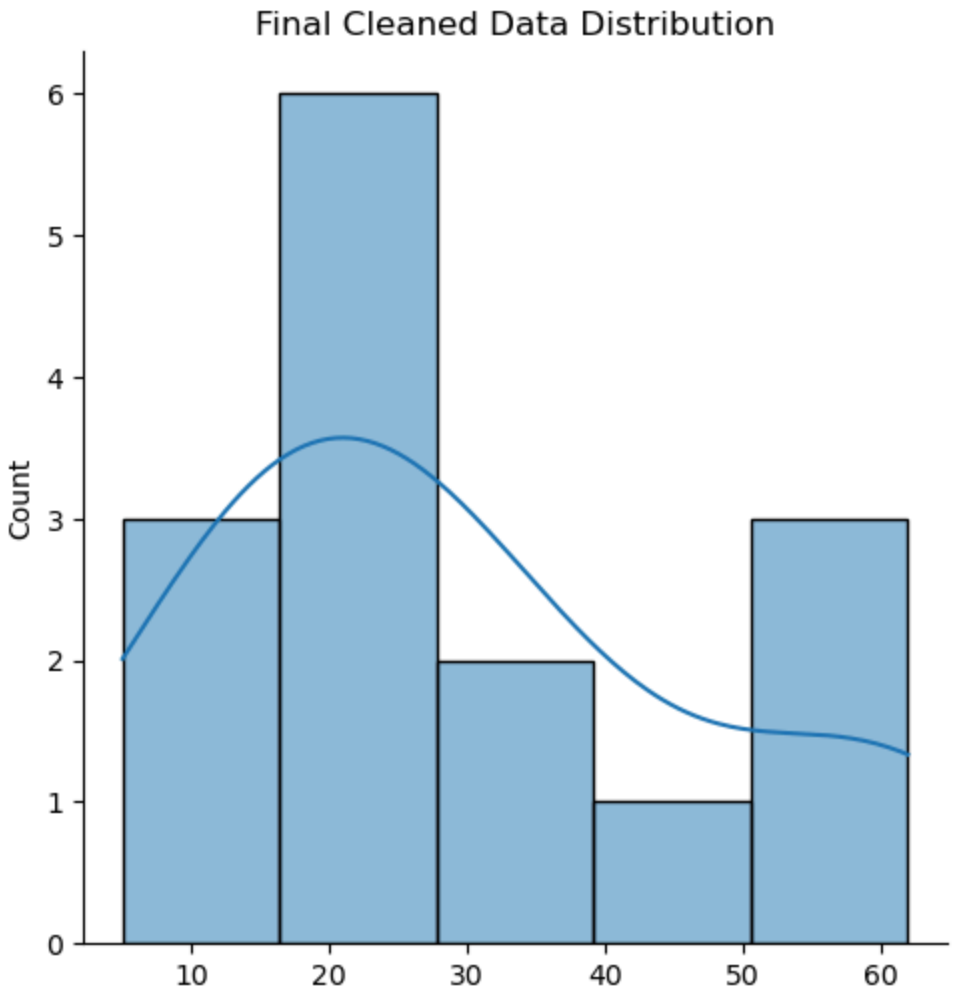
```
Original Array: [18 27  5  9 60 23 40 25 31 62 19 98 17 38 58 13]
Mean: 33.9375
Q1 (25%): 17.75
Median (50%): 26.0
Q3 (75%): 44.5
Max: 98.0
Lower Range: -22.375 Upper Range: 84.625
```




```
Array without outliers: [18 27  5  9 60 23 40 25 31 62 19 17 38 58 13]
```




```
Final Cleaned Array: [18 27  5  9 60 23 40 25 31 62 19 17 38 58 13]
```


Final Cleaned Data Distribution
Count
0
1
2
3
4
5
6
10
20
30
40
50
60

In [ ]:

In [ ]:

In [2]:

```
import numpy as np
import pandas as pd
from sklearn.impute import SimpleImputer
from sklearn.preprocessing import OneHotEncoder, StandardScaler, MinMaxScaler

df = pd.read_csv('E:\pre_process_datasample.csv')
print("Initial DataFrame:\n", df, "\n")

df.Country.fillna(df.Country.mode()[0], inplace=True)

features = df.iloc[:, :-1].values
label = df.iloc[:, -1].values

age = SimpleImputer(strategy="mean", missing_values=np.nan)
Salary = SimpleImputer(strategy="mean", missing_values=np.nan)

age.fit(features[:, [1]])
Salary.fit(features[:, [2]])

features[:, [1]] = age.transform(features[:, [1]])
features[:, [2]] = Salary.transform(features[:, [2]])

print("After Missing Value Imputation:\n", features, "\n")

oh = OneHotEncoder(sparse_output=False)
Country = oh.fit_transform(features[:, [0]])

final_set = np.concatenate((Country, features[:, [1, 2]]), axis=1)
print("After One-Hot Encoding:\n", final_set, "\n")

sc = StandardScaler()
feat_standard_scaler = sc.fit_transform(final_set)
print("After Standard Scaling:\n", feat_standard_scaler, "\n")

mms = MinMaxScaler(feature_range=(0, 1))
feat_minmax_scaler = mms.fit_transform(final_set)
print("After Min-Max Scaling:\n", feat_minmax_scaler)
```

```
Initial DataFrame:
    Country   Age   Salary Purchased
0   France  44.0  72000.0        No
1    Spain  27.0  48000.0       Yes
2  Germany  30.0  54000.0        No
3    Spain  38.0  61000.0        No
4  Germany  40.0      NaN       Yes
5   France  35.0  58000.0       Yes
6    Spain   NaN  52000.0        No
7   France  48.0  79000.0       Yes
8  Germany  50.0  83000.0        No
9   France  37.0  67000.0       Yes

After Missing Value Imputation:
 [['France' 44.0 72000.0]
 ['Spain' 27.0 48000.0]
 ['Germany' 30.0 54000.0]
 ['Spain' 38.0 61000.0]
 ['Germany' 40.0 63777.77777777778]
 ['France' 35.0 58000.0]
 ['Spain' 38.77777777777778 52000.0]
 ['France' 48.0 79000.0]
 ['Germany' 50.0 83000.0]
 ['France' 37.0 67000.0]]

After One-Hot Encoding:
 [[1.0 0.0 0.0 44.0 72000.0]
 [0.0 0.0 1.0 27.0 48000.0]
 [0.0 1.0 0.0 30.0 54000.0]
 [0.0 0.0 1.0 38.0 61000.0]
 [0.0 1.0 0.0 40.0 63777.77777777778]
 [1.0 0.0 0.0 35.0 58000.0]
 [0.0 0.0 1.0 38.77777777777778 52000.0]
 [1.0 0.0 0.0 48.0 79000.0]
 [0.0 1.0 0.0 50.0 83000.0]
 [1.0 0.0 0.0 37.0 67000.0]]

After Standard Scaling:
 [[ 1.22474487e+00 -6.54653671e-01 -6.54653671e-01  7.58874362e-01
   7.49473254e-01]
 [-8.16496581e-01 -6.54653671e-01  1.52752523e+00 -1.71150388e+00
  -1.43817841e+00]
 [-8.16496581e-01  1.52752523e+00 -6.54653671e-01 -1.27555478e+00
  -8.91265492e-01]
 [-8.16496581e-01 -6.54653671e-01  1.52752523e+00 -1.13023841e-01
  -2.53200424e-01]
 [-8.16496581e-01  1.52752523e+00 -6.54653671e-01  1.77608893e-01
   6.63219199e-16]
 [ 1.22474487e+00 -6.54653671e-01 -6.54653671e-01 -5.48972942e-01
  -5.26656882e-01]
 [-8.16496581e-01 -6.54653671e-01  1.52752523e+00  0.00000000e+00
  -1.07356980e+00]
 [ 1.22474487e+00 -6.54653671e-01 -6.54653671e-01  1.34013983e+00
   1.38753832e+00]
```

```
 [-8.16496581e-01  1.52752523e+00 -6.54653671e-01  1.63077256e+00
   1.75214693e+00]
 [ 1.22474487e+00 -6.54653671e-01 -6.54653671e-01 -2.58340208e-01
   2.93712492e-01]]

After Min-Max Scaling:
 [[1.         0.         0.         0.73913043 0.68571429]
 [0.         0.         1.         0.         0.        ]
 [0.         1.         0.         0.13043478 0.17142857]
 [0.         0.         1.         0.47826087 0.37142857]
 [0.         1.         0.         0.56521739 0.45079365]
 [1.         0.         0.         0.34782609 0.28571429]
 [0.         0.         1.         0.51207729 0.11428571]
 [1.         0.         0.         0.91304348 0.88571429]
 [0.         1.         0.         1.         1.        ]
 [1.         0.         0.         0.43478261 0.54285714]]
```

```
<>:6: SyntaxWarning: invalid escape sequence '\p'
<>:6: SyntaxWarning: invalid escape sequence '\p'
C:\Users\sownd\AppData\Local\Temp\ipykernel_14424\2206898782.py:6: SyntaxWarnin
g: invalid escape sequence '\p'
  df = pd.read_csv('E:\pre_process_datasample.csv')
C:\Users\sownd\AppData\Local\Temp\ipykernel_14424\2206898782.py:9: FutureWarnin
g: A value is trying to be set on a copy of a DataFrame or Series through chain
ed assignment using an inplace method.
The behavior will change in pandas 3.0. This inplace method will never work bec
ause the intermediate object on which we are setting values always behaves as a
copy.

For example, when doing 'df[col].method(value, inplace=True)', try using 'df.me
thod({col: value}, inplace=True)' or df[col] = df[col].method(value) instead, t
o perform the operation inplace on the original object.


  df.Country.fillna(df.Country.mode()[0], inplace=True)
```

In [4]:

```python
#EXP 8 (B)
import numpy as np
import pandas as pd

df = pd.read_csv("E:\pre_process_datasample.csv")
print("Initial DataFrame:\n", df, "\n")

df.Country.fillna(df.Country.mode()[0], inplace=True)
df.Age.fillna(df.Age.median(), inplace=True)
df.Salary.fillna(round(df.Salary.mean()), inplace=True)
print("After Filling Missing Values:\n", df, "\n")

encoded_country = pd.get_dummies(df.Country)
print("Encoded Country Columns:\n", encoded_country, "\n")

updated_dataset = pd.concat([encoded_country, df.iloc[:, [1, 2, 3]]], axis=1)
print("Combined Dataset (Before Encoding 'Purchased'):\n", updated_dataset, "\
```

```
updated_dataset.Purchased.replace(['No', 'Yes'], [0, 1], inplace=True)
print("Final Preprocessed Dataset:\n", updated_dataset)
```

```
Initial DataFrame:
    Country   Age   Salary Purchased
0   France  44.0  72000.0        No
1    Spain  27.0  48000.0       Yes
2  Germany  30.0  54000.0        No
3    Spain  38.0  61000.0        No
4  Germany  40.0      NaN       Yes
5   France  35.0  58000.0       Yes
6    Spain   NaN  52000.0        No
7   France  48.0  79000.0       Yes
8  Germany  50.0  83000.0        No
9   France  37.0  67000.0       Yes

After Filling Missing Values:
    Country   Age   Salary Purchased
0   France  44.0  72000.0        No
1    Spain  27.0  48000.0       Yes
2  Germany  30.0  54000.0        No
3    Spain  38.0  61000.0        No
4  Germany  40.0  63778.0       Yes
5   France  35.0  58000.0       Yes
6    Spain  38.0  52000.0        No
7   France  48.0  79000.0       Yes
8  Germany  50.0  83000.0        No
9   France  37.0  67000.0       Yes

Encoded Country Columns:
    France  Germany  Spain
0    True    False  False
1   False    False   True
2   False     True  False
3   False    False   True
4   False     True  False
5    True    False  False
6   False    False   True
7    True    False  False
8   False     True  False
9    True    False  False

Combined Dataset (Before Encoding 'Purchased'):
    France  Germany  Spain   Age   Salary Purchased
0    True    False  False  44.0  72000.0        No
1   False    False   True  27.0  48000.0       Yes
2   False     True  False  30.0  54000.0        No
3   False    False   True  38.0  61000.0        No
4   False     True  False  40.0  63778.0       Yes
5    True    False  False  35.0  58000.0       Yes
6   False    False   True  38.0  52000.0        No
7    True    False  False  48.0  79000.0       Yes
8   False     True  False  50.0  83000.0        No
9    True    False  False  37.0  67000.0       Yes

Final Preprocessed Dataset:
    France  Germany  Spain   Age   Salary  Purchased
```

0	True	False	False	44.0	72000.0	0
1	False	False	True	27.0	48000.0	1
2	False	True	False	30.0	54000.0	0
3	False	False	True	38.0	61000.0	0
4	False	True	False	40.0	63778.0	1
5	True	False	False	35.0	58000.0	1
6	False	False	True	38.0	52000.0	0
7	True	False	False	48.0	79000.0	1
8	False	True	False	50.0	83000.0	0
9	True	False	False	37.0	67000.0	1

```
<>:5: SyntaxWarning: invalid escape sequence '\p'
<>:5: SyntaxWarning: invalid escape sequence '\p'
C:\Users\sownd\AppData\Local\Temp\ipykernel_21780\3069696153.py:5: SyntaxWarnin
g: invalid escape sequence '\p'
  df = pd.read_csv("E:\pre_process_datasample.csv")
C:\Users\sownd\AppData\Local\Temp\ipykernel_21780\3069696153.py:8: FutureWarnin
g: A value is trying to be set on a copy of a DataFrame or Series through chain
ed assignment using an inplace method.
The behavior will change in pandas 3.0. This inplace method will never work bec
ause the intermediate object on which we are setting values always behaves as a
copy.

For example, when doing 'df[col].method(value, inplace=True)', try using 'df.me
thod({col: value}, inplace=True)' or df[col] = df[col].method(value) instead, t
o perform the operation inplace on the original object.


  df.Country.fillna(df.Country.mode()[0], inplace=True)
C:\Users\sownd\AppData\Local\Temp\ipykernel_21780\3069696153.py:9: FutureWarnin
g: A value is trying to be set on a copy of a DataFrame or Series through chain
ed assignment using an inplace method.
The behavior will change in pandas 3.0. This inplace method will never work bec
ause the intermediate object on which we are setting values always behaves as a
copy.

For example, when doing 'df[col].method(value, inplace=True)', try using 'df.me
thod({col: value}, inplace=True)' or df[col] = df[col].method(value) instead, t
o perform the operation inplace on the original object.


  df.Age.fillna(df.Age.median(), inplace=True)
C:\Users\sownd\AppData\Local\Temp\ipykernel_21780\3069696153.py:10: FutureWarni
ng: A value is trying to be set on a copy of a DataFrame or Series through chai
ned assignment using an inplace method.
The behavior will change in pandas 3.0. This inplace method will never work bec
ause the intermediate object on which we are setting values always behaves as a
copy.

For example, when doing 'df[col].method(value, inplace=True)', try using 'df.me
thod({col: value}, inplace=True)' or df[col] = df[col].method(value) instead, t
o perform the operation inplace on the original object.


  df.Salary.fillna(round(df.Salary.mean()), inplace=True)
C:\Users\sownd\AppData\Local\Temp\ipykernel_21780\3069696153.py:19: FutureWarni
ng: A value is trying to be set on a copy of a DataFrame or Series through chai
ned assignment using an inplace method.
The behavior will change in pandas 3.0. This inplace method will never work bec
ause the intermediate object on which we are setting values always behaves as a
copy.

For example, when doing 'df[col].method(value, inplace=True)', try using 'df.me
thod({col: value}, inplace=True)' or df[col] = df[col].method(value) instead, t
o perform the operation inplace on the original object.
```

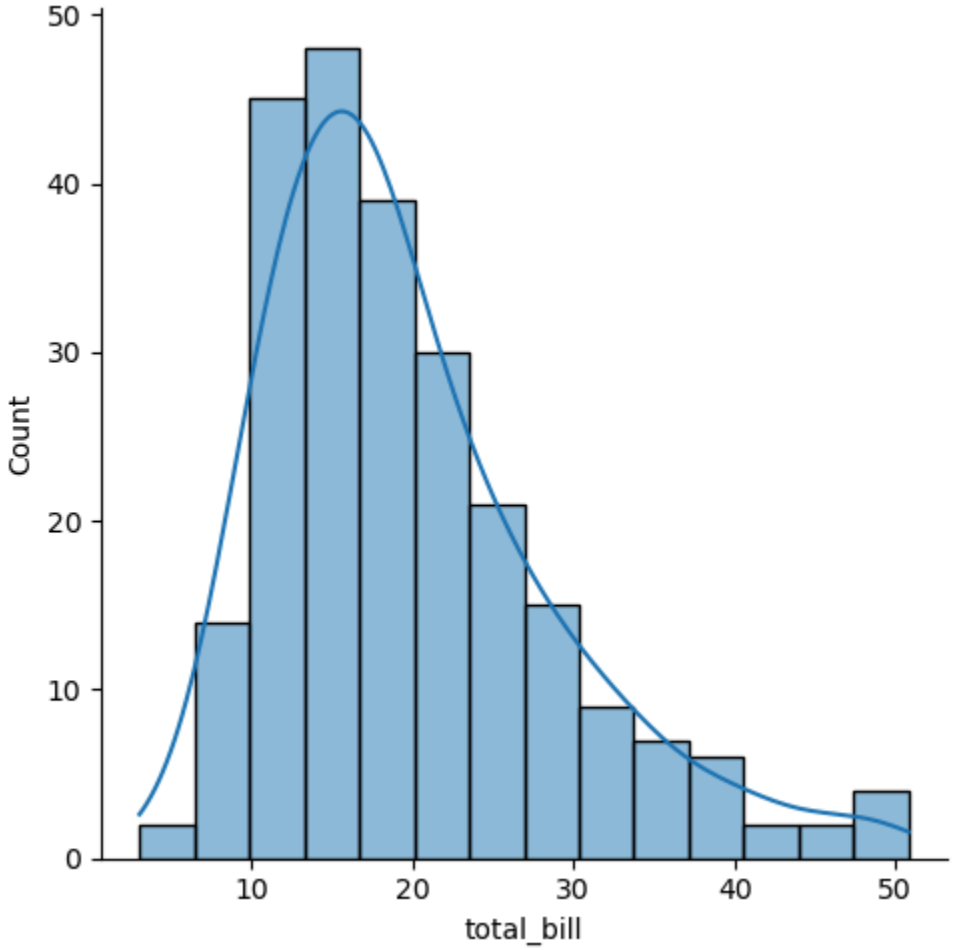
```
  updated_dataset.Purchased.replace(['No', 'Yes'], [0, 1], inplace=True)
C:\Users\sownd\AppData\Local\Temp\ipykernel_21780\3069696153.py:19: FutureWarni
ng: Downcasting behavior in `replace` is deprecated and will be removed in a fu
ture version. To retain the old behavior, explicitly call `result.infer_object
s(copy=False)`. To opt-in to the future behavior, set `pd.set_option('future.n
o_silent_downcasting', True)`
  updated_dataset.Purchased.replace(['No', 'Yes'], [0, 1], inplace=True)
```

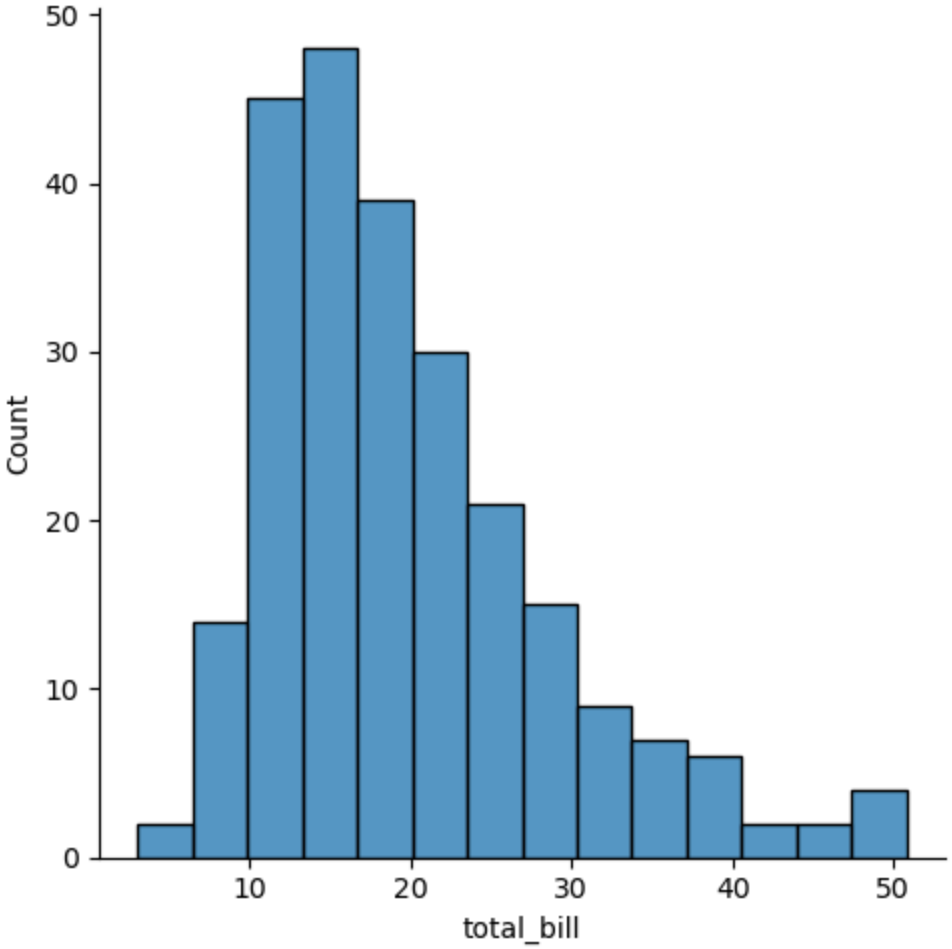
In [ ]:

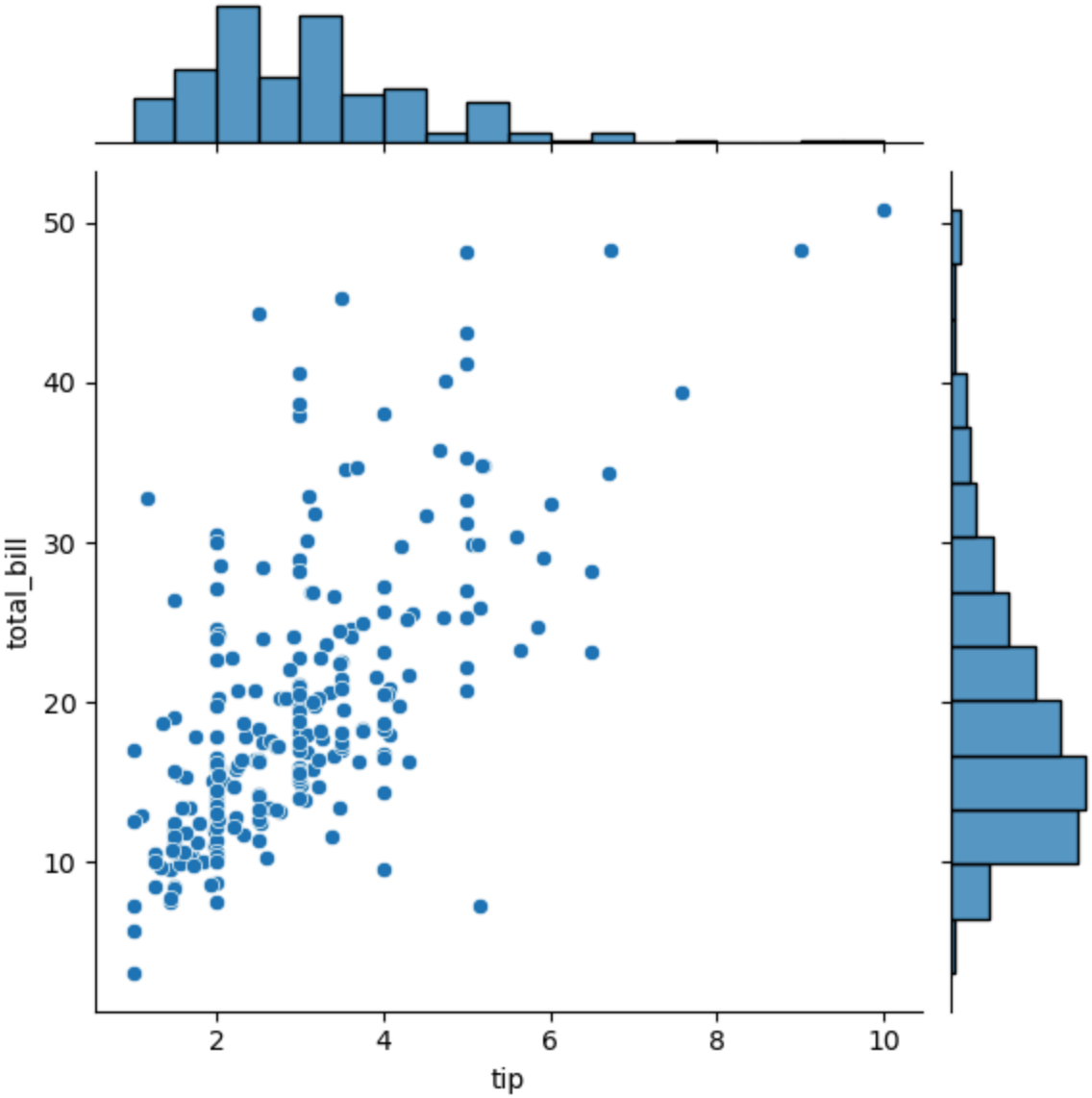
In [1]:

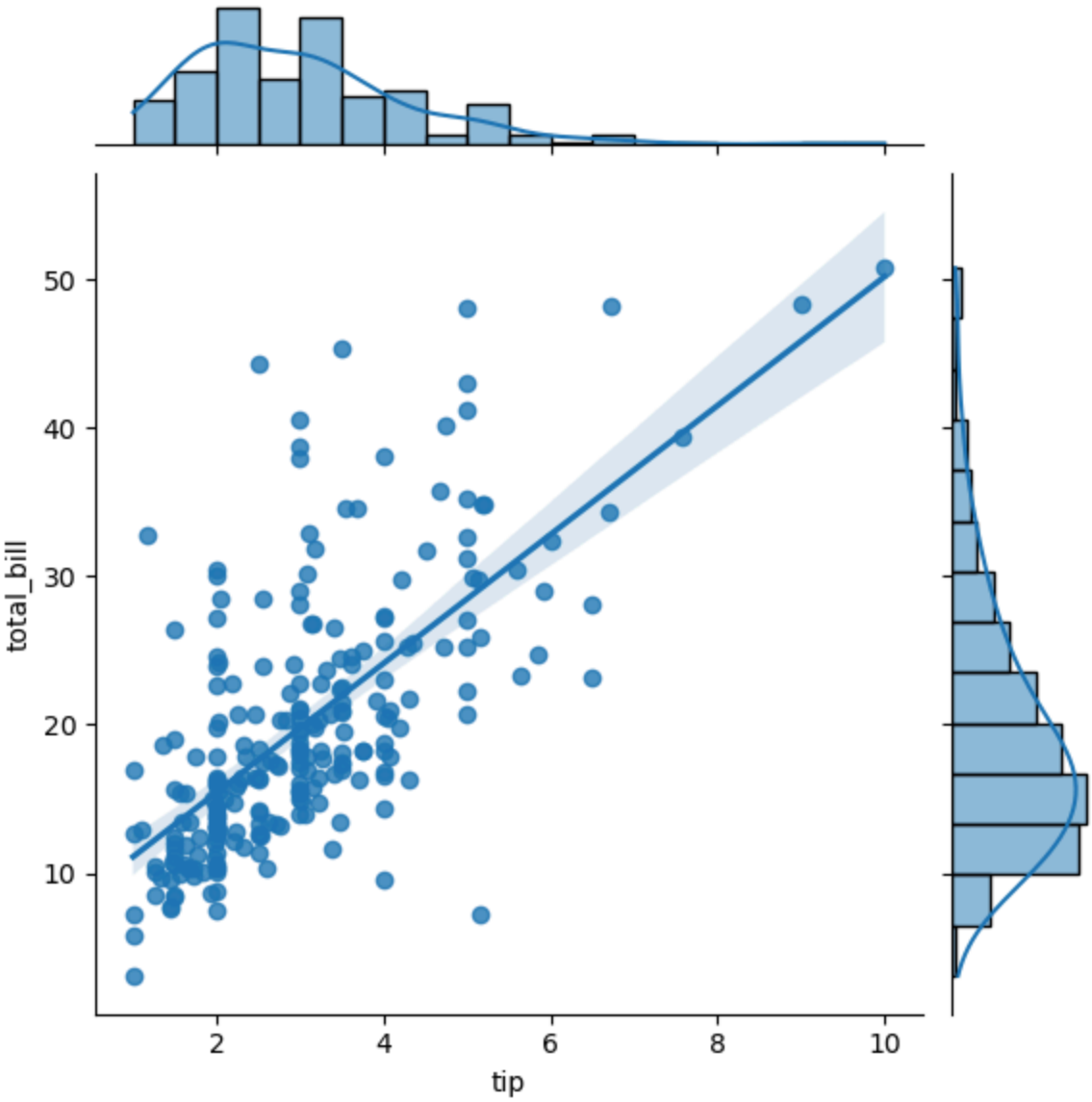
```
import seaborn as sns
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
%matplotlib inline

tips = sns.load_dataset('tips')

print(tips.head())

sns.displot(tips['total_bill'], kde=True)
sns.displot(tips['total_bill'], kde=False)

sns.jointplot(x='tip', y='total_bill', data=tips)
sns.jointplot(x='tip', y='total_bill', data=tips, kind='reg')
sns.jointplot(x='tip', y='total_bill', data=tips, kind='hex')

sns.pairplot(tips)
print(tips['time'].value_counts())

sns.pairplot(tips, hue='time')
sns.pairplot(tips, hue='day')

sns.heatmap(tips.corr(numeric_only=True), annot=True, cmap='coolwarm')

sns.boxplot(x='total_bill', data=tips)
sns.boxplot(x='tip', data=tips)

sns.countplot(x='day', data=tips)
sns.countplot(x='sex', data=tips)

tips['sex'].value_counts().plot(kind='pie', autopct='%1.1f%%', ylabel='')
plt.title('Gender Distribution')
plt.show()

tips['sex'].value_counts().plot(kind='bar', color=['skyblue', 'salmon'])
plt.title('Gender Count')
plt.xlabel('Sex')
plt.ylabel('Count')
plt.show()

sns.countplot(x='day', data=tips[tips['time'] == 'Dinner'])
plt.title('Dinner Count by Day')
plt.show()
```

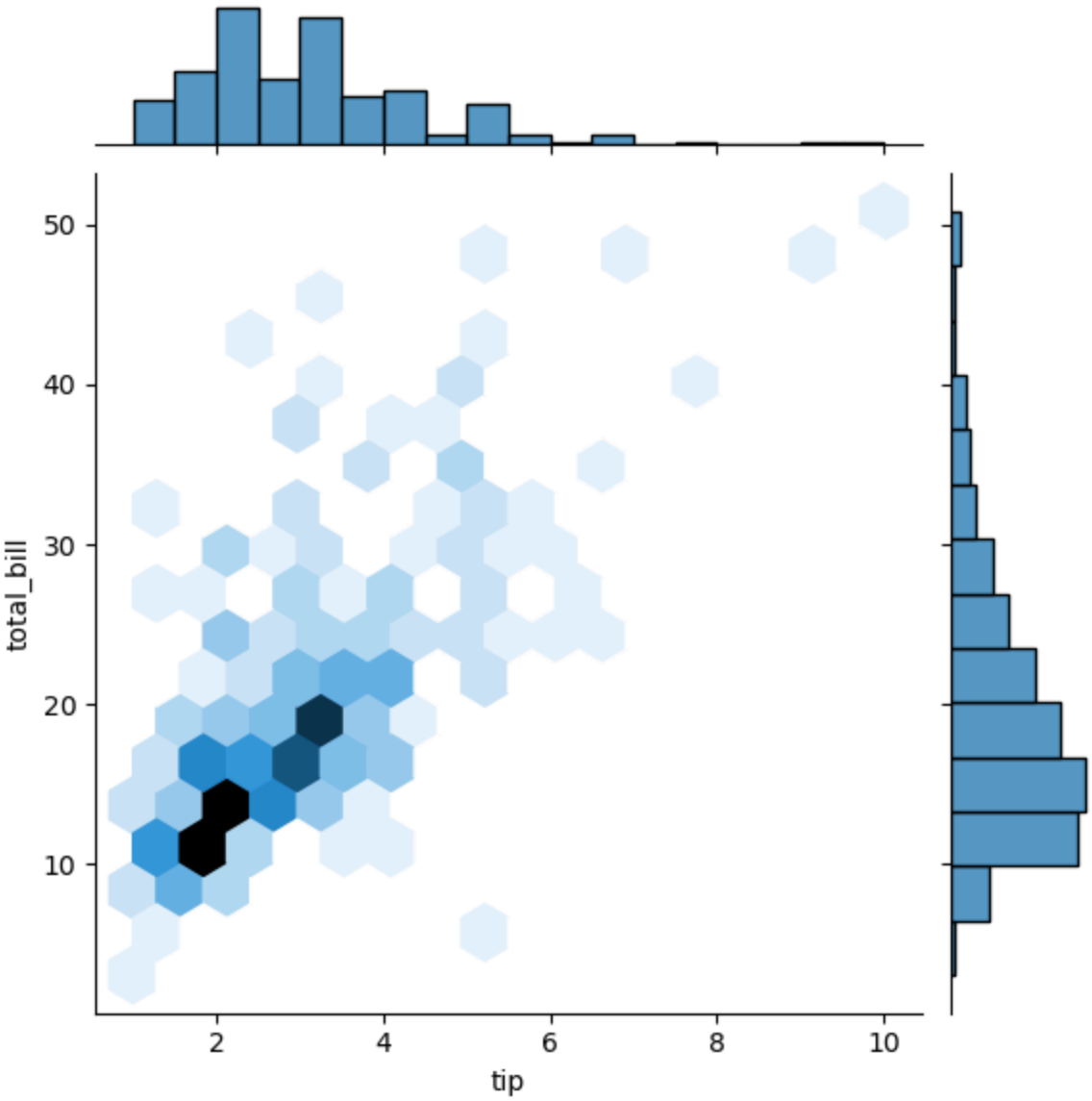
```
   total_bill   tip     sex smoker  day    time  size
0       16.99  1.01  Female     No  Sun  Dinner     2
1       10.34  1.66    Male     No  Sun  Dinner     3
2       21.01  3.50    Male     No  Sun  Dinner     3
3       23.68  3.31    Male     No  Sun  Dinner     2
4       24.59  3.61  Female     No  Sun  Dinner     4
time
Dinner    176
Lunch      68
Name: count, dtype: int64
```

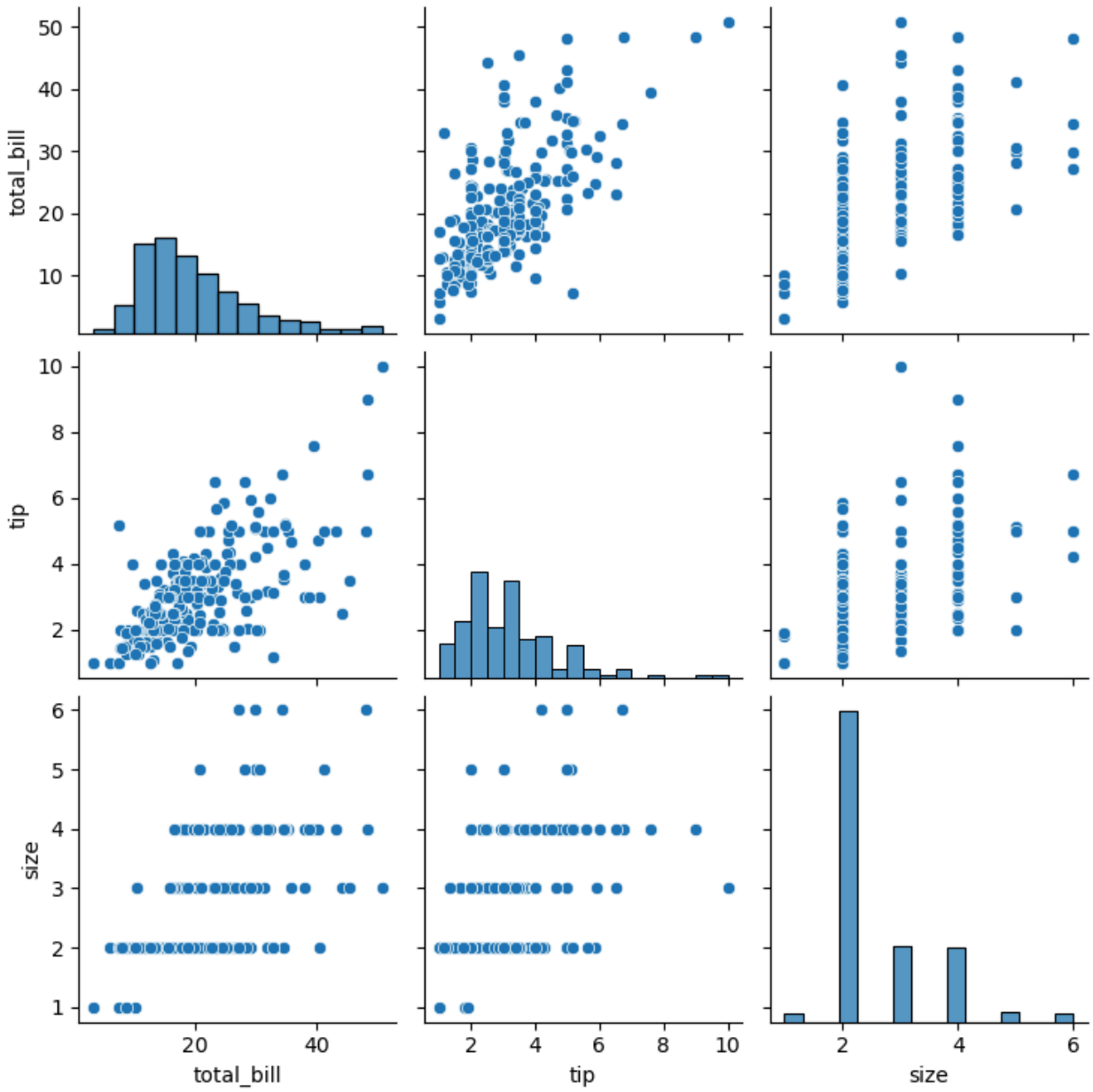


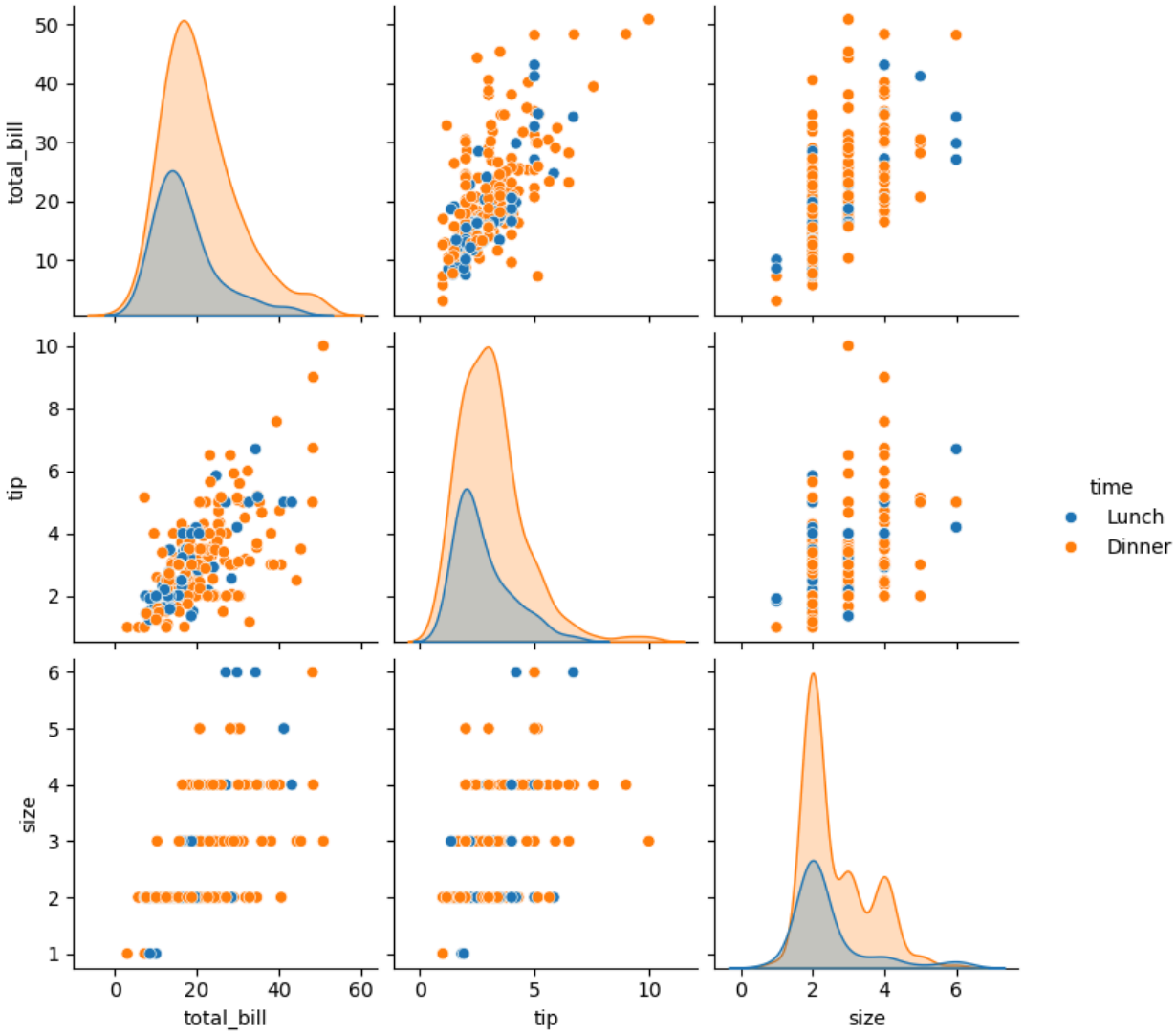

50
40
30
20
10
0
Count
10
20
30
40
50
total_bill

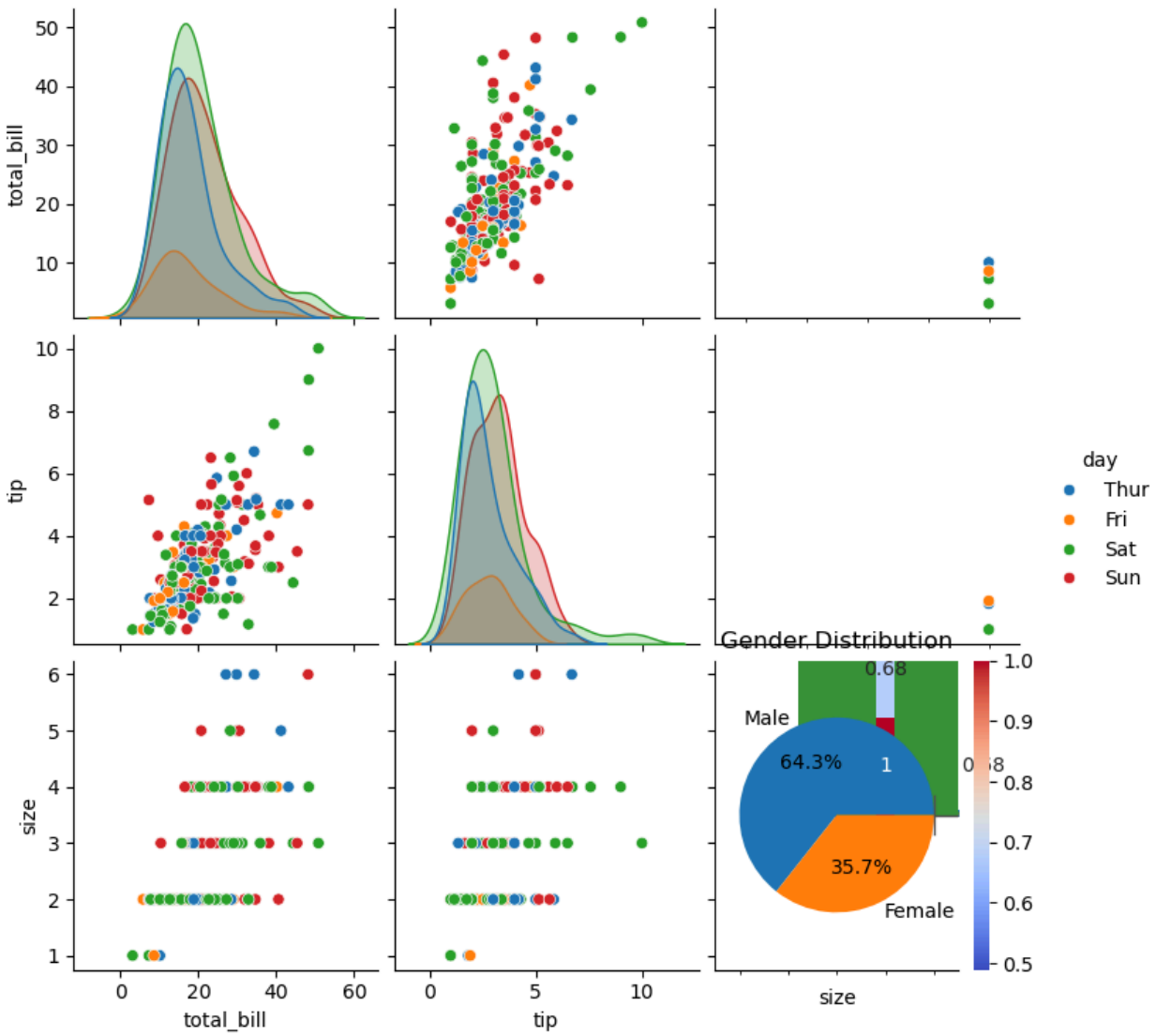

total_bill
tip
10
20
30
40
50
2
4
6
8
10

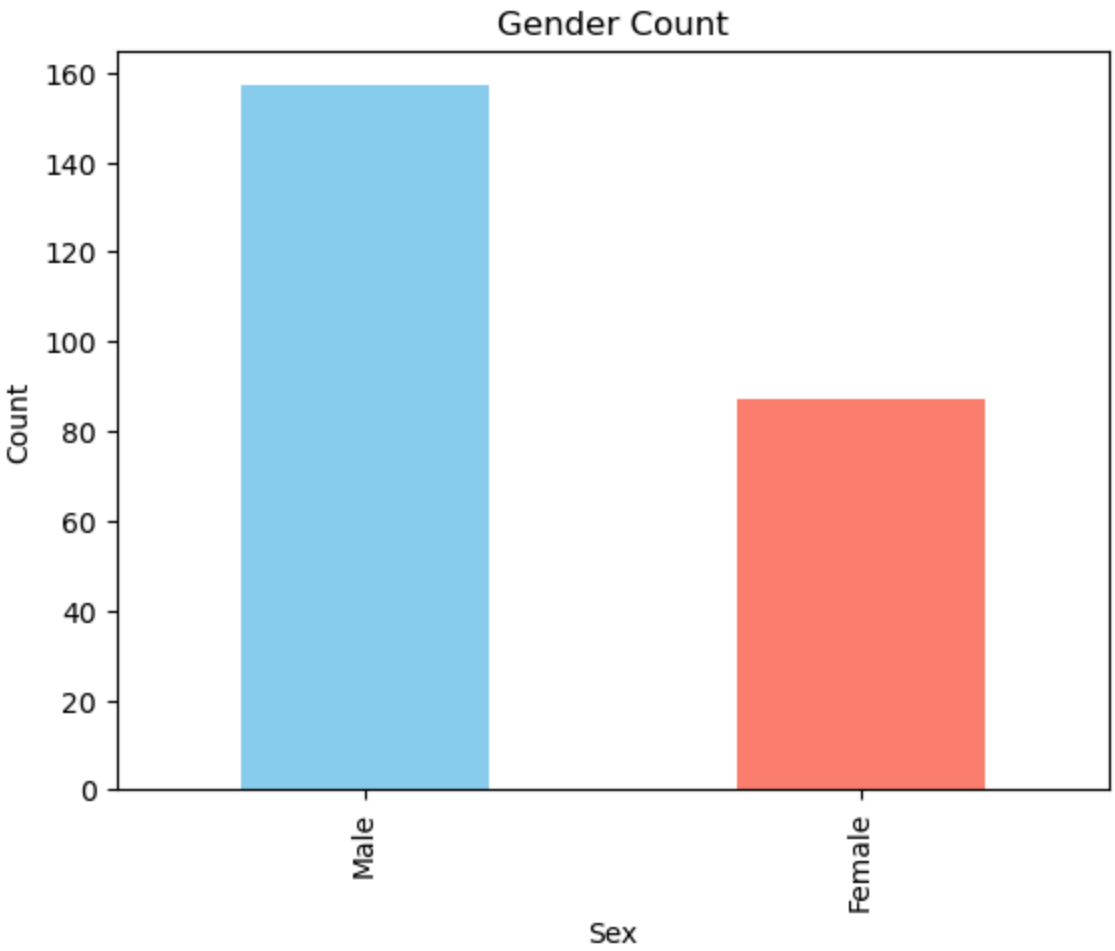

total_bill
tip
10
20
30
40
50
2
4
6
8
10

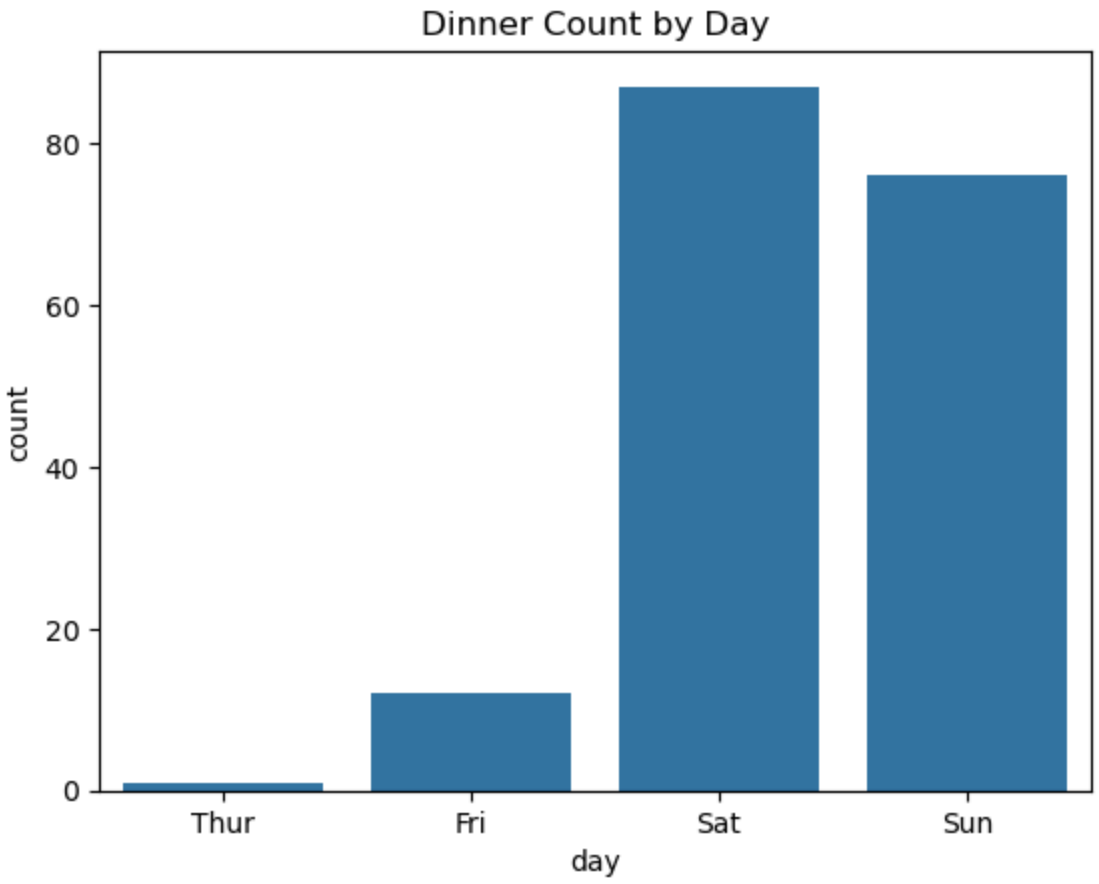

total_bill
50
40
30
20
10
2
4
6
8
10
tip


total_bill
tip
size
50
40
30
20
10
10
8
6
4
2
6
5
4
3
2
1
20
40
2
4
6
8
10
2
4
6


total_bill
tip
size
time
Lunch
Dinner


total_bill
tip
size
day
Thur
Fri
Sat
Sun
Gender Distribution
Male
Female
64.3%
35.7%
0.68


Gender Count
160
140
120
100
80
60
40
20
0
Count
Male
Female
Sex



In [ ]:

In [1]:
```python
#EXP10
import numpy as np
import pandas as pd

df = pd.read_csv('E:\Salary_data.csv')
print(df)

df.info()

df.dropna(inplace=True)
df.info()

df.describe()

features = df.iloc[:, [0]].values
label = df.iloc[:, [1]].values

from sklearn.model_selection import train_test_split
x_train, x_test, y_train, y_test = train_test_split(
    features, label, test_size=0.2, random_state=0
)

from sklearn.linear_model import LinearRegression
model = LinearRegression()
model.fit(x_train, y_train)

print("Training Accuracy:", model.score(x_train, y_train))
print("Testing Accuracy:", model.score(x_test, y_test))

print("Coefficient:", model.coef_)
print("Intercept:", model.intercept_)

import pickle
pickle.dump(model, open('SalaryPred.model', 'wb'))

model = pickle.load(open('SalaryPred.model', 'rb'))

yr_of_exp = float(input("Enter Years of Experience: "))
yr_of_exp_NP = np.array([[yr_of_exp]])
Salary = model.predict(yr_of_exp_NP)

print(f"Estimated Salary for {yr_of_exp} years of experience is {Salary}")
```

```
<>:5: SyntaxWarning: invalid escape sequence '\S'
<>:5: SyntaxWarning: invalid escape sequence '\S'
C:\Users\sownd\AppData\Local\Temp\ipykernel_13788\4287389640.py:5: SyntaxWarnin
g: invalid escape sequence '\S'
  df = pd.read_csv('E:\Salary_data.csv')
```

```
    YearsExperience  Salary
0               1.1   39343
1               1.3   46205
2               1.5   37731
3               2.0   43525
4               2.2   39891
5               2.9   56642
6               3.0   60150
7               3.2   54445
8               3.2   64445
9               3.7   57189
10              3.9   63218
11              4.0   55794
12              4.0   56957
13              4.1   57081
14              4.5   61111
15              4.9   67938
16              5.1   66029
17              5.3   83088
18              5.9   81363
19              6.0   93940
20              6.8   91738
21              7.1   98273
22              7.9  101302
23              8.2  113812
24              8.7  109431
25              9.0  105582
26              9.5  116969
27              9.6  112635
28             10.3  122391
29             10.5  121872
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 30 entries, 0 to 29
Data columns (total 2 columns):
 #   Column           Non-Null Count  Dtype  
---  ------           --------------  -----  
 0   YearsExperience  30 non-null     float64
 1   Salary           30 non-null     int64  
dtypes: float64(1), int64(1)
memory usage: 612.0 bytes
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 30 entries, 0 to 29
Data columns (total 2 columns):
 #   Column           Non-Null Count  Dtype  
---  ------           --------------  -----  
 0   YearsExperience  30 non-null     float64
 1   Salary           30 non-null     int64  
dtypes: float64(1), int64(1)
memory usage: 612.0 bytes
Training Accuracy: 0.9411949620562126
Testing Accuracy: 0.988169515729126
Coefficient: [[9312.57512673]]
Intercept: [26780.09915063]
Estimated Salary for 8.0 years of experience is [[101280.70016446]]
```

In [ ]:

In [1]:
```
import numpy as np
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import classification_report

df = pd.read_csv('E:\Social_Network_Ads.csv')
print(df.head())
print("\n")

features = df.iloc[:, [2, 3]].values
label = df.iloc[:, 4].values

for i in range(1, 401):
    x_train, x_test, y_train, y_test = train_test_split(
        features, label, test_size=0.2, random_state=i
    )
    model = LogisticRegression()
    model.fit(x_train, y_train)
    train_score = model.score(x_train, y_train)
    test_score = model.score(x_test, y_test)
    if test_score > train_score:
        print("Test {} Train{} Random State {}".format(test_score, train_score
        #print("\n")
print("\n")

x_train, x_test, y_train, y_test = train_test_split(
    features, label, test_size=0.2, random_state=26
)
finalModel = LogisticRegression()
finalModel.fit(x_train, y_train)

print(finalModel.score(x_train, y_train))
print("\n")
print(finalModel.score(x_test, y_test))
print("\n")
print(classification_report(label, finalModel.predict(features)))
```

```
<>:7: SyntaxWarning: invalid escape sequence '\S'
<>:7: SyntaxWarning: invalid escape sequence '\S'
C:\Users\sownd\AppData\Local\Temp\ipykernel_14224\2726418315.py:7: SyntaxWarnin
g: invalid escape sequence '\S'
  df = pd.read_csv('E:\Social_Network_Ads.csv')
```

	User ID	Gender	Age	EstimatedSalary	Purchased
0	15624510	Male	19	19000	0
1	15810944	Male	35	20000	0
2	15668575	Female	26	43000	0
3	15603246	Female	27	57000	0
4	15804002	Male	19	76000	0

```
Test 0.9 Train0.840625 Random State 4
Test 0.8625 Train0.85 Random State 5
Test 0.8625 Train0.859375 Random State 6
Test 0.8875 Train0.8375 Random State 7
Test 0.8625 Train0.8375 Random State 9
Test 0.9 Train0.840625 Random State 10
Test 0.8625 Train0.85625 Random State 14
Test 0.85 Train0.84375 Random State 15
Test 0.8625 Train0.85625 Random State 16
Test 0.875 Train0.834375 Random State 18
Test 0.85 Train0.84375 Random State 19
Test 0.875 Train0.84375 Random State 20
Test 0.8625 Train0.834375 Random State 21
Test 0.875 Train0.840625 Random State 22
Test 0.875 Train0.840625 Random State 24
Test 0.85 Train0.834375 Random State 26
Test 0.85 Train0.840625 Random State 27
Test 0.8625 Train0.834375 Random State 30
Test 0.8625 Train0.85625 Random State 31
Test 0.875 Train0.853125 Random State 32
Test 0.8625 Train0.84375 Random State 33
Test 0.875 Train0.83125 Random State 35
Test 0.8625 Train0.853125 Random State 36
Test 0.8875 Train0.840625 Random State 38
Test 0.875 Train0.8375 Random State 39
Test 0.8875 Train0.8375 Random State 42
Test 0.875 Train0.846875 Random State 46
Test 0.9125 Train0.83125 Random State 47
Test 0.875 Train0.83125 Random State 51
Test 0.9 Train0.84375 Random State 54
Test 0.85 Train0.84375 Random State 57
Test 0.875 Train0.84375 Random State 58
Test 0.925 Train0.8375 Random State 61
Test 0.8875 Train0.834375 Random State 65
Test 0.8875 Train0.840625 Random State 68
Test 0.9 Train0.83125 Random State 72
Test 0.8875 Train0.8375 Random State 75
Test 0.925 Train0.825 Random State 76
Test 0.8625 Train0.840625 Random State 77
Test 0.8625 Train0.859375 Random State 81
Test 0.875 Train0.8375 Random State 82
Test 0.8875 Train0.8375 Random State 83
Test 0.8625 Train0.853125 Random State 84
Test 0.8625 Train0.840625 Random State 85
Test 0.8625 Train0.840625 Random State 87
Test 0.875 Train0.846875 Random State 88
```

Test 0.9125 Train0.8375 Random State 90
Test 0.8625 Train0.85 Random State 95
Test 0.875 Train0.85 Random State 99
Test 0.85 Train0.840625 Random State 101
Test 0.85 Train0.840625 Random State 102
Test 0.9 Train0.825 Random State 106
Test 0.8625 Train0.840625 Random State 107
Test 0.85 Train0.834375 Random State 109
Test 0.85 Train0.840625 Random State 111
Test 0.9125 Train0.840625 Random State 112
Test 0.8625 Train0.85 Random State 115
Test 0.8625 Train0.840625 Random State 116
Test 0.875 Train0.834375 Random State 119
Test 0.9125 Train0.828125 Random State 120
Test 0.8625 Train0.859375 Random State 125
Test 0.85 Train0.846875 Random State 128
Test 0.875 Train0.85 Random State 130
Test 0.9 Train0.84375 Random State 133
Test 0.925 Train0.834375 Random State 134
Test 0.8625 Train0.85 Random State 135
Test 0.875 Train0.83125 Random State 138
Test 0.8625 Train0.85 Random State 141
Test 0.85 Train0.846875 Random State 143
Test 0.85 Train0.846875 Random State 146
Test 0.85 Train0.84375 Random State 147
Test 0.8625 Train0.85 Random State 148
Test 0.875 Train0.8375 Random State 150
Test 0.8875 Train0.83125 Random State 151
Test 0.925 Train0.84375 Random State 152
Test 0.85 Train0.840625 Random State 153
Test 0.9 Train0.84375 Random State 154
Test 0.9 Train0.840625 Random State 155
Test 0.8875 Train0.846875 Random State 156
Test 0.8875 Train0.834375 Random State 158
Test 0.875 Train0.828125 Random State 159
Test 0.9 Train0.83125 Random State 161
Test 0.85 Train0.8375 Random State 163
Test 0.875 Train0.83125 Random State 164
Test 0.8625 Train0.85 Random State 169
Test 0.875 Train0.840625 Random State 171
Test 0.85 Train0.840625 Random State 172
Test 0.9 Train0.825 Random State 180
Test 0.85 Train0.834375 Random State 184
Test 0.925 Train0.821875 Random State 186
Test 0.9 Train0.83125 Random State 193
Test 0.8625 Train0.85 Random State 195
Test 0.8625 Train0.840625 Random State 196
Test 0.8625 Train0.8375 Random State 197
Test 0.875 Train0.840625 Random State 198
Test 0.8875 Train0.8375 Random State 199
Test 0.8875 Train0.84375 Random State 200
Test 0.8625 Train0.8375 Random State 202
Test 0.8625 Train0.840625 Random State 203
Test 0.8875 Train0.83125 Random State 206

Test 0.8625 Train0.834375 Random State 211
Test 0.85 Train0.84375 Random State 212
Test 0.8625 Train0.834375 Random State 214
Test 0.875 Train0.83125 Random State 217
Test 0.9625 Train0.81875 Random State 220
Test 0.875 Train0.84375 Random State 221
Test 0.85 Train0.840625 Random State 222
Test 0.9 Train0.84375 Random State 223
Test 0.8625 Train0.853125 Random State 227
Test 0.8625 Train0.834375 Random State 228
Test 0.9 Train0.840625 Random State 229
Test 0.85 Train0.84375 Random State 232
Test 0.875 Train0.846875 Random State 233
Test 0.9125 Train0.840625 Random State 234
Test 0.8625 Train0.840625 Random State 235
Test 0.85 Train0.846875 Random State 236
Test 0.875 Train0.846875 Random State 239
Test 0.85 Train0.84375 Random State 241
Test 0.8875 Train0.85 Random State 242
Test 0.8875 Train0.825 Random State 243
Test 0.875 Train0.846875 Random State 244
Test 0.875 Train0.840625 Random State 245
Test 0.875 Train0.846875 Random State 246
Test 0.8625 Train0.859375 Random State 247
Test 0.8875 Train0.84375 Random State 248
Test 0.8625 Train0.85 Random State 250
Test 0.875 Train0.83125 Random State 251
Test 0.8875 Train0.84375 Random State 252
Test 0.8625 Train0.846875 Random State 255
Test 0.9 Train0.840625 Random State 257
Test 0.8625 Train0.85625 Random State 260
Test 0.8625 Train0.840625 Random State 266
Test 0.8625 Train0.8375 Random State 268
Test 0.875 Train0.840625 Random State 275
Test 0.8625 Train0.85 Random State 276
Test 0.925 Train0.8375 Random State 277
Test 0.875 Train0.846875 Random State 282
Test 0.85 Train0.846875 Random State 283
Test 0.85 Train0.84375 Random State 285
Test 0.9125 Train0.834375 Random State 286
Test 0.85 Train0.840625 Random State 290
Test 0.85 Train0.840625 Random State 291
Test 0.85 Train0.846875 Random State 292
Test 0.8625 Train0.8375 Random State 294
Test 0.8875 Train0.828125 Random State 297
Test 0.8625 Train0.834375 Random State 300
Test 0.8625 Train0.85 Random State 301
Test 0.8875 Train0.85 Random State 302
Test 0.875 Train0.846875 Random State 303
Test 0.8625 Train0.834375 Random State 305
Test 0.9125 Train0.8375 Random State 306
Test 0.875 Train0.846875 Random State 308
Test 0.9 Train0.84375 Random State 311
Test 0.8625 Train0.834375 Random State 313

```
Test 0.9125 Train0.834375 Random State 314
Test 0.875 Train0.8375 Random State 315
Test 0.9 Train0.846875 Random State 317
Test 0.9125 Train0.821875 Random State 319
Test 0.8625 Train0.85 Random State 321
Test 0.9125 Train0.828125 Random State 322
Test 0.85 Train0.846875 Random State 328
Test 0.85 Train0.8375 Random State 332
Test 0.8875 Train0.853125 Random State 336
Test 0.85 Train0.8375 Random State 337
Test 0.875 Train0.840625 Random State 343
Test 0.8625 Train0.84375 Random State 346
Test 0.8875 Train0.83125 Random State 351
Test 0.8625 Train0.85 Random State 352
Test 0.95 Train0.81875 Random State 354
Test 0.8625 Train0.85 Random State 356
Test 0.9125 Train0.840625 Random State 357
Test 0.8625 Train0.8375 Random State 358
Test 0.85 Train0.840625 Random State 362
Test 0.9 Train0.84375 Random State 363
Test 0.8625 Train0.853125 Random State 364
Test 0.9375 Train0.821875 Random State 366
Test 0.9125 Train0.840625 Random State 369
Test 0.8625 Train0.853125 Random State 371
Test 0.925 Train0.834375 Random State 376
Test 0.9125 Train0.828125 Random State 377
Test 0.8875 Train0.85 Random State 378
Test 0.8875 Train0.85 Random State 379
Test 0.8625 Train0.840625 Random State 382
Test 0.8625 Train0.859375 Random State 386
Test 0.85 Train0.8375 Random State 387
Test 0.875 Train0.828125 Random State 388
Test 0.85 Train0.84375 Random State 394
Test 0.8625 Train0.8375 Random State 395
Test 0.9 Train0.84375 Random State 397
Test 0.8625 Train0.84375 Random State 400


0.834375


0.85


              precision    recall  f1-score   support

           0       0.85      0.91      0.88       257
           1       0.81      0.71      0.76       143

    accuracy                           0.84       400
   macro avg       0.83      0.81      0.82       400
weighted avg       0.84      0.84      0.83       400
```

In [ ]:

In [1]:

```
import numpy as np
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.neighbors import KNeighborsClassifier
from sklearn.metrics import confusion_matrix, classification_report

df = pd.read_csv('E:\Iris.csv')
df.info()
df.variety.value_counts()
df.head()

features = df.iloc[:, :-1].values
label = df.iloc[:, 4].values

xtrain, xtest, ytrain, ytest = train_test_split(
    features, label, test_size=0.2, random_state=42
)

model_KNN = KNeighborsClassifier(n_neighbors=5)
model_KNN.fit(xtrain, ytrain)

print(model_KNN.score(xtrain, ytrain))
print("\n")
print(model_KNN.score(xtest, ytest))
print("\n")
print(confusion_matrix(label, model_KNN.predict(features)))
print("\n")
print(classification_report(label, model_KNN.predict(features)))
```

```
<>:7: SyntaxWarning: invalid escape sequence '\I'
<>:7: SyntaxWarning: invalid escape sequence '\I'
C:\Users\sownd\AppData\Local\Temp\ipykernel_2540\140597085.py:7: SyntaxWarning:
invalid escape sequence '\I'
  df = pd.read_csv('E:\Iris.csv')
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 150 entries, 0 to 149
Data columns (total 5 columns):
 #   Column        Non-Null Count  Dtype  
---  ------        --------------  -----  
 0   sepal.length  150 non-null    float64
 1   sepal.width   150 non-null    float64
 2   petal.length  150 non-null    float64
 3   petal.width   150 non-null    float64
 4   variety       150 non-null    object 
dtypes: float64(4), object(1)
memory usage: 6.0+ KB
0.9666666666666667


1.0


[[50  0  0]
 [ 0 47  3]
 [ 0  1 49]]


              precision    recall  f1-score   support

      Setosa       1.00      1.00      1.00        50
  Versicolor       0.98      0.94      0.96        50
   Virginica       0.94      0.98      0.96        50

    accuracy                           0.97       150
   macro avg       0.97      0.97      0.97       150
weighted avg       0.97      0.97      0.97       150
```

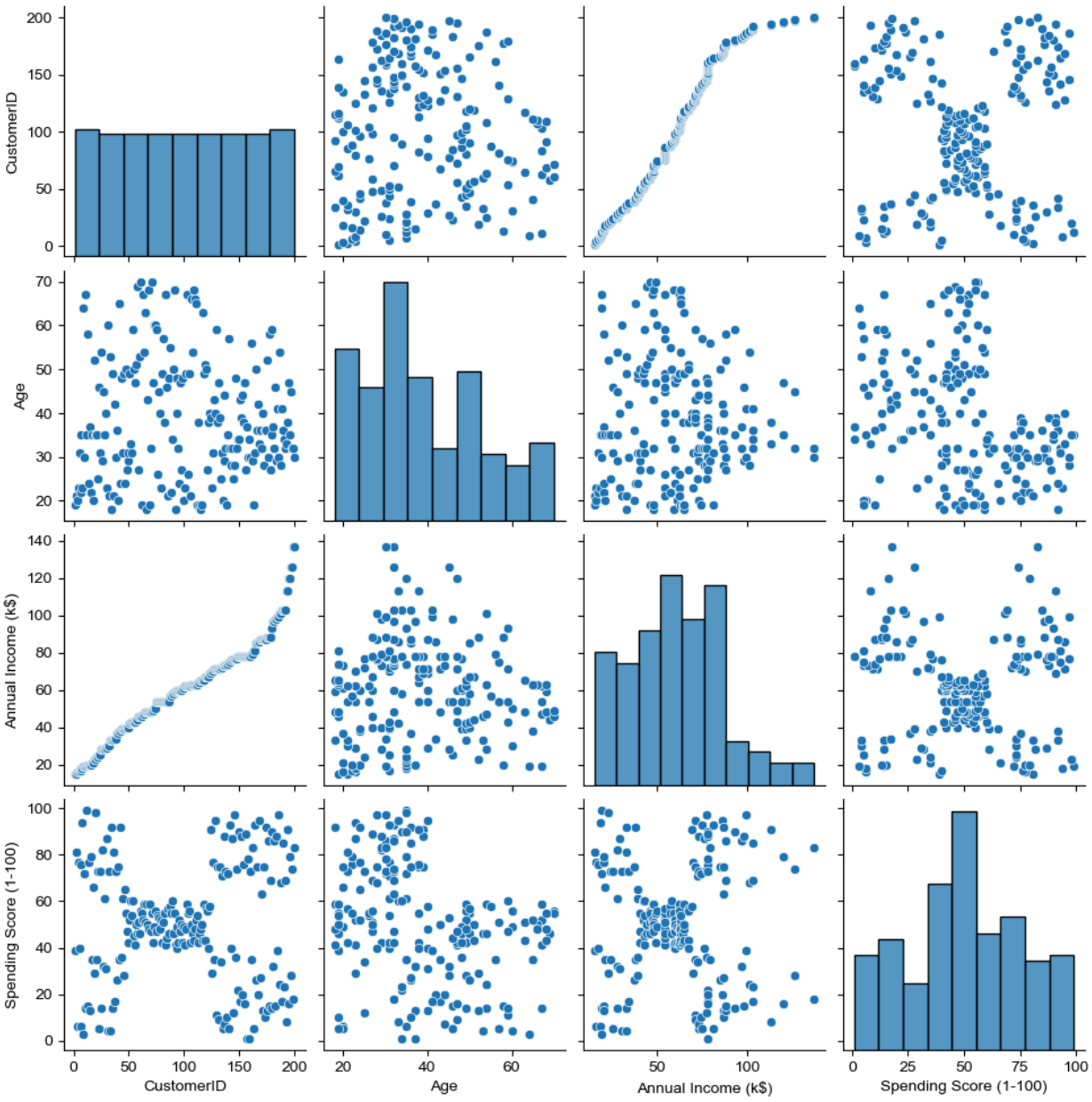
In [ ]:

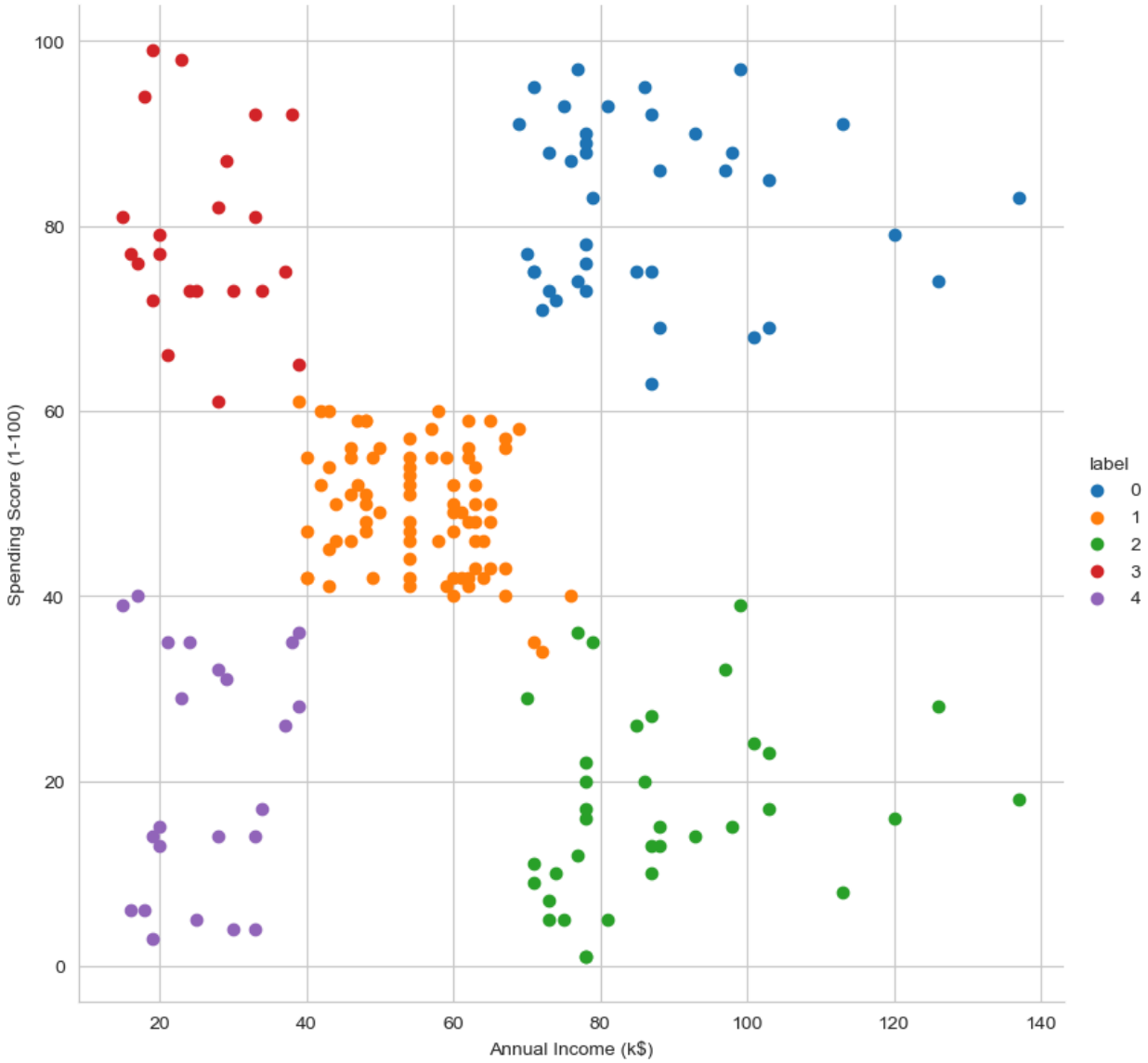
In [1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.cluster import KMeans

df = pd.read_csv('E:\Mall_Customers.csv')
df.info()
df.head()

sns.pairplot(df)

features = df.iloc[:, [3, 4]].values

model = KMeans(n_clusters=5)
model.fit(features)

Final = df.iloc[:, [3, 4]]
Final['label'] = model.predict(features)
Final.head()

sns.set_style("whitegrid")
sns.FacetGrid(Final, hue="label", height=8) \
    .map(plt.scatter, "Annual Income (k$)", "Spending Score (1-100)") \
    .add_legend()
plt.show()

features_el = df.iloc[:, [2, 3, 4]].values
wcss = []
for i in range(1, 10):
    model = KMeans(n_clusters=i)
    model.fit(features_el)
    wcss.append(model.inertia_)

plt.plot(range(1, 10), wcss)
plt.xlabel("Number of Clusters")
plt.ylabel("WCSS")
plt.title("Elbow Method")
plt.show()
```

```
<>:7: SyntaxWarning: invalid escape sequence '\M'
<>:7: SyntaxWarning: invalid escape sequence '\M'
C:\Users\sownd\AppData\Local\Temp\ipykernel_17980\1677738136.py:7: SyntaxWarnin
g: invalid escape sequence '\M'
  df = pd.read_csv('E:\Mall_Customers.csv')
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 200 entries, 0 to 199
Data columns (total 5 columns):
 #   Column                  Non-Null Count  Dtype
---  ------                  --------------  -----
 0   CustomerID              200 non-null    int64
 1   Gender                  200 non-null    object
 2   Age                     200 non-null    int64
 3   Annual Income (k$)      200 non-null    int64
 4   Spending Score (1-100)  200 non-null    int64
dtypes: int64(4), object(1)
memory usage: 7.9+ KB
```

```
C:\Users\sownd\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1446: UserWarning: KMeans is known to have a memory leak on Windows with MKL, when there are less chunks than available threads. You can avoid it by setting the environment variable OMP_NUM_THREADS=1.
  warnings.warn(
C:\Users\sownd\AppData\Local\Temp\ipykernel_17980\1677738136.py:19: 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
  Final['label'] = model.predict(features)
```


CustomerID
Age
Annual Income (k$)
Spending Score (1-100)
CustomerID
Age
Annual Income (k$)
Spending Score (1-100)


Spending Score (1-100)
Annual Income (k$)
label
0
1
2
3
4

```
C:\Users\sownd\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1446: Use
rWarning: KMeans is known to have a memory leak on Windows with MKL, when there
are less chunks than available threads. You can avoid it by setting the environ
ment variable OMP_NUM_THREADS=1.
  warnings.warn(
C:\Users\sownd\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1446: Use
rWarning: KMeans is known to have a memory leak on Windows with MKL, when there
are less chunks than available threads. You can avoid it by setting the environ
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  warnings.warn(
C:\Users\sownd\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1446: Use
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  warnings.warn(
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C:\Users\sownd\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1446: Use
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are less chunks than available threads. You can avoid it by setting the environ
ment variable OMP_NUM_THREADS=1.
  warnings.warn(
C:\Users\sownd\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1446: Use
rWarning: KMeans is known to have a memory leak on Windows with MKL, when there
are less chunks than available threads. You can avoid it by setting the environ
ment variable OMP_NUM_THREADS=1.
  warnings.warn(
C:\Users\sownd\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1446: Use
rWarning: KMeans is known to have a memory leak on Windows with MKL, when there
are less chunks than available threads. You can avoid it by setting the environ
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  warnings.warn(
C:\Users\sownd\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1446: Use
rWarning: KMeans is known to have a memory leak on Windows with MKL, when there
are less chunks than available threads. You can avoid it by setting the environ
ment variable OMP_NUM_THREADS=1.
  warnings.warn(
C:\Users\sownd\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1446: Use
rWarning: KMeans is known to have a memory leak on Windows with MKL, when there
are less chunks than available threads. You can avoid it by setting the environ
ment variable OMP_NUM_THREADS=1.
  warnings.warn(
```

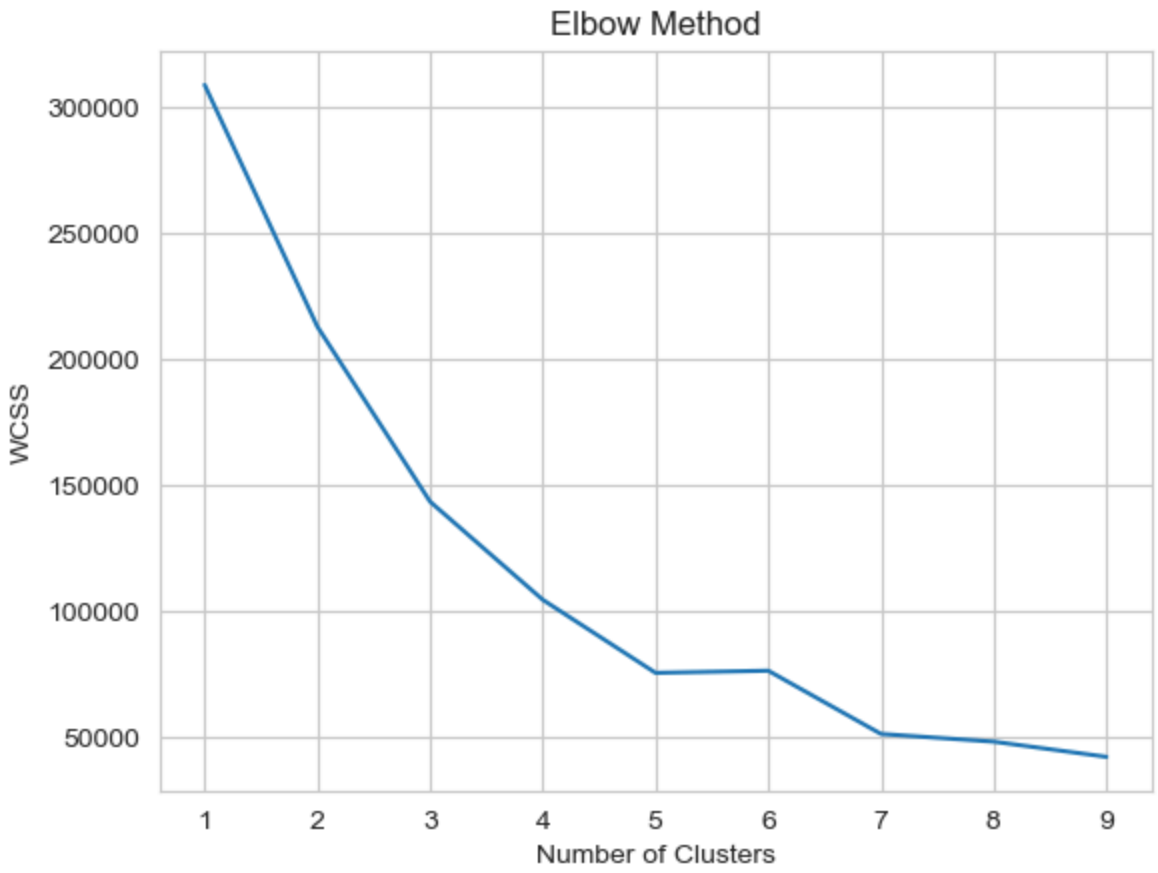
Elbow Method
300000
250000
200000
150000
100000
50000
WCSS
1
2
3
4
5
6
7
8
9
Number of Clusters

In [ ]:

In [1]:
```python
import numpy as np
from scipy import stats

marks = np.array([72, 68, 75, 70, 74, 69, 71, 73, 70, 72])
mu_0 = 70

t_stat, p_value = stats.ttest_1samp(marks, mu_0)

print(f"T-statistic: {t_stat:.3f}")
print(f"P-value: {p_value:.4f}")

alpha = 0.05
if p_value < alpha:
    print("Reject Null Hypothesis → Mean is significantly different from 70.")
else:
    print("Fail to Reject Null Hypothesis → No significant difference.")
```

```
T-statistic: 1.993
P-value: 0.0774
Fail to Reject Null Hypothesis → No significant difference.
```

In [2]:
```python
import numpy as np
from math import sqrt
from scipy.stats import norm

x_bar = 51.2
mu_0 = 50
sigma = 3
n = 36

z_stat = (x_bar - mu_0) / (sigma / sqrt(n))
p_value = 2 * (1 - norm.cdf(abs(z_stat)))

print(f"Z-statistic: {z_stat:.3f}")
print(f"P-value: {p_value:.4f}")

alpha = 0.05
if p_value < alpha:
    print("Reject Null Hypothesis → Mean is significantly different from 50 g.")
else:
    print("Fail to Reject Null Hypothesis → No significant difference.")
```

```
Z-statistic: 2.400
P-value: 0.0164
Reject Null Hypothesis → Mean is significantly different from 50 g.
```

In [3]:
```python
import numpy as np
from scipy import stats

A = [20, 22, 23]
B = [19, 20, 18]
C = [25, 27, 26]

f_stat, p_value = stats.f_oneway(A, B, C)
```

```
print(f"F-statistic: {f_stat:.3f}")
print(f"P-value: {p_value:.4f}")

alpha = 0.05
if p_value < alpha:
    print("Reject Null Hypothesis → Means are significantly different.")
else:
    print("Fail to Reject Null Hypothesis → No significant difference.")
```

```
F-statistic: 25.923
P-value: 0.0011
Reject Null Hypothesis → Means are significantly different.
```

In [ ]: