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

df = pd.read_csv('second_hand_cars.csv')
df.sample(4)
```

	Company Name	Car Name	Variant	Fuel Type	Tyre Condition	Make Year	Owner Type	Registration Number	Mileage
1626	Nissan	Elantra	NaN	CNG	Needs Replacement	2019	Third	23-854-1941	128423
1215	Toyota	Elantra	NaN	Diesel	Needs Replacement	2023	Third	27-961-3312	15638(
1872	Nissan	Swift	SE	Petrol	Used	2020	Third	95-331-4870	16394(
1425	Hyundai	Swift	SE	CNG	Used	2022	Third	67-231-7442	65541

```
df.info()
df.isnull().sum()
```

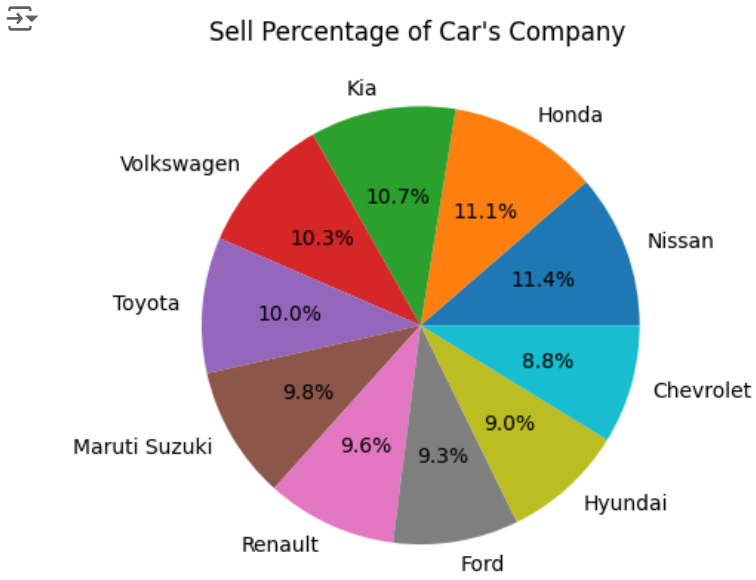
```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2500 entries, 0 to 2499
Data columns (total 16 columns):
 #   Column                   Non-Null Count  Dtype
---  ------                   --------------  -----
 0   Company Name             2500 non-null   object
 1   Car Name                 2500 non-null   object
 2   Variant                  2238 non-null   object
 3   Fuel Type                2500 non-null   object
 4   Tyre Condition           2500 non-null   object
 5   Make Year                2500 non-null   int64
 6   Owner Type               2500 non-null   object
 7   Registration Number      2500 non-null   object
 8   Mileage                  2500 non-null   int64
 9   Price                    2500 non-null   int64
 10  Transmission Type        2500 non-null   object
 11  Body Color               2500 non-null   object
 12  Service Record           2500 non-null   object
 13  Insurance                2500 non-null   object
 14  Registration Certificate 2500 non-null   object
 15  Accessories              2018 non-null   object
dtypes: int64(3), object(13)
memory usage: 312.6+ KB
Company Name                 0
Car Name                     0
Variant                    262
Fuel Type                    0
Tyre Condition               0
Make Year                    0
Owner Type                   0
Registration Number          0
Mileage                      0
Price                        0
Transmission Type            0
Body Color                   0
Service Record               0
Insurance                    0
Registration Certificate     0
Accessories                482
dtype: int64
```

```
# Handle missing values
df = df.dropna()

numeric_columns = df.select_dtypes(include=['float64', 'int64']).columns
```

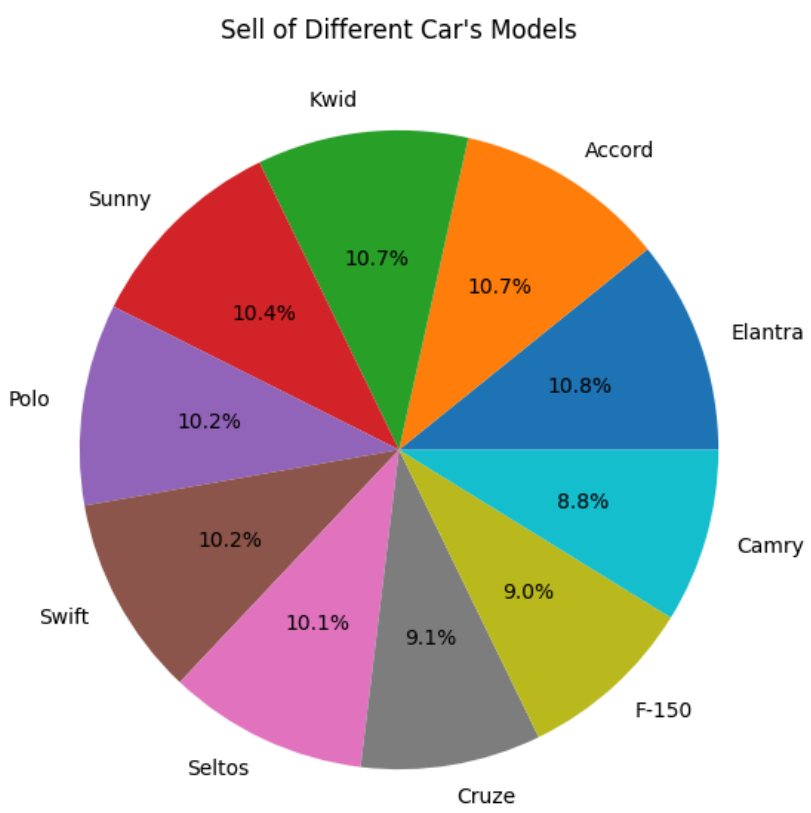
```
def remove_outliers_iqr(df, columns):
    for column in columns:
        Q1 = df[column].quantile(0.25)
        Q3 = df[column].quantile(0.75)
        IQR = Q3 - Q1
        lower_bound = Q1 - 1.5 * IQR
        upper_bound = Q3 + 1.5 * IQR
        df = df[(df[column] >= lower_bound) & (df[column] <= upper_bound)]
    return df

df_cleaned = remove_outliers_iqr(df, numeric_columns)

df.shape, df_cleaned.shape
```

```
((1814, 16), (1814, 16))
```

```
Brand = df['Company Name'].value_counts()
plt.pie(Brand, labels=Brand.index,autopct='%1.1f%%')
plt.title("Sell Percentage of Car's Company ")
plt.show()
```

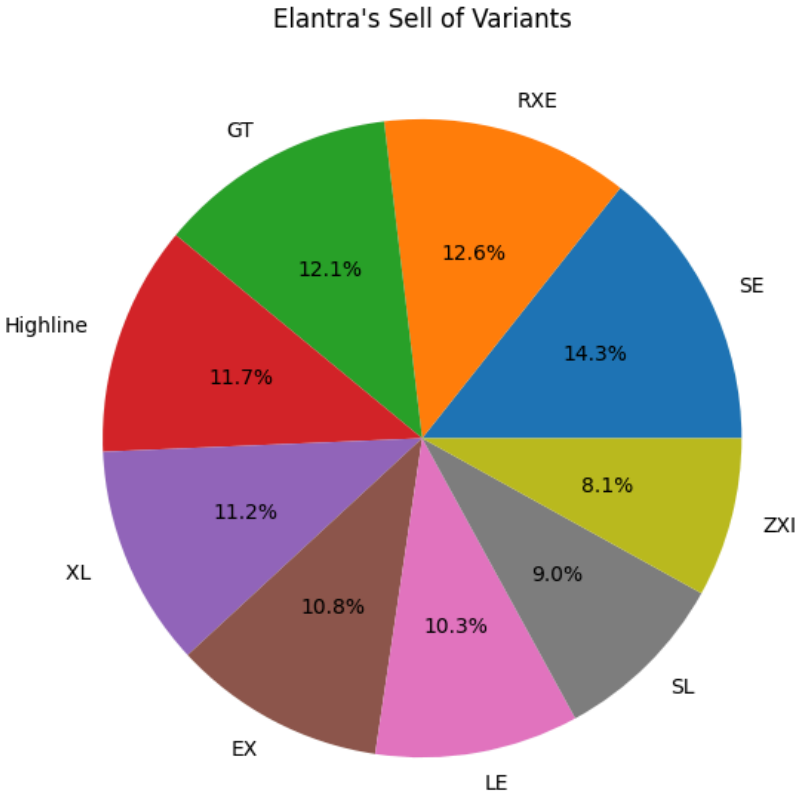



```
cars_quantity = []
cars=list(set(df['Car Name']))
for x in df['Car Name'].value_counts():
    cars_quantity.append(x)

df['Car Name'].value_counts()

fig = plt.figure(figsize=(10, 7))
plt.pie(cars_quantity, labels=cars,autopct='%1.1f%%')
plt.title("Sell of Different Car's Models")
plt.show()
```

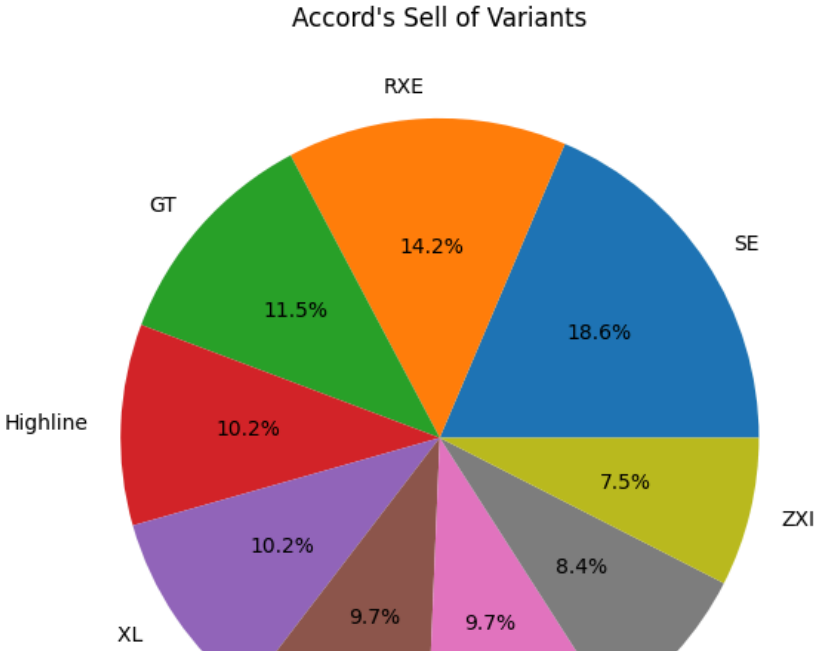



```
variant = ['SE','RXE','GT','Highline','XL ','EX','LE','SL','ZXI']

for x in range(len(cars)):
    # print(f'{df[df['Car Name'] == cars[x]]['Variant'].value_counts()}')
    print(f"{df[df['Car Name'] == cars[x]]['Variant'].value_counts()}")
    fig = plt.figure(figsize=(10, 7))
    plt.pie(df[df['Car Name'] == cars[x]]['Variant'].value_counts(), labels=variant,autopct='%1.1f%%')
    plt.title(f"{cars[x]}'s Sell of Variants")
    plt.show()
```

```
Variant
SL          32
XL          28
Highline    27
EX          26
LE          25
RXE         24
ZXI         23
SE          20
GT          18
Name: count, dtype: int64
```

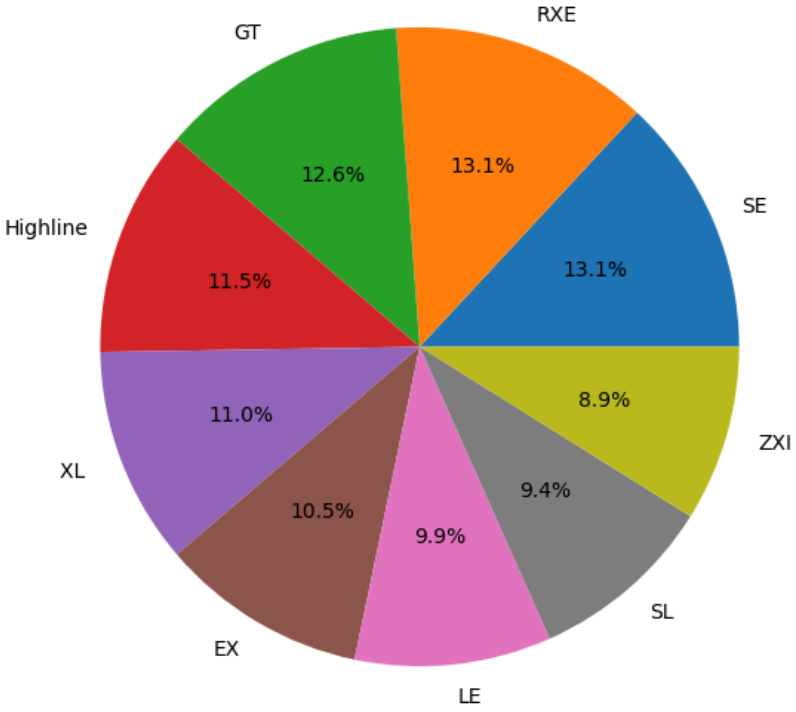



```
Variant
ZXI         42
XL          32
Highline    26
SL          23
LE          23
RXE         22
GT          22
SE          19
EX          17
Name: count, dtype: int64
```



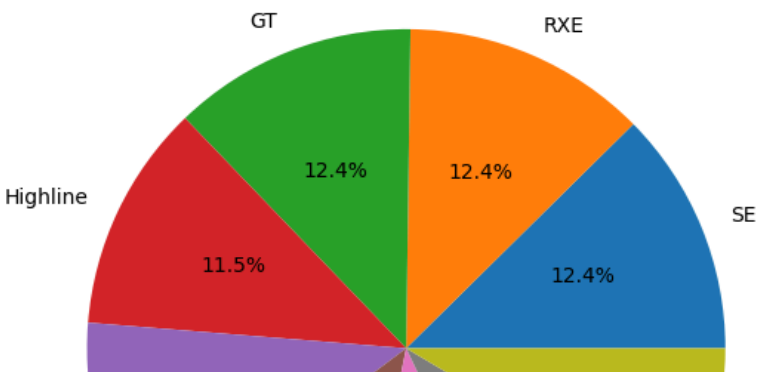

```
Variant
Highline    25
ZXI         25
GT          24
SE          22
LE          21
EX          20
SL          19
XL          18
RXE         17
Name: count, dtype: int64
```

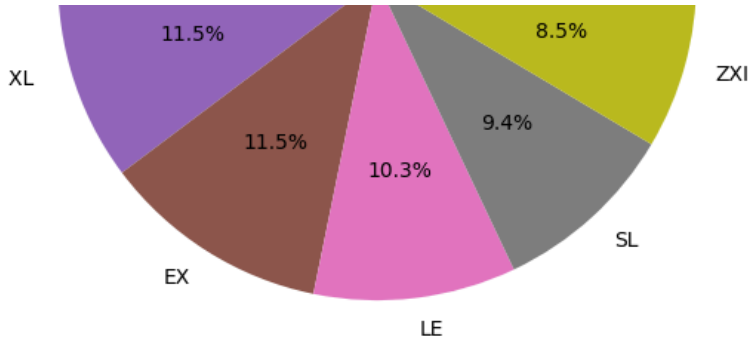
Kwid's Sell of Variants




```
Variant
SE          29
ZXI         29
XL          29
LE          27
RXE         27
Highline    27
SL          24
GT          22
EX          20
Name: count, dtype: int64
```

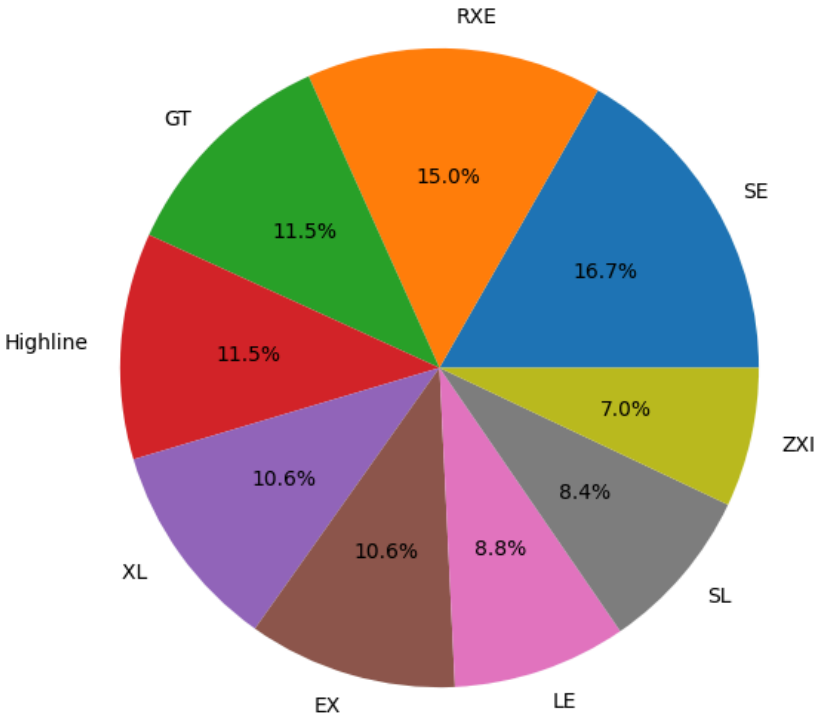
Sunny's Sell of Variants





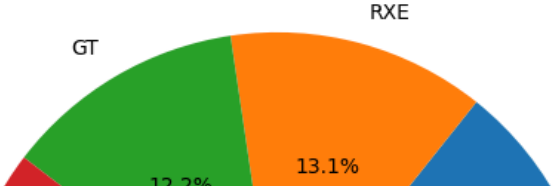

```
Variant
EX          38
RXE         34
GT          26
LE          26
SE          24
SL          24
Highline    20
XL          19
ZXI         16
Name: count, dtype: int64
```

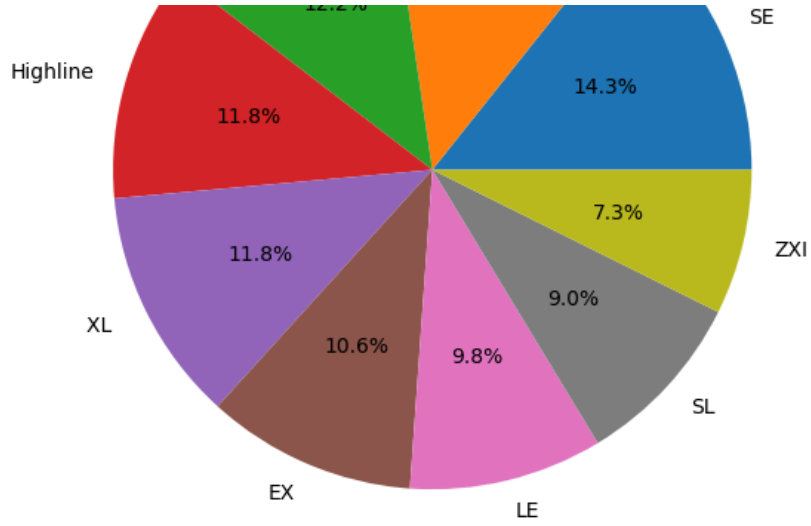
Polo's Sell of Variants




```
Variant
LE          35
SE          32
GT          30
RXE         29
XL          29
ZXI         26
SL          24
Highline    22
EX          18
Name: count, dtype: int64
```

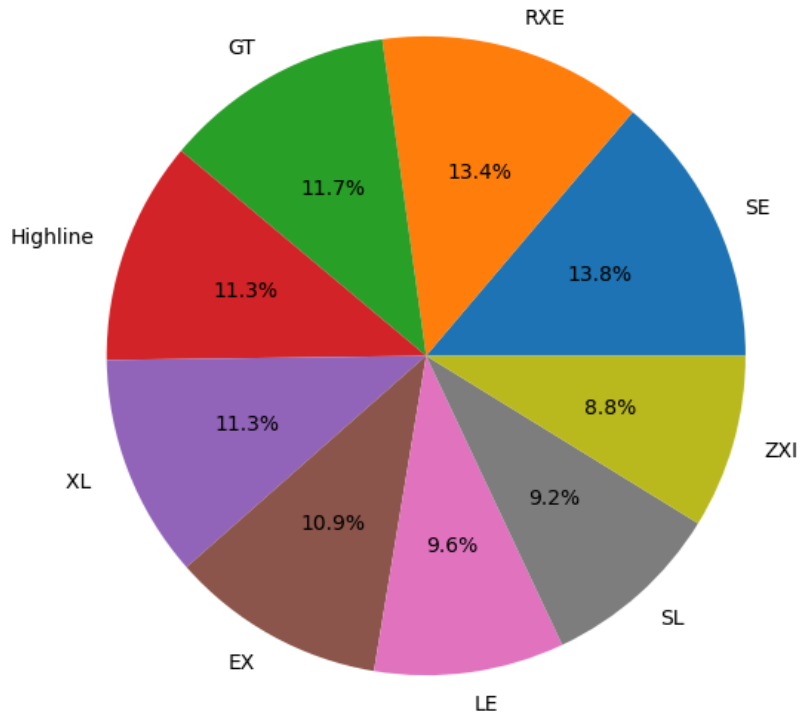
Swift's Sell of Variants





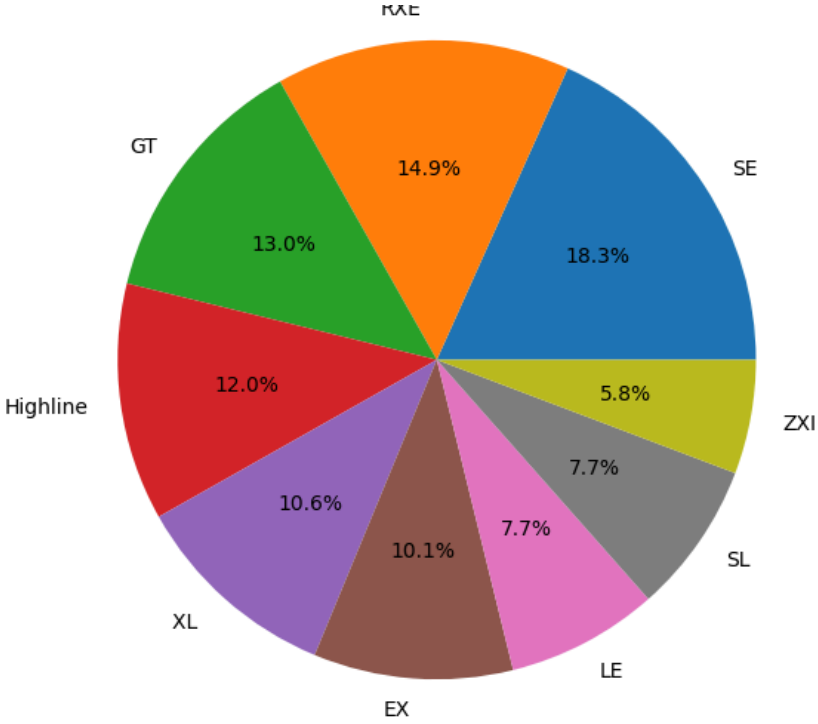

```
Variant
Highline    33
EX          32
SE          28
RXE         27
LE          27
XL          26
GT          23
ZXI         22
SL          21
Name: count, dtype: int64
```

Seltos's Sell of Variants



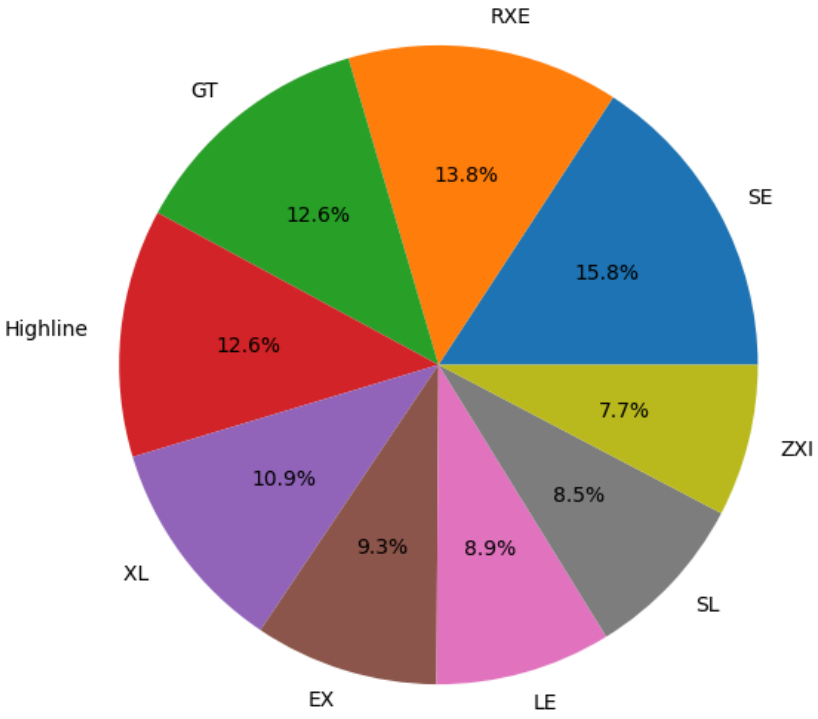

```
Variant
LE          38
GT          31
SL          27
EX          25
RXE         22
Highline    21
ZXI         16
SE          16
XL          12
Name: count, dtype: int64
```

Cruze's Sell of Variants



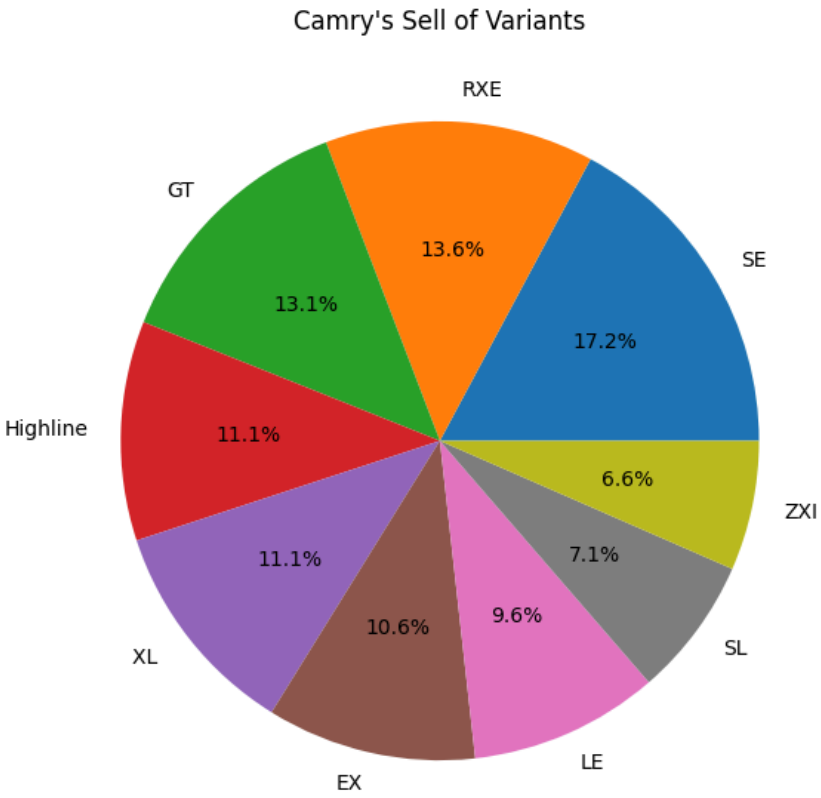

```
Variant
SE          39
RXE         34
GT          31
Highline    31
XL          27
EX          23
LE          22
SL          21
ZXI         19
Name: count, dtype: int64
```

F-150's Sell of Variants

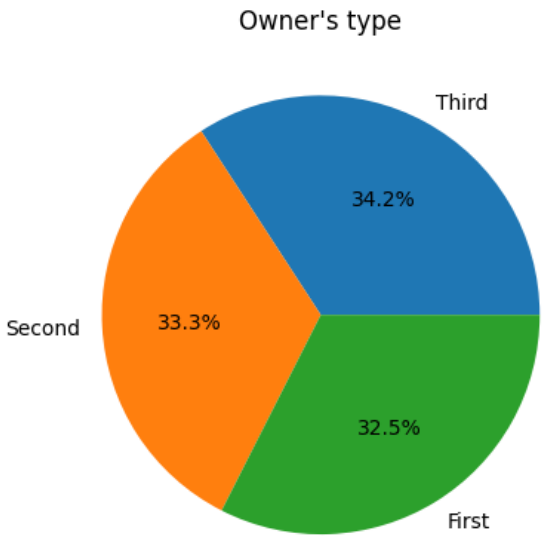



```
Variant
GT          34
ZXI         27
LE          26
Highline    22
EX          22
SE          21
```

```
RXE          19
XL           14
SL           13
Name: count, dtype: int64
```




```
owner = df['Owner Type'].value_counts()
plt.pie(owner,labels=owner.index,autopct='%1.1f%%')
plt.title("Owner's type")
plt.show()
```



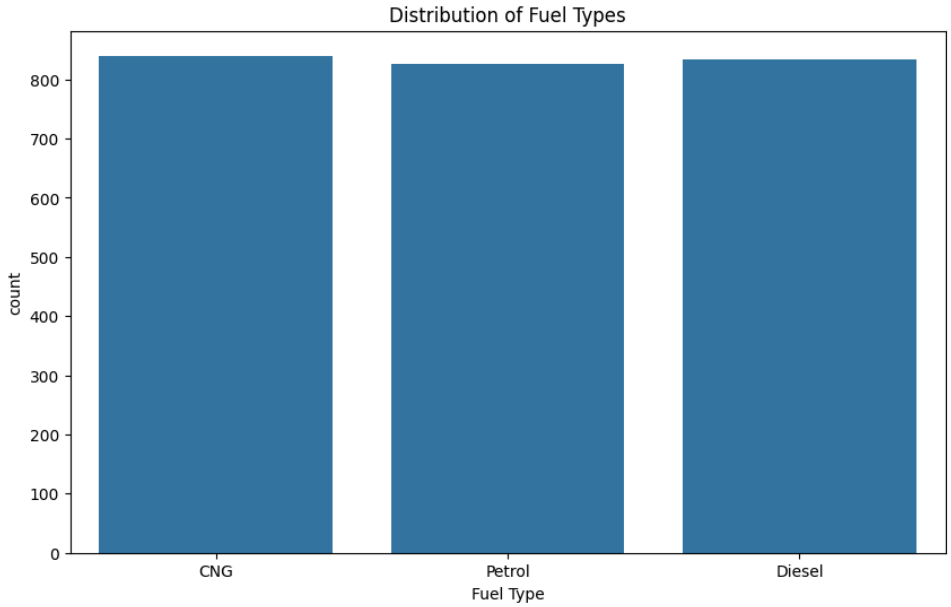

```
df['Variant'].fillna('Unknown', inplace=True)
df['Accessories'].fillna('None', inplace=True)
```

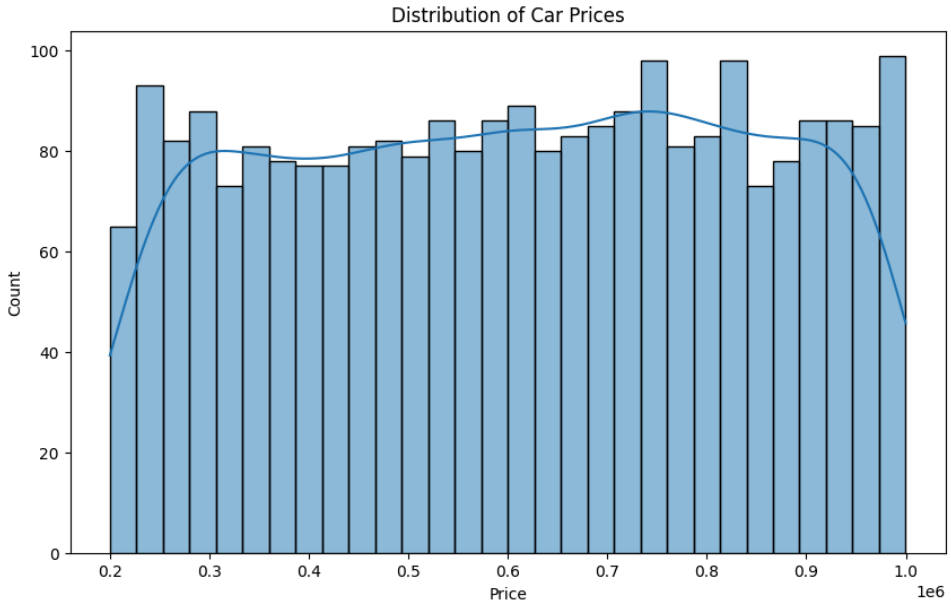
```
df['Make Year'] = df['Make Year'].astype(int)
df['Mileage'] = df['Mileage'].astype(int)
df['Price'] = df['Price'].astype(int)
```

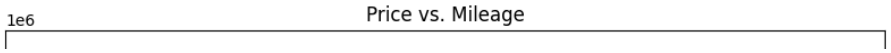
```
import seaborn as sns

print(df.dtypes)

plt.figure(figsize=(10, 6))
sns.countplot(x='Fuel Type', data=df)
plt.title('Distribution of Fuel Types')

# plt.show()
print('''


''')
plt.figure(figsize=(10, 6))
sns.histplot(df['Price'], bins=30, kde=True)
plt.title('Distribution of Car Prices')
# plt.show()
print('''


''')
plt.figure(figsize=(10, 6))
sns.scatterplot(x='Mileage', y='Price', data=df,color='orange')
plt.title('Price vs. Mileage')
# plt.show()
print('''


''')
plt.figure(figsize=(12, 8))
numeric_columns = ['Make Year', 'Mileage', 'Price']
numeric_df = df[numeric_columns]

sns.heatmap(numeric_df.corr(), annot=True, cmap='coolwarm')
plt.title('Correlation Heatmap')
# plt.show()
```

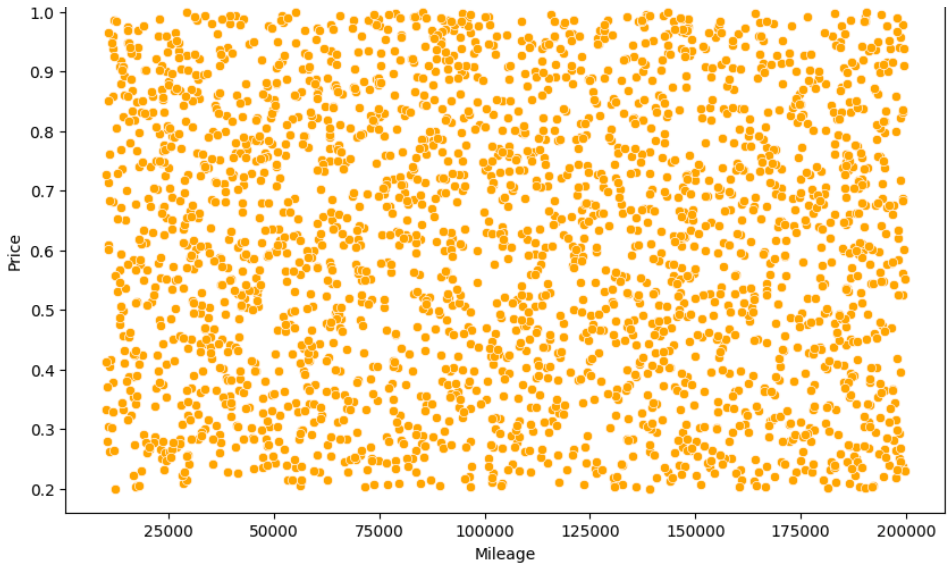
```
Company Name               object
Car Name                   object
Variant                    object
Fuel Type                  object
Tyre Condition             object
Make Year                   int64
Owner Type                 object
Registration Number        object
Mileage                     int64
Price                       int64
Transmission Type          object
Body Color                 object
Service Record             object
Insurance                  object
Registration Certificate   object
Accessories                object
Cluster                     int32
dtype: object
```

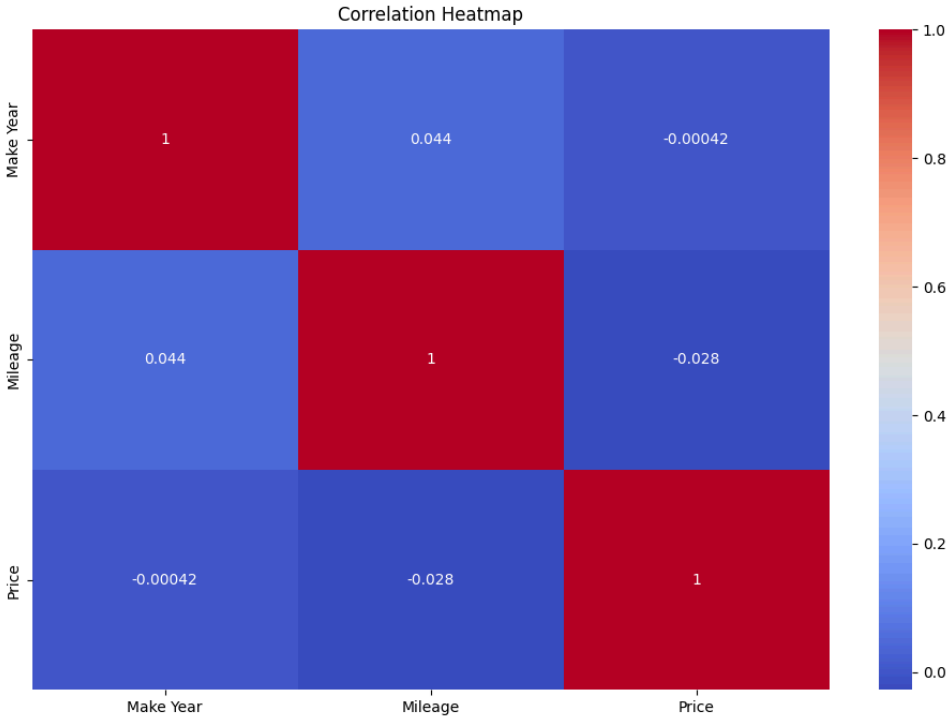
```
Text(0.5, 1.0, 'Correlation Heatmap')
```








Price
Mileage
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
25000
50000
75000
100000
125000
150000
175000
200000


Correlation Heatmap
Make Year
Mileage
Price
1
0.044
-0.00042
0.044
1
-0.028
-0.00042
-0.028
1
Make Year
Mileage
Price
1.0
0.8
0.6
0.4
0.2
0.0

```
from sklearn.cluster import KMeans
from sklearn.preprocessing import StandardScaler

scaler = StandardScaler()
df_scaled = scaler.fit_transform(df[['Mileage', 'Price']])
```

```
wcss = []

for i in range(1,11):
    km = KMeans(n_clusters=i)
    km.fit_predict(df_scaled)
    wcss.append(km.inertia_)
```

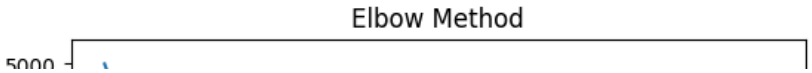
```
/usr/local/lib/python3.10/dist-packages/sklearn/cluster/_kmeans.py:870: FutureWarning: The default value of `n_init`
  warnings.warn(
/usr/local/lib/python3.10/dist-packages/sklearn/cluster/_kmeans.py:870: FutureWarning: The default value of `n_init`
  warnings.warn(
/usr/local/lib/python3.10/dist-packages/sklearn/cluster/_kmeans.py:870: FutureWarning: The default value of `n_init`
  warnings.warn(
/usr/local/lib/python3.10/dist-packages/sklearn/cluster/_kmeans.py:870: FutureWarning: The default value of `n_init`
  warnings.warn(
/usr/local/lib/python3.10/dist-packages/sklearn/cluster/_kmeans.py:870: FutureWarning: The default value of `n_init`
  warnings.warn(
/usr/local/lib/python3.10/dist-packages/sklearn/cluster/_kmeans.py:870: FutureWarning: The default value of `n_init`
  warnings.warn(
/usr/local/lib/python3.10/dist-packages/sklearn/cluster/_kmeans.py:870: FutureWarning: The default value of `n_init`
  warnings.warn(
/usr/local/lib/python3.10/dist-packages/sklearn/cluster/_kmeans.py:870: FutureWarning: The default value of `n_init`
  warnings.warn(
/usr/local/lib/python3.10/dist-packages/sklearn/cluster/_kmeans.py:870: FutureWarning: The default value of `n_init`
  warnings.warn(
/usr/local/lib/python3.10/dist-packages/sklearn/cluster/_kmeans.py:870: FutureWarning: The default value of `n_init`
  warnings.warn(
```

```
wcss
```

```
[4999.999999999995,
 3111.40779114869,
 1961.7933455019029,
 1246.8970254951014,
 1058.716648034422,
 892.5272692414267,
 751.6121146663704,
 628.2182714172255,
 545.4201665738697,
 491.1986213065466]
```

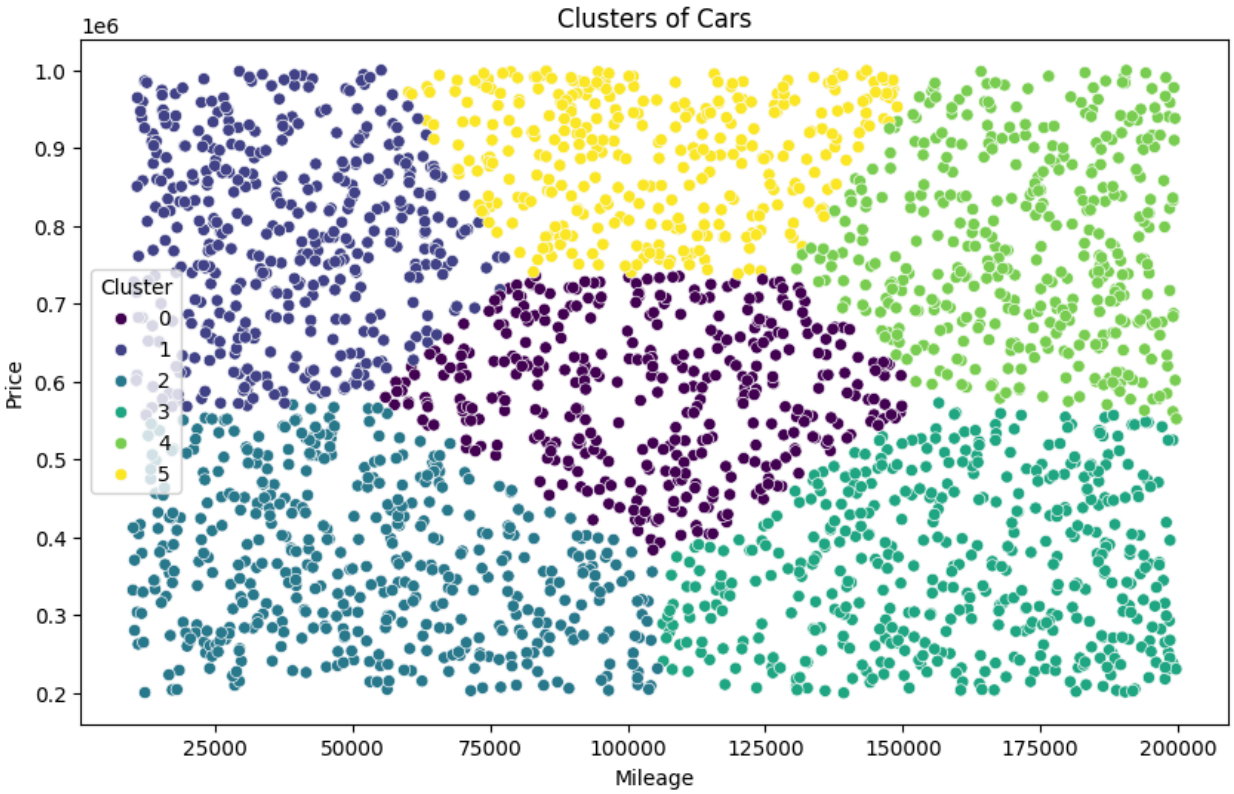
```
plt.title("Elbow Method")
plt.plot(range(1,11),wcss)
```

```
[<matplotlib.lines.Line2D at 0x7cf8232649a0>]
```




```
kmeans = KMeans(n_clusters=6)
df['Cluster'] = kmeans.fit_predict(df_scaled)

plt.figure(figsize=(10, 6))
sns.scatterplot(x='Mileage', y='Price', hue='Cluster', data=df, palette='viridis')
plt.title('Clusters of Cars')

plt.show()
```

```
/usr/local/lib/python3.10/dist-packages/sklearn/cluster/_kmeans.py:870: FutureWarning: The default value of `n_init`
  warnings.warn(
```




```
average_price_by_fuel = df.groupby('Fuel Type')['Price'].mean()
print(average_price_by_fuel)


from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression

X = df[['Mileage', 'Make Year']]
y = df['Price']
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2)

model = LinearRegression()
model.fit(X_train, y_train)

pred = model.predict(X_test)
# pred



insights = {
    "Total cars analyzed": len(df_cleaned),
    "Average price": df_cleaned['Price'].mean(),
    "Average mileage": df_cleaned['Mileage'].mean(),
    "Price distribution insights": "The majority of cars are priced within a specific range, with few very expensive or ver
    "Correlation insights": "Price is moderately negatively correlated with mileage, indicating that higher mileage cars te
```