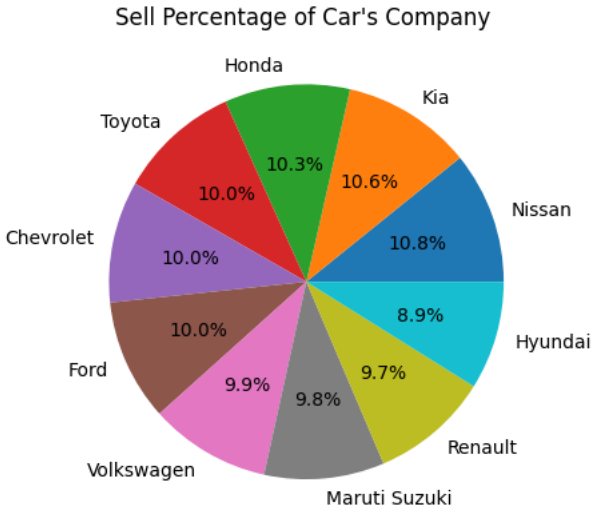
```
import pandas as pd
import matplotlib.pyplot as plt

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	Price	Transmission Type	Body Color	Service Record	Insu
2200	Nissan	Camry	LE	CNG	Used	2017	First	63-490-6659	18222	583656	Automatic (Tiptronic)	Maroon	Major Service at 149889 km	Vali
982	Nissan	Camry	XL	Diesel	Needs Replacement	2021	First	18-176-2046	137747	853519	Automatic	Maroon	No Service Record	No C Ins
2007	Hyundai	Swift	Highline	Diesel	Used	2024	First	18-783-2629	14829	537052	Manual	White	Major Service at 110951 km	Vali
2276	Volkswagen	Sunny	SE	CNG	Used	2016	First	91-573-2341	194124	361256	Automatic	Grey	No Service Record	Vali

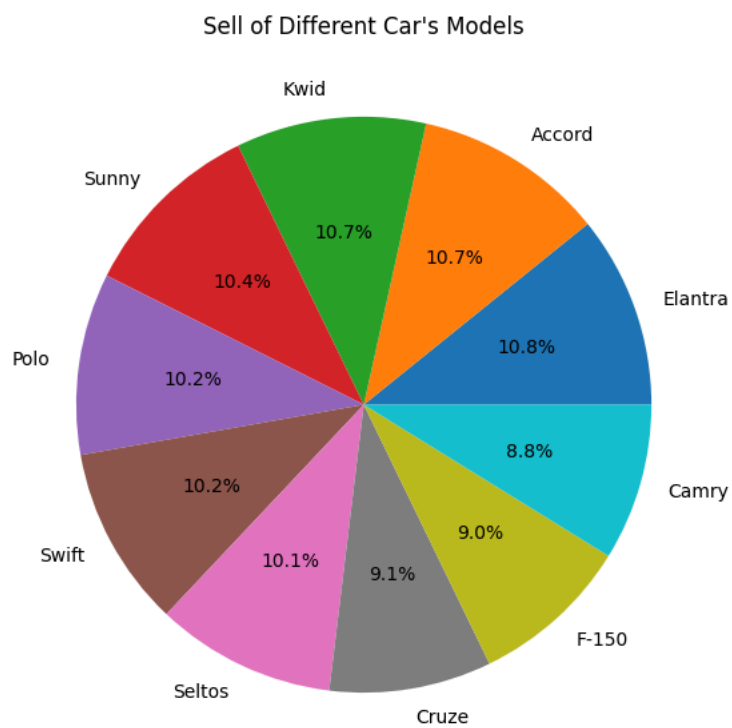
```
df.info()
df.isnull().sum()
```

```
<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
```

```
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()
```

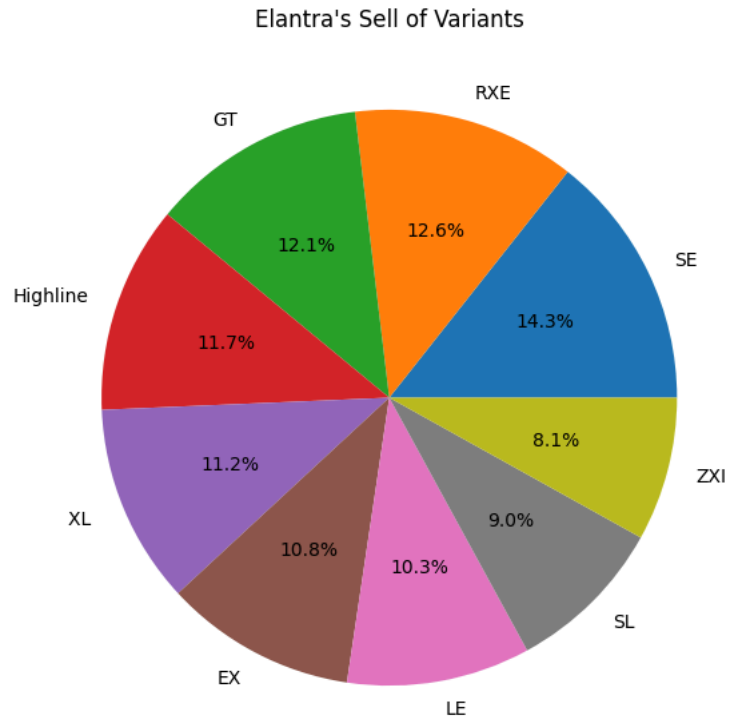



```
cars_quantity = []
cars=list(set(df['Car Name']))
for x in df['Car Name'].value_counts():
    cars_quantity.append(x)

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()
```

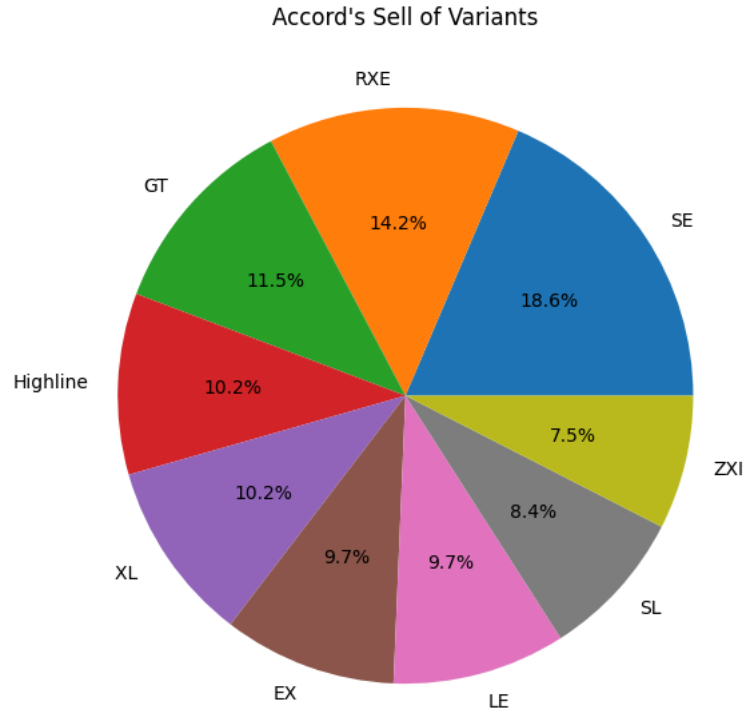



```
variant = ['SE','RXE','GT','Highline','XL ','EX','LE','SL','ZXI']

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
```

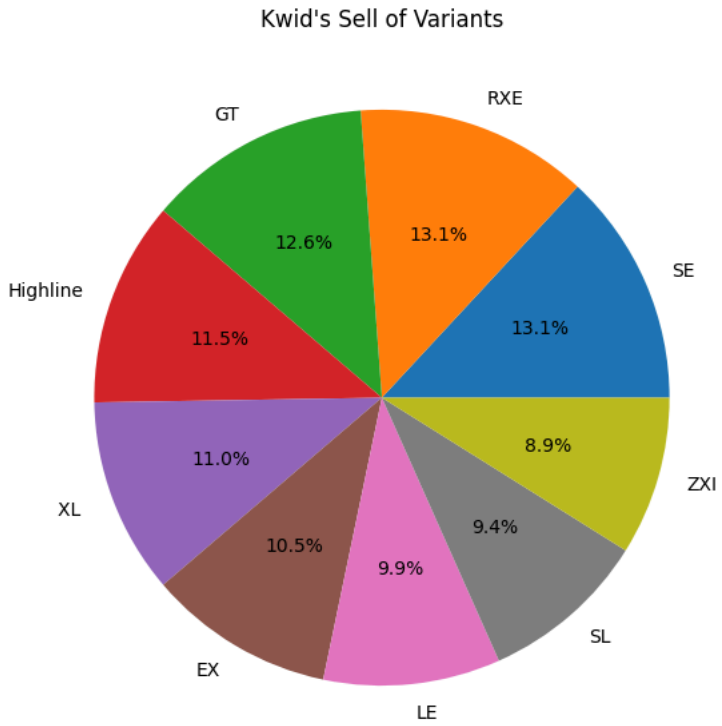



```
Variant
ZXI         42
XL          32
Highline    26
SL          23
LE          23
RXE         22
GT          22
SE          19
EX          17
Name: count, dtype: int64
```

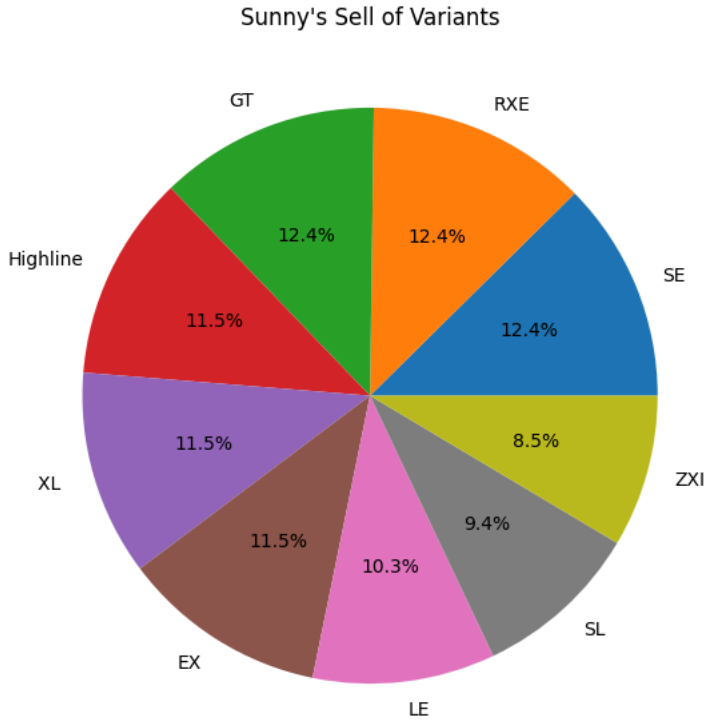



```
Variant
```

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

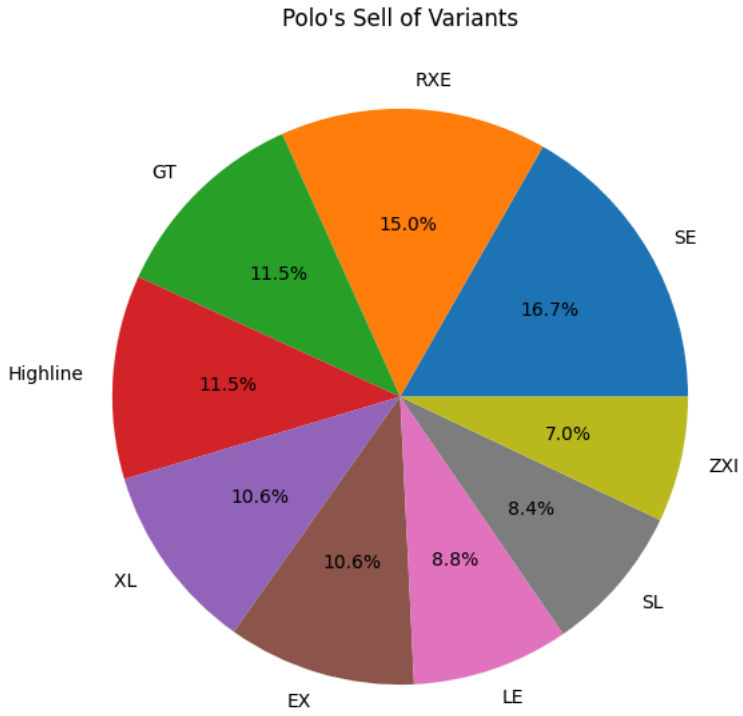



```
Variant
SE          29
ZXI         29
XL          29
LE          27
RXE         27
Highline    27
SL          24
GT          22
EX          20
Name: count, dtype: int64
```

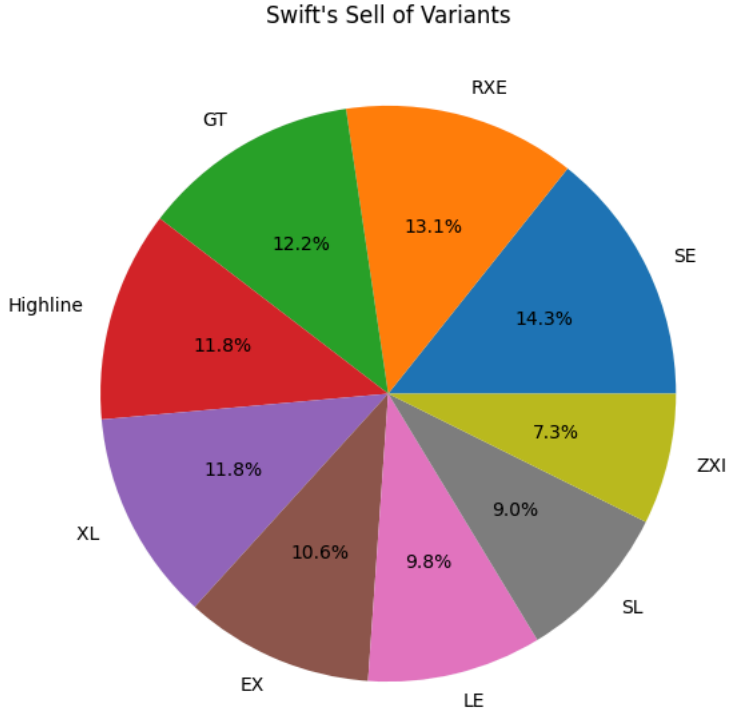



```
Variant
EX          38
RXE         34
```

```
GT           26
LE           26
SE           24
SL           24
Highline     20
XL           19
ZXI          16
Name: count, dtype: int64
```

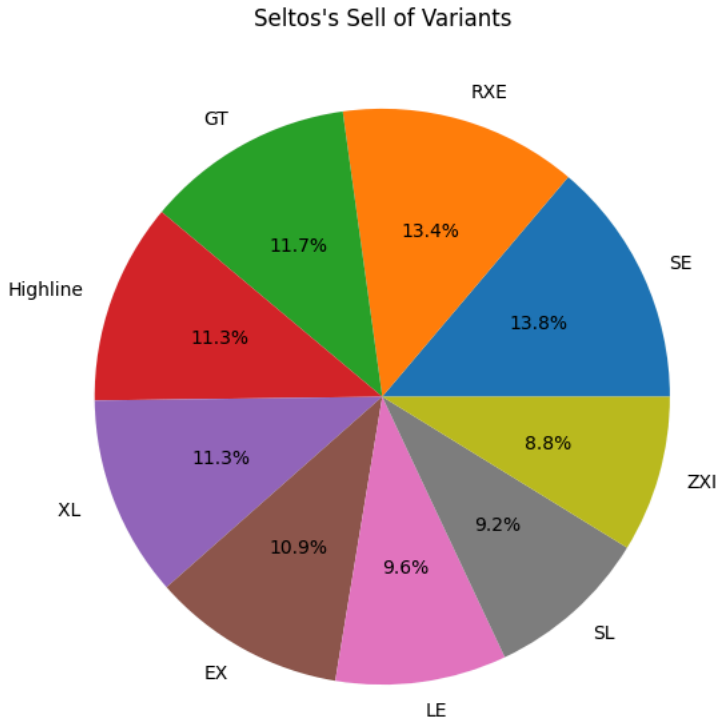



```
Variant
LE           35
SE           32
GT           30
RXE          29
XL           29
ZXI          26
SL           24
Highline     22
EX           18
Name: count, dtype: int64
```

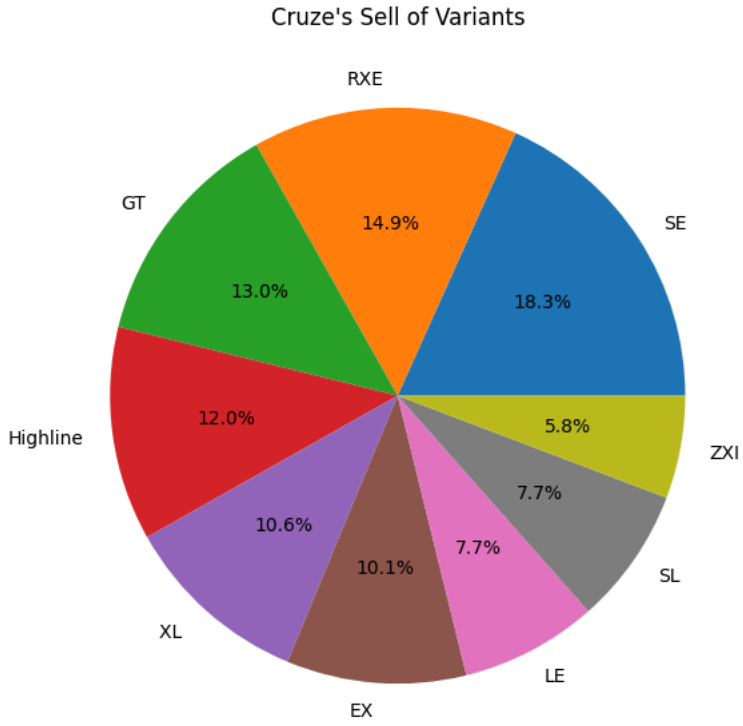



```
Variant
Highline     33
EX           32
SE           28
```

```
RXE          27
LE           27
XL           26
GT           23
ZXI          22
SL           21
Name: count, dtype: int64
```

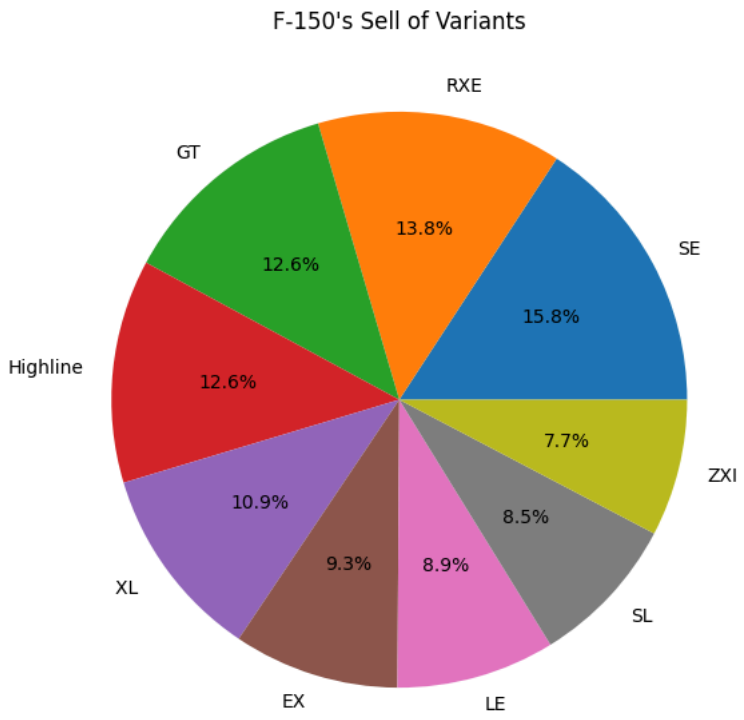



```
Variant
LE           38
GT           31
SL           27
EX           25
RXE          22
Highline     21
ZXI          16
SE           16
XL           12
Name: count, dtype: int64
```

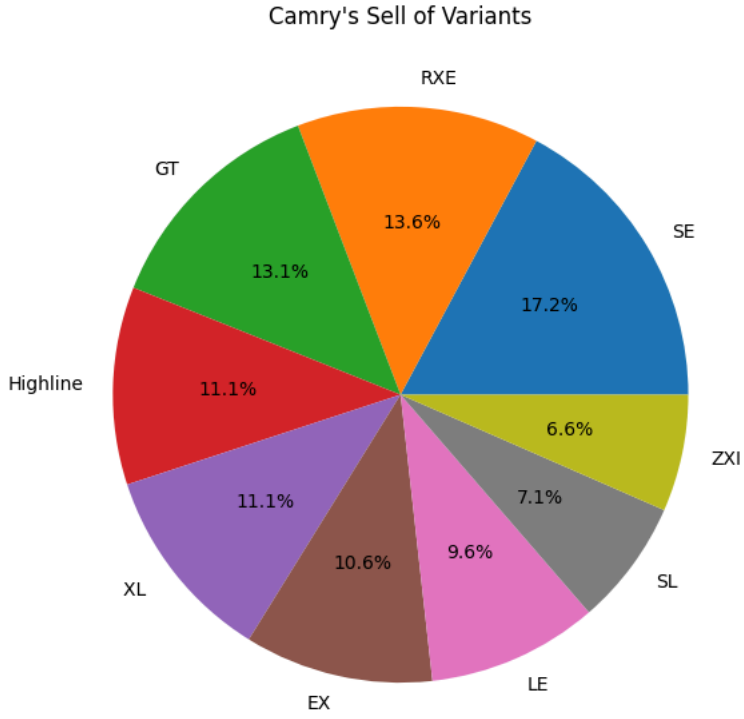



```
Variant
SE           39
RXE          34
GT           31
Highline     31
XL           27
```

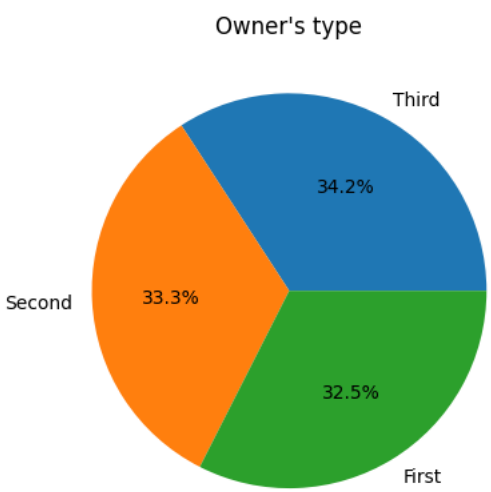
```
EX          23
LE          22
SL          21
ZXI         19
Name: count, dtype: int64
```




```
Variant
GT          34
ZXI         27
LE          26
Highline    22
EX          22
SE          21
RXE         19
XL          14
SL          13
Name: count, dtype: int64
```



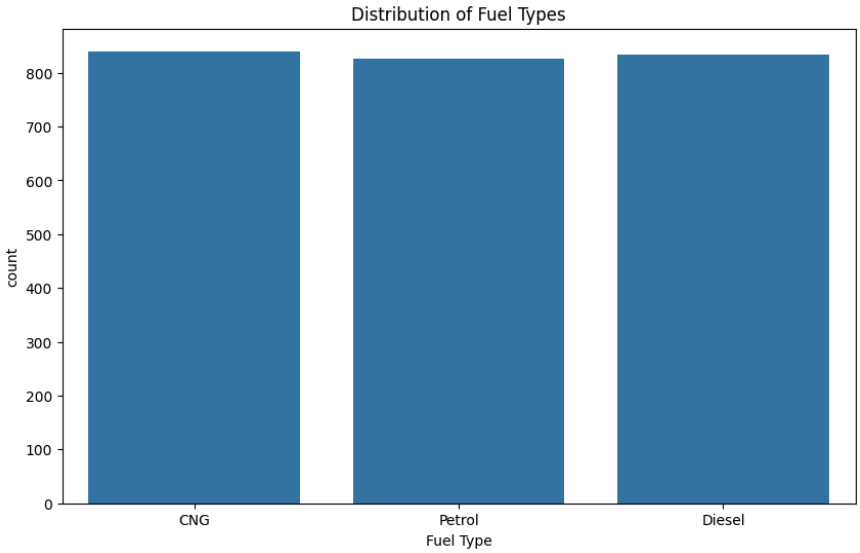

```
owner = df['Owner Type'].value_counts()
plt.pie(owner,labels=owner.index,autopct='%1.1f%%')
plt.title("Owner's type")
plt.show()
```

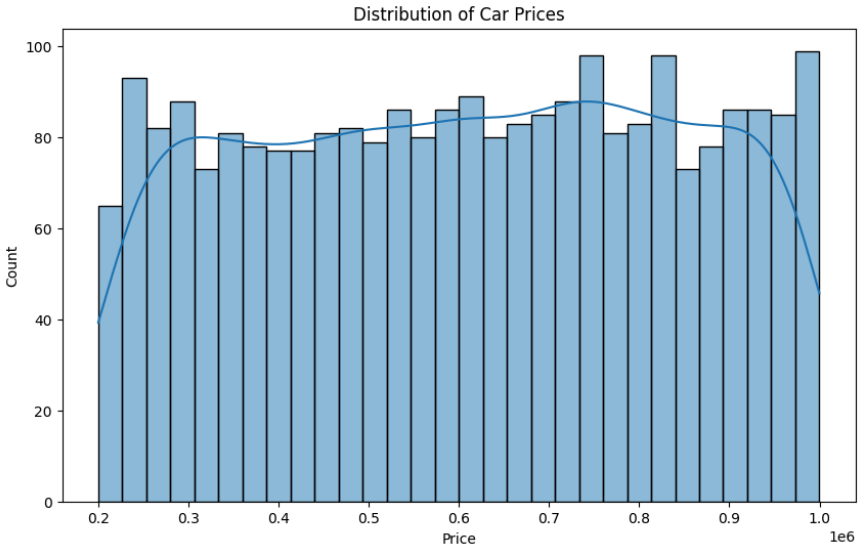


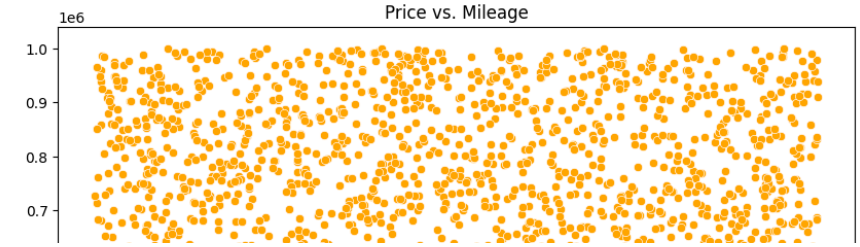

```
df['Variant'].fillna('Unknown', inplace=True)
df['Accessories'].fillna('None', inplace=True)


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()
```

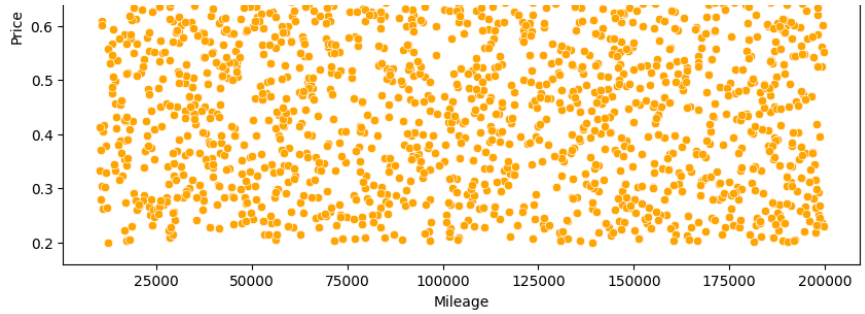
```
Company Name                object
Car Name                    object
Variant                     object
Fuel Type                   object
Tyre Condition              object
Make Year                    int64
Owner Type                  object
Registration Number         object
Mileage         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

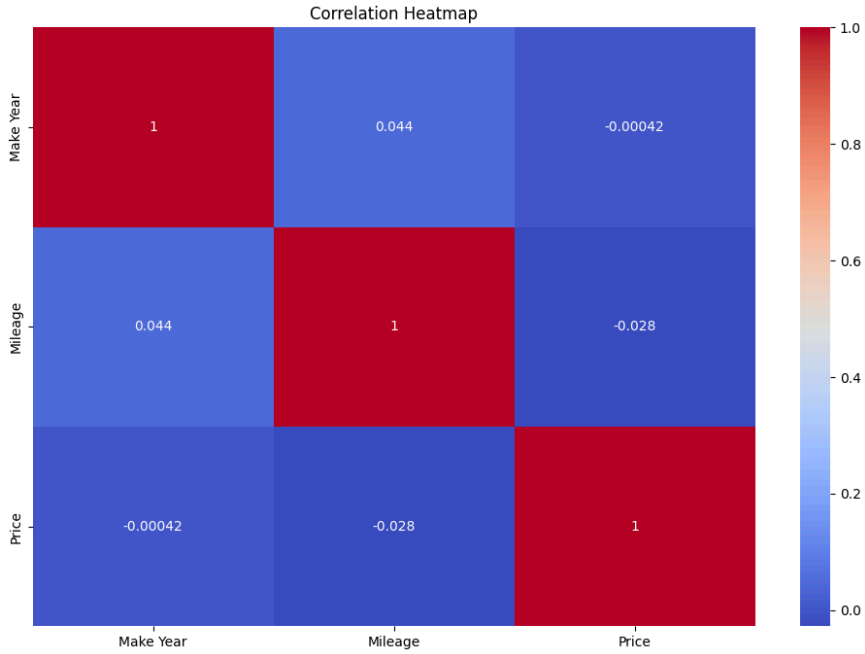
```
Text(0.5, 1.0, 'Correlation Heatmap')
```












```
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_)
```

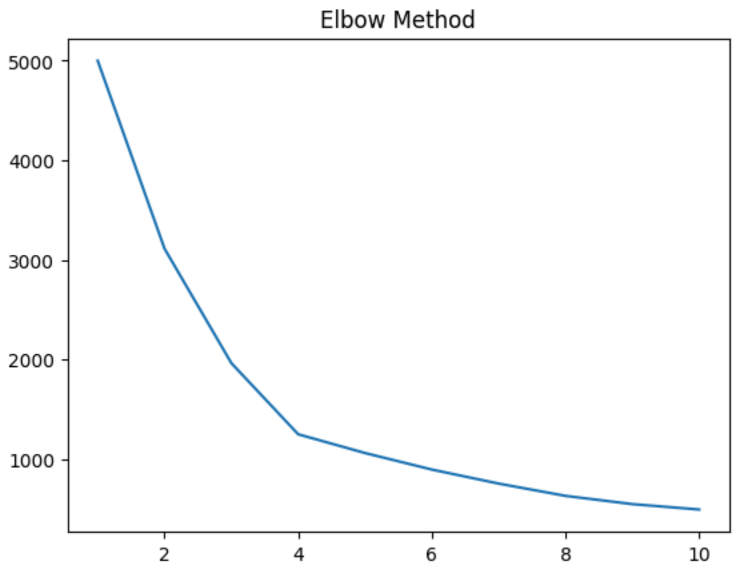
```
/usr/local/lib/python3.10/dist-packages/sklearn/cluster/_kmeans.py:870: FutureWarning: The default value of `n_init` will change frc
  warnings.warn(
/usr/local/lib/python3.10/dist-packages/sklearn/cluster/_kmeans.py:870: FutureWarning: The default value of `n_init` will change frc
  warnings.warn(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

```
wcss
```

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

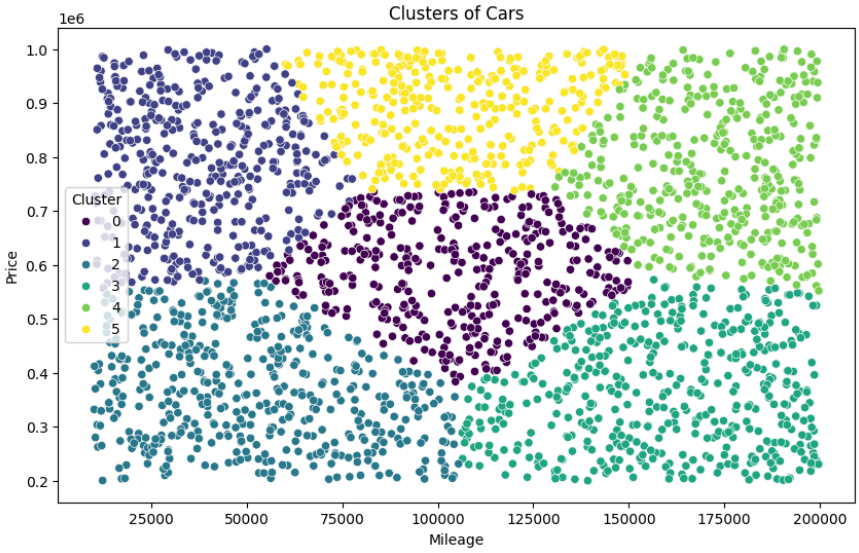
```
plt.title("Elbow Method")
plt.plot(range(1,11),wcss)
```

```
[<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
  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
```

```
Fuel Type
CNG       608814.659524
Diesel    601408.979592
Petrol    614176.844015
Name: Price, dtype: float64
array([615722.34535501, 610820.8889521 , 611535.76956023, 600032.67472487,
       596386.25357253, 597555.22691041, 613001.16353671, 609967.8625108 ,
       608938.34715651, 596458.54154949, 611711.53810255, 611292.74499252,
       602818.04811389, 613771.81622885, 606728.66509134, 610040.48391975,
       613937.07983971, 609070.5902075 , 610844.02799789, 610869.952156  ,
       609913.30533242, 607010.97836221, 610640.06688064, 602257.60339621,
       610434.72946327, 601673.93390546, 608465.80296603, 600116.29560027,
       612296.47629709, 611101.98760882, 596375.93132162, 612445.10606715,
       611954.46571698, 612203.79123155, 607765.53519514, 607273.59392057,
       607842.2961475 , 600411.31836119, 601274.23695961, 607846.79070045,
       600062.43721499, 608646.48551206, 602495.94008737, 608243.88550601,
       599084.56504436, 610223.65007522, 602769.77001333, 610586.30515716,
       610157.8566602 , 609863.44667362, 611932.4987132 , 596345.73873771,
       611737.06409599, 610457.53507707, 606970.35622256, 600828.96100677,
       609869.15613222, 604035.17037845, 606551.90718756, 600983.44005234,
       614719.68913916, 614651.18598754, 605271.15232847, 604888.23997487,
       596577.07539743, 609230.64953778, 613132.39594017, 605239.47584812,
       610471.79261327, 613877.30744624, 599326.57896454, 615274.21984865,
       613086.12849163, 602708.96539476, 610417.85885227, 610245.68181169,
       608141.60920326, 611718.11839176, 610698.52741519, 615595.96222257,
       605751.58866709, 600147.1979118 , 615107.63373582, 602955.86080656,
       613021.34572414, 612024.27008449, 613737.6345615 , 612632.22908547,
       598759.28525834, 612692.23795766, 607063.38536313, 602502.53101962,
       604885.0788584 , 599280.41911232, 611878.14550145, 600084.24282429,
       603763.31888391, 601465.97277025, 607032.35416921, 610797.69610815,
       608079.12707317, 609732.14982897, 612224.39257825, 609658.09832173,
       604638.20502416, 610541.67206501, 601825.8646089 , 608822.53339673,
       608723.83795268, 603541.63790261, 610839.58753458, 605300.01176738,
       612519.20043802, 612447.4930148 , 613207.56539976, 608164.74795756,
       600659.65451431, 603375.5247472 , 606494.09164795, 614911.84440055,
```

605053.60024753, 617473.18178972, 616615.05866416, 598978.64373319,
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607936.86298267, 604415.79273768, 614325.41137504, 610884.18811464,
615900.21056812, 613981.20746235, 603725.11591251, 613035.74307725,
612110.91225944, 609201.74723524, 610657.17397036, 612722.21534893,
614922.09127574, 605043.38559294, 605475.64049279, 608466.19019618,
602818.33839076, 598194.86239173, 598328.77201971, 611449.27755374,
605179.81134245, 603492.72515866, 603541.55159236, 607799.07157607,
613936.42391025, 604554.47626096, 612283.34764778, 598974.42881407,