19120688

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1 Thông tin sinh viên

- MSSV: 19120688
- Họ và tên: Đỗ Nhật Toàn

2 Chuẩn bị

2.1 Import các thư viện

[1]:
```
import matplotlib.pyplot as plt
import pandas as pd
import numpy as np
import seaborn as sns
```

[2]:
```
sns.set(style="white")
sns.set(style="whitegrid", color_codes=True)
```

2.2 Test data

[3]:
```
data = pd.read_csv('./ToyotaCorolla.csv', header=0)
data = data.dropna()
```

[4]:
```
data.shape
```

[4]:
```
(1436, 12)
```

[5]:
```
data.head()
```

[5]:

	Price	Age	Kilometers	Fuel_Type	HP	Metallic	Color	Automatic	CC	Doors	Quarterly_Tax	Weight
0	13500	23	46986	Diesel	90	1	Blue	0	2000	3	210	1165
1	13750	23	72937	Diesel	90	1	Silver	0	2000			
2	13950	24	41711	Diesel	90	1	Blue	0	2000			
3	14950	26	48000	Diesel	90	0	Black	0	2000			
4	13750	30	38500	Diesel	90	0	Black	0	2000			

```
1       3            210    1165
2       3            210    1165
3       3            210    1165
4       3            210    1170
```

3 Hãy trực quan hóa các thông tin thống kê mô tả cho các biến

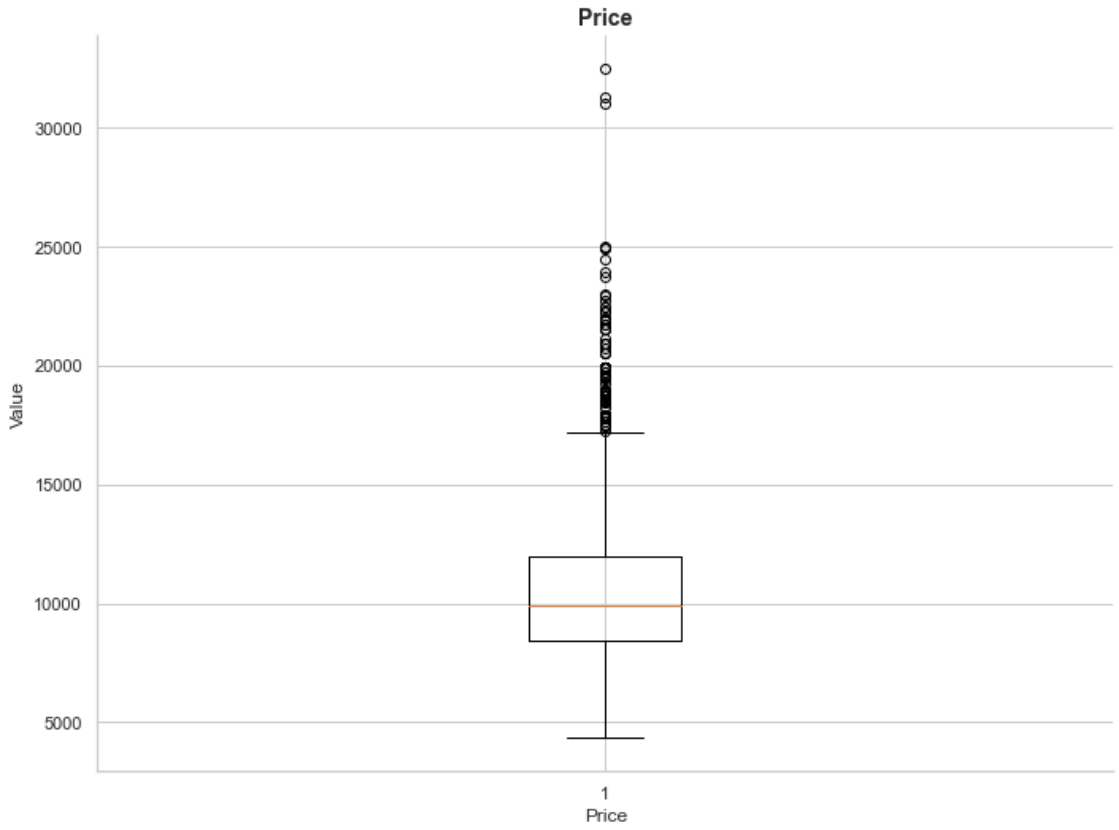
3.1 Khai báo danh sách thuộc tính

[6]:
```
atr_list = ['Price', 'Age', 'Kilometers', 'Fuel_Type', 'HP', 'Metallic',␣
 ↪'Color', 'Automatic', 'CC', 'Doors', 'Quarterly_Tax', 'Weight']
numeric_list = ['Price', 'Age', 'HP', 'CC', 'Doors', 'Quarterly_Tax', 'Weight']
categorical_list = ['Fuel_Type', 'Metallic', 'Automatic', 'Color']
```

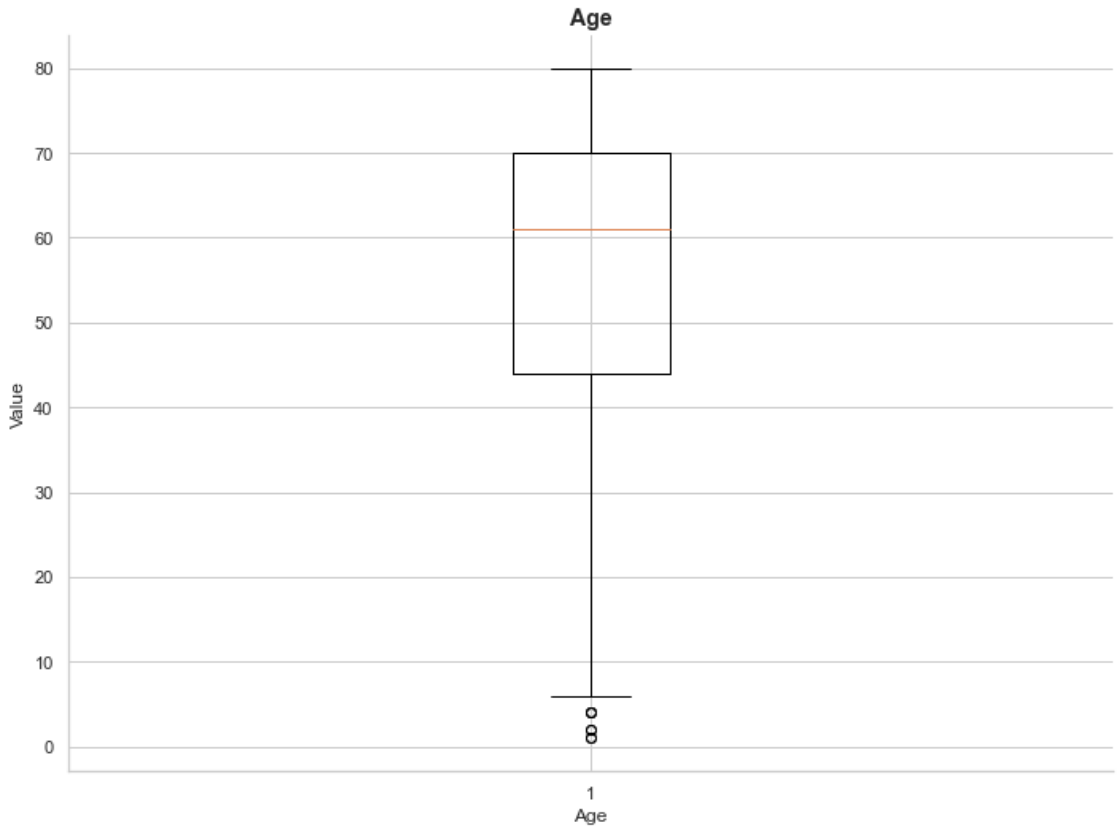
3.2 Biểu đồ box plot thể hiện thông tin thống kê mô tả của các thuộc tính numeric

[7]:
```
for x in numeric_list:
    print("Descriptive statistics information of", x)
    print(data[x].describe())
    fig_obj = plt.figure(figsize=(10, 7.5))
    ax = plt.subplot(111)
    ax.spines["bottom"].set_visible(True)
    ax.spines["left"].set_visible(True)
    ax.spines['right'].set_visible(False)
    ax.spines['top'].set_visible(False)
    p = plt.boxplot(data[x])
    plt.title(x, fontsize=14, fontweight='bold')
    plt.xlabel(x)
    plt.ylabel("Value")
    plt.tight_layout()
    plt.show()
```

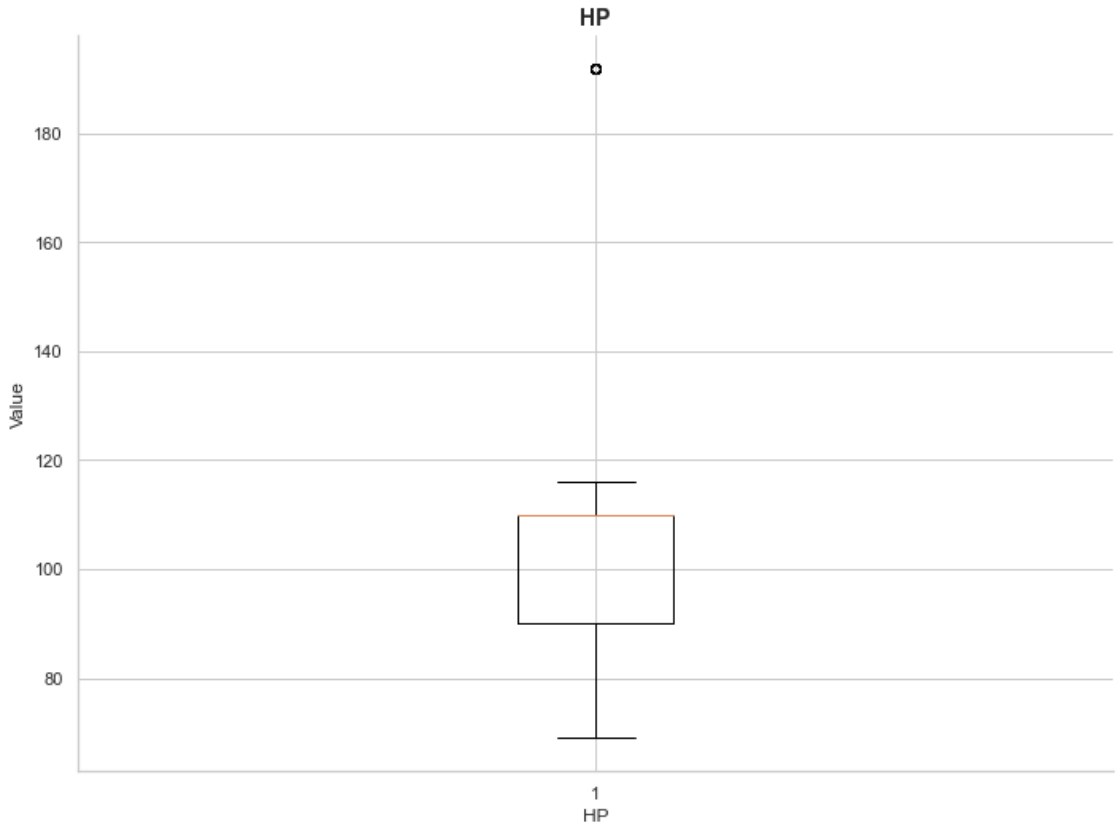
```
Descriptive statistics information of Price
count     1436.000000
mean     10730.824513
std       3626.964585
min       4350.000000
25%       8450.000000
50%       9900.000000
75%      11950.000000
max      32500.000000
Name: Price, dtype: float64
```



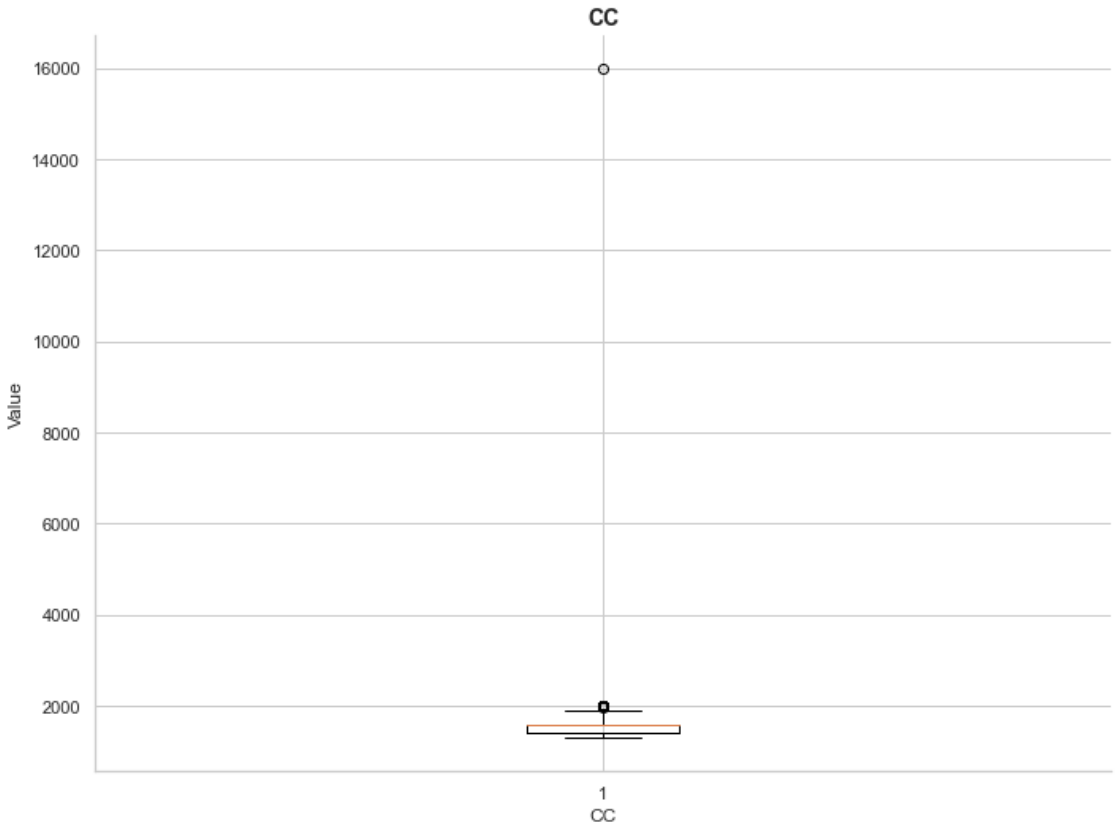

```
Descriptive statistics information of Age
count    1436.000000
mean       55.947075
std        18.599988
min         1.000000
25%        44.000000
50%        61.000000
75%        70.000000
max        80.000000
Name: Age, dtype: float64
```



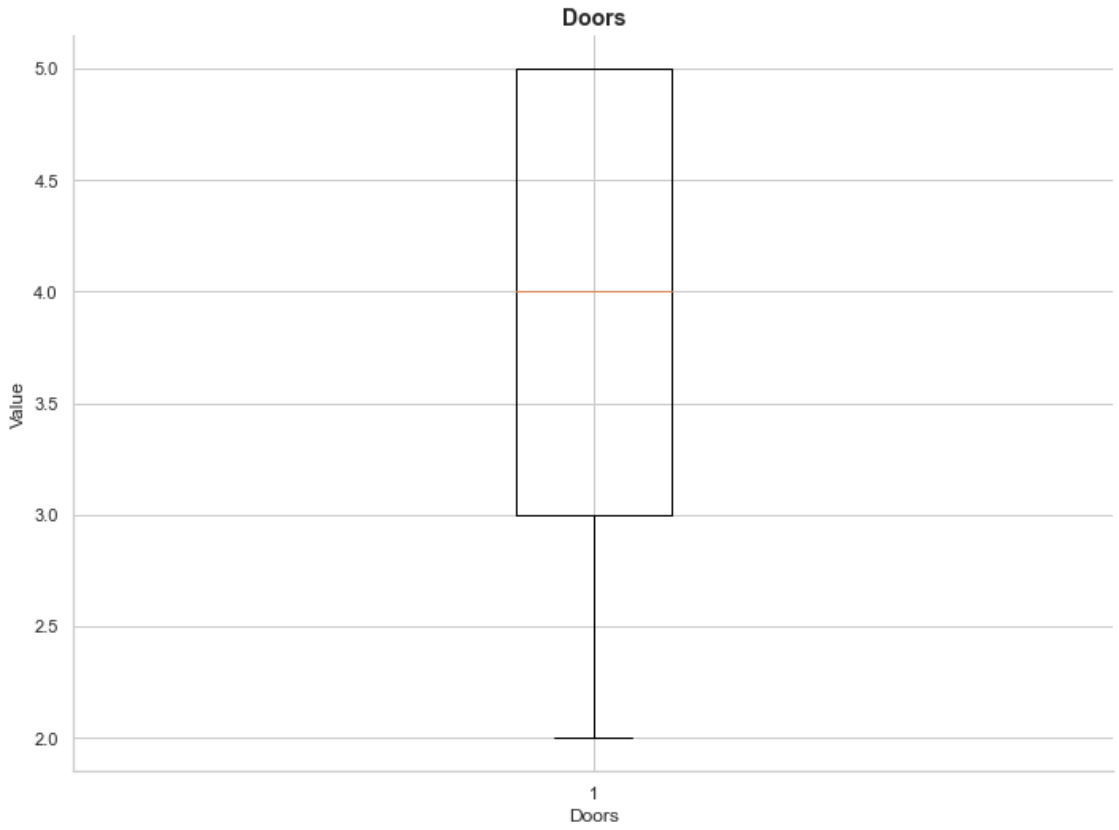

```
Descriptive statistics information of HP
count    1436.000000
mean      101.502089
std        14.981080
min        69.000000
25%        90.000000
50%       110.000000
75%       110.000000
max       192.000000
Name: HP, dtype: float64
```



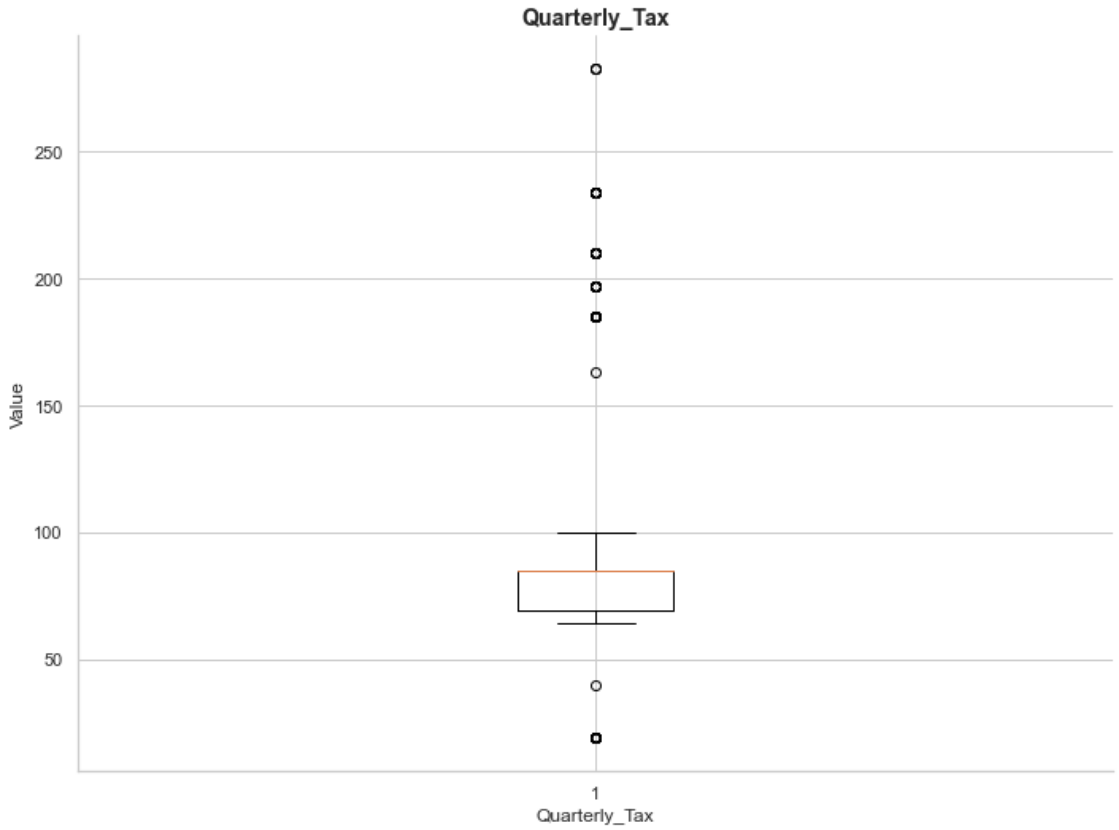

```
Descriptive statistics information of CC
count     1436.00000
mean      1576.85585
std        424.38677
min       1300.00000
25%       1400.00000
50%       1600.00000
75%       1600.00000
max      16000.00000
Name: CC, dtype: float64
```



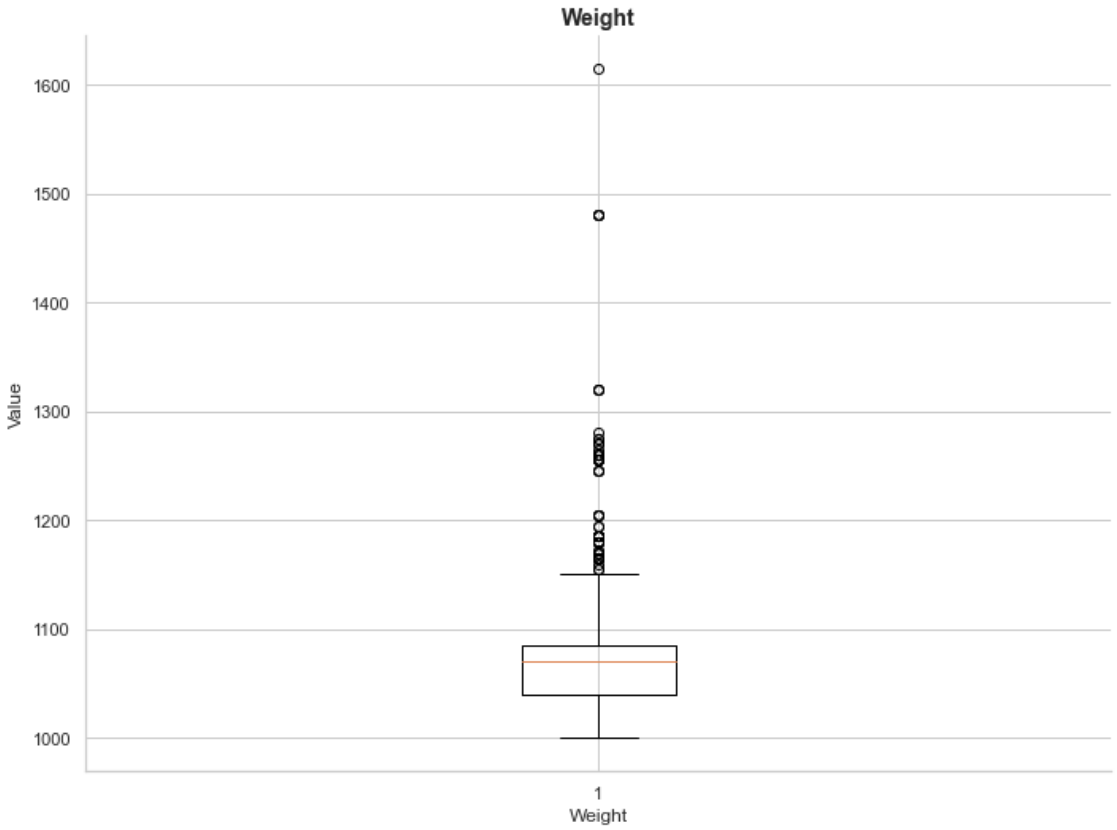

```
Descriptive statistics information of Doors
count    1436.000000
mean        4.033426
std         0.952677
min         2.000000
25%         3.000000
50%         4.000000
75%         5.000000
max         5.000000
Name: Doors, dtype: float64
```




```
Descriptive statistics information of Quarterly_Tax
count    1436.000000
mean       87.122563
std        41.128611
min        19.000000
25%        69.000000
50%        85.000000
75%        85.000000
max       283.000000
Name: Quarterly_Tax, dtype: float64
```

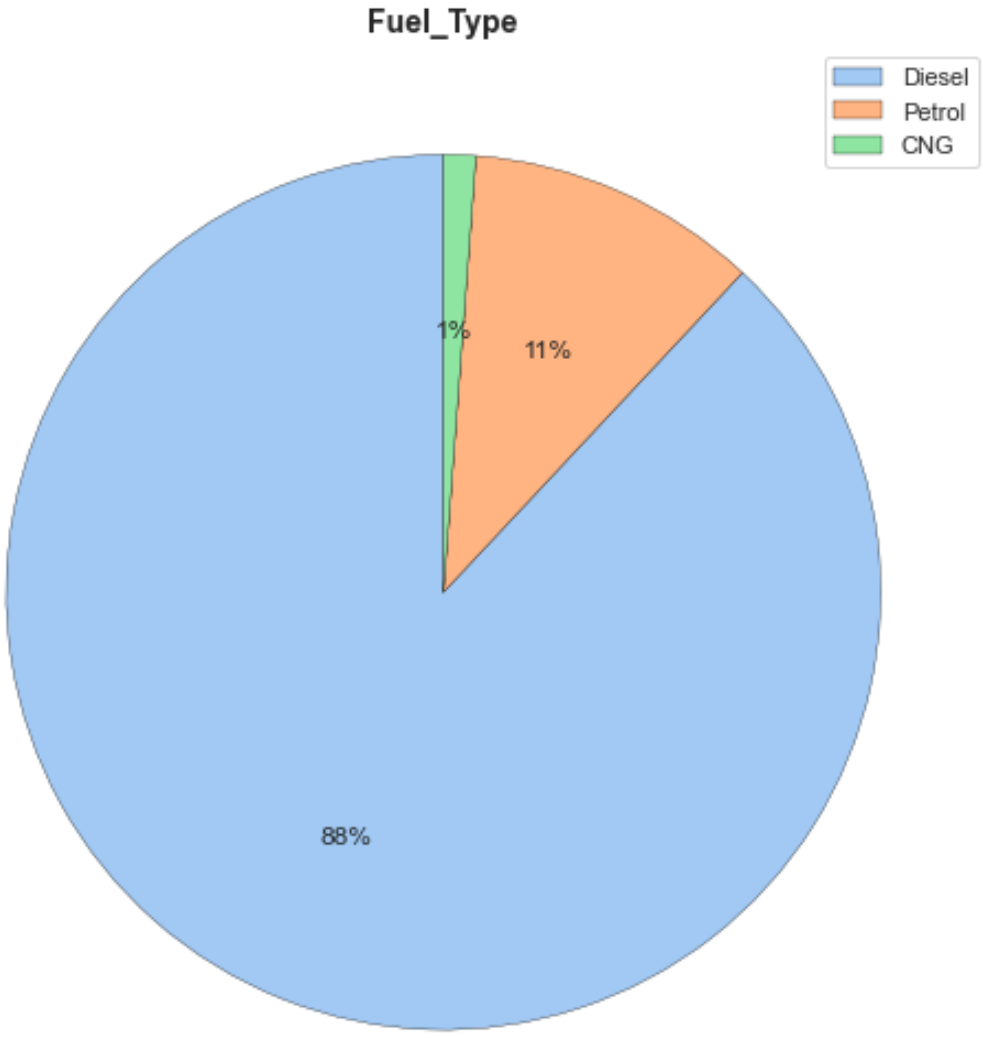


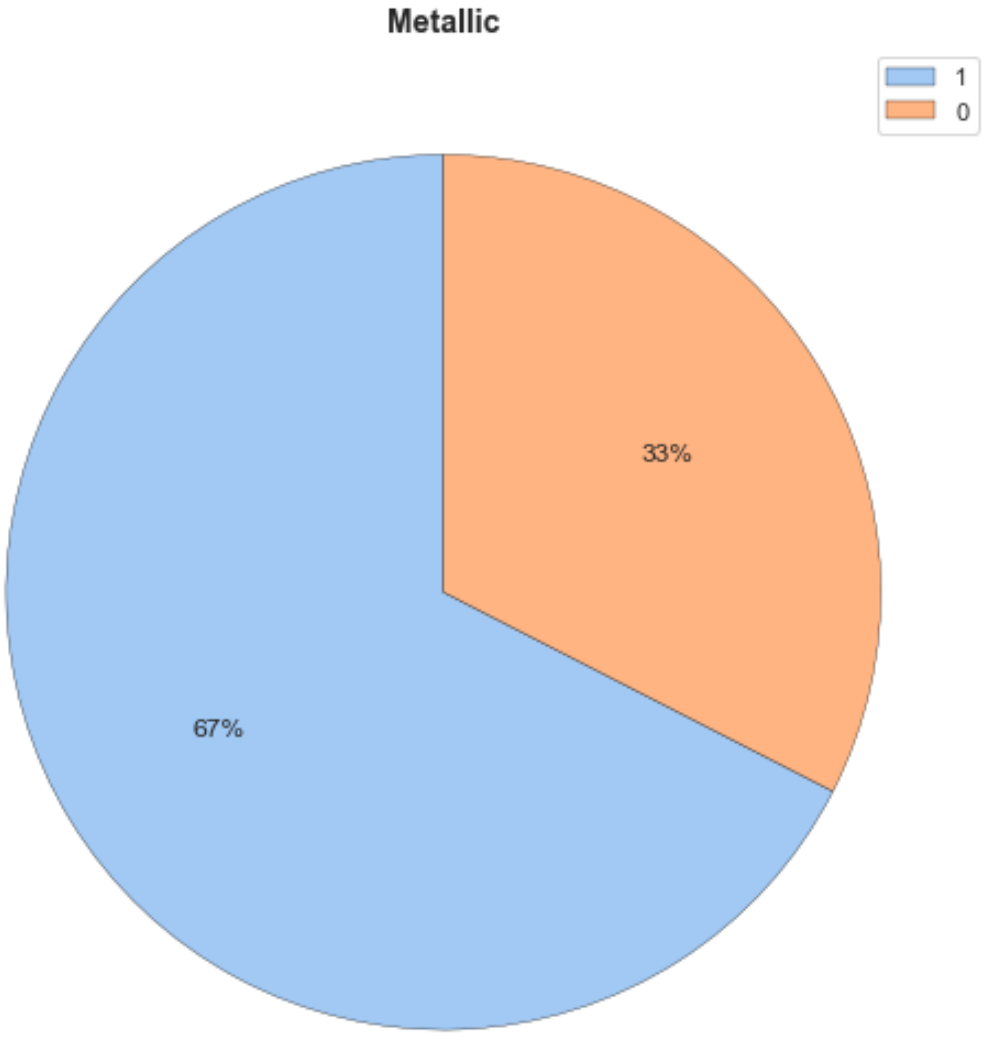

```
Descriptive statistics information of Weight
count    1436.00000
mean     1072.45961
std        52.64112
min      1000.00000
25%      1040.00000
50%      1070.00000
75%      1085.00000
max      1615.00000
Name: Weight, dtype: float64
```

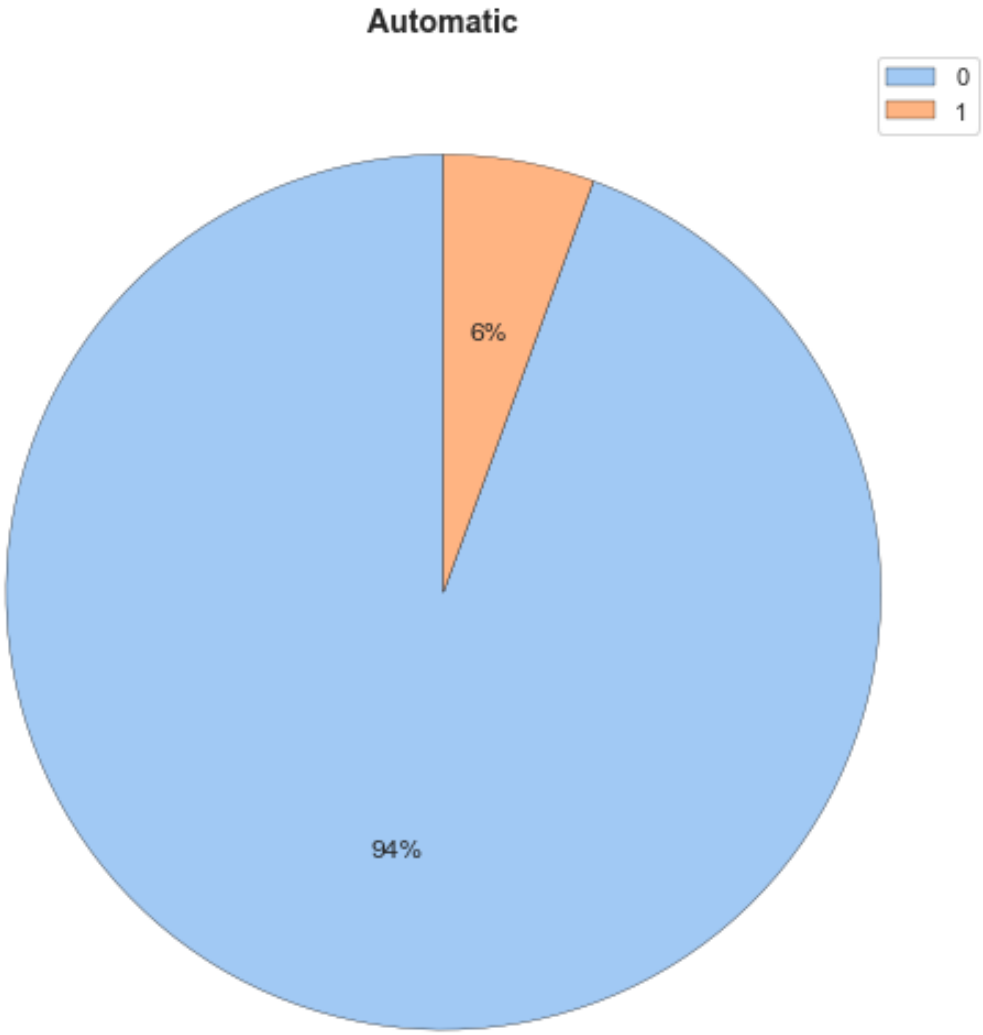


3.3 Biểu đồ pie chart thể hiện thông tin của các thuộc tính categorical

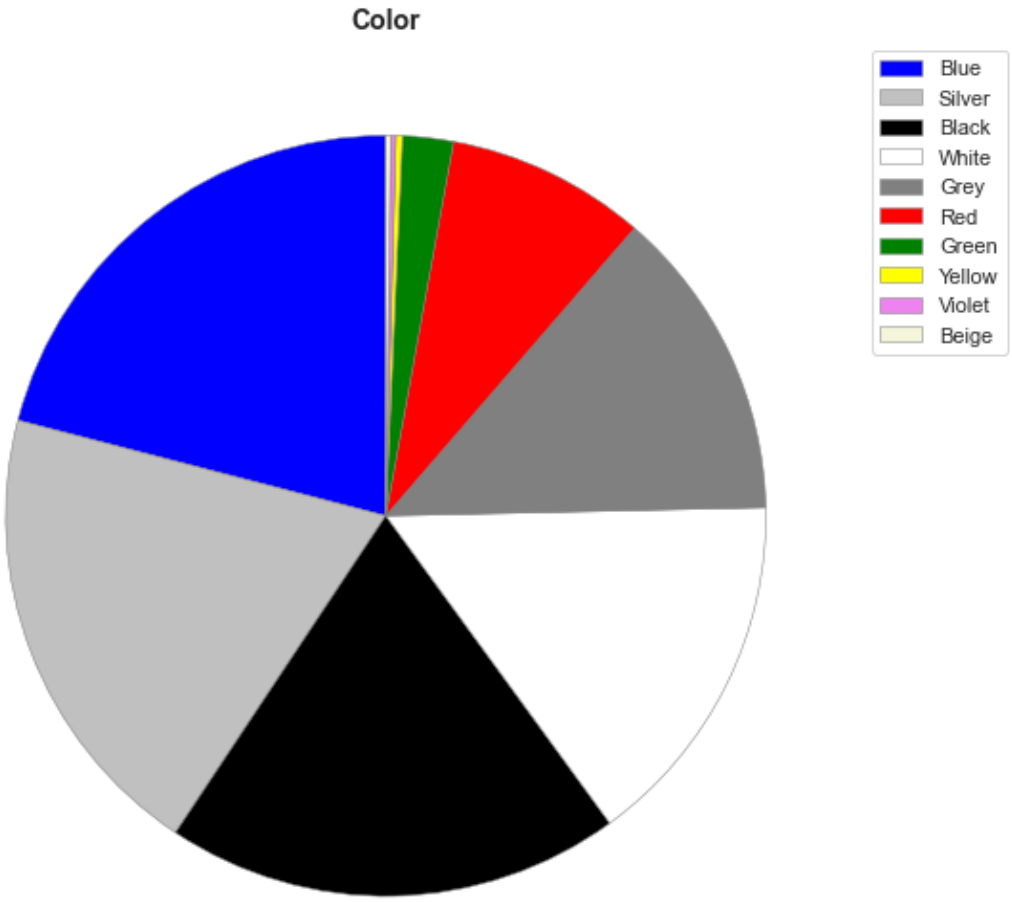
[8]:
```
colors = sns.color_palette('pastel')
for x in categorical_list[:-1]:
    fig_obj = plt.figure(figsize=(10, 7.5))
    fig_obj.set_facecolor('white')
    value = data[x].value_counts()
    label = data[x].unique().tolist()
    ax = plt.subplot(111)
    plt.title(x, fontsize=14, fontweight='bold')
    plt.pie(value, colors=colors,autopct='%.0f%%', startangle=90, wedgeprops =␣
 ↪{"edgecolor" : "black",
                        'linewidth': 0.3,
                        'antialiased': True})
    plt.legend(label,loc=1)
    plt.tight_layout()
    plt.show()
```


Fuel_Type
Diesel
Petrol
CNG
1%
11%
88%


Metallic
1
0
33%
67%



[9]:
```
fig_obj = plt.figure(figsize=(10, 7.5))
fig_obj.set_facecolor('white')
value = data['Color'].value_counts()
label = data['Color'].unique().tolist()
ax = plt.subplot(111)
plt.title('Color', fontsize=14, fontweight='bold')
plt.pie(value, colors=label, startangle=90, wedgeprops = {"edgecolor" : "grey",
                      'linewidth': 0.5,
                      'antialiased': True})
plt.legend(label, bbox_to_anchor=(1.0, 1.0))
plt.tight_layout()
plt.show()
```



4 Tìm và trực quan mối quan hệ tương quan giữa các cặp biến (nếu có)

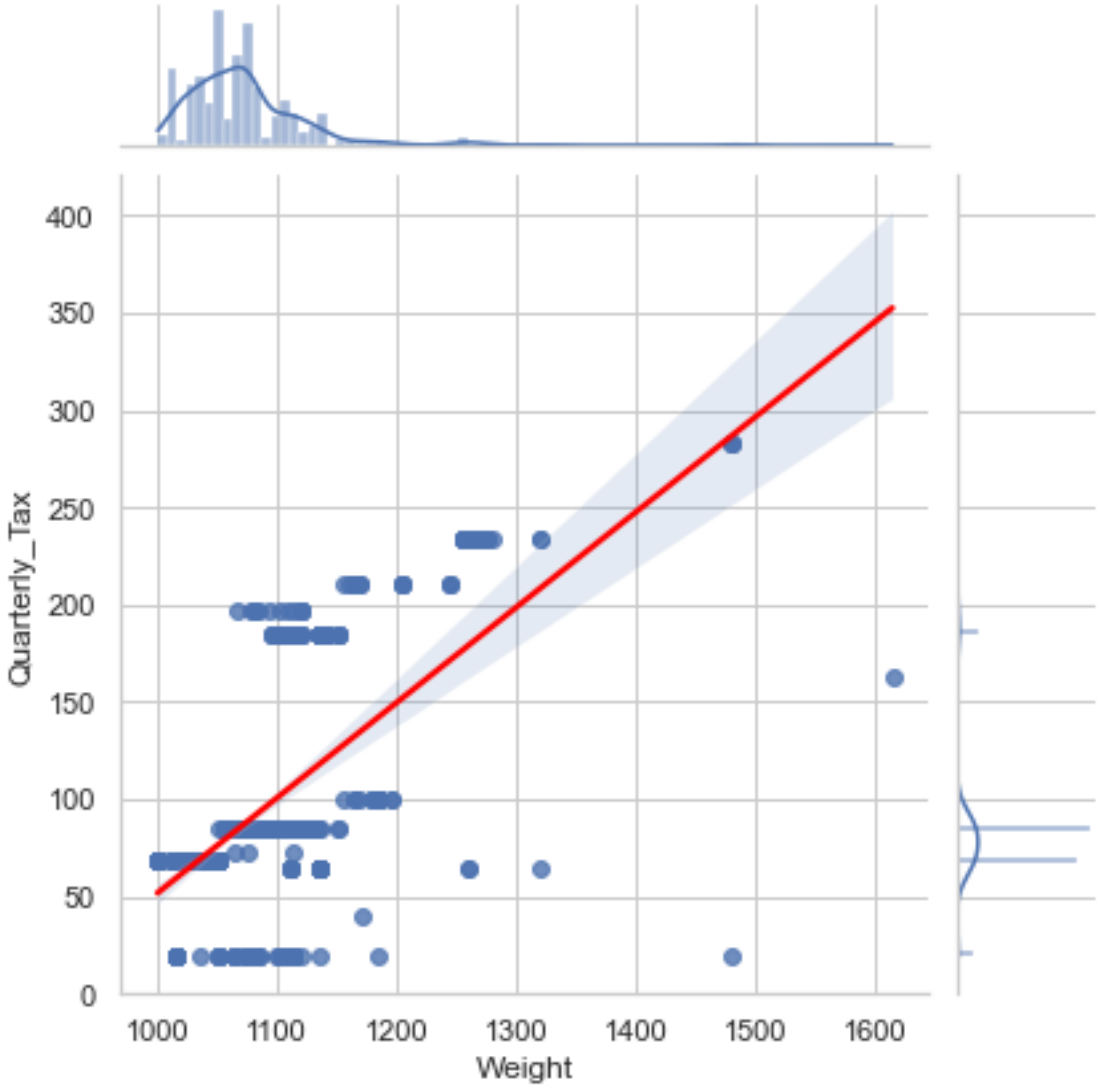
[10]:
```
corr = data.corr(method="pearson")
f, ax = plt.subplots(figsize=(12, 10))
mask = np.triu(np.ones_like(corr, dtype=bool))
cmap = sns.diverging_palette(230, 20, as_cmap=True)
sns.heatmap(corr, annot=True, mask = mask, cmap=cmap)
```

[10]: <AxesSubplot:>

4.1 Weight vs. Quarterly_Tax

[11]:
```
print("Correlation matrix:\n", np.corrcoef(data['Weight'],␣
  ↪data['Quarterly_Tax']))
a = sns.jointplot(x="Weight",y="Quarterly_Tax", data=data, kind='reg')
regline = a.ax_joint.get_lines()[0]
regline.set_color('red')
```

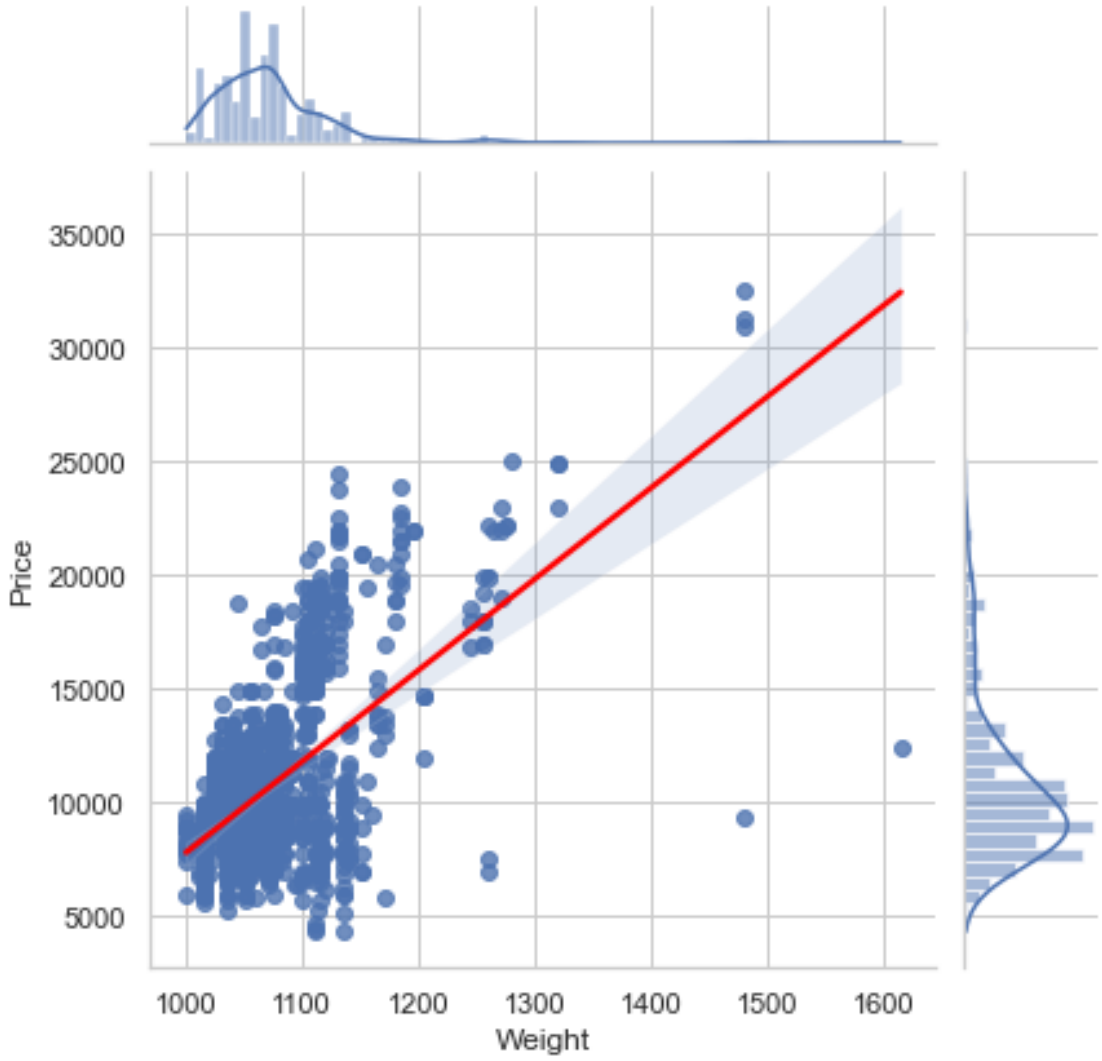
```
Correlation matrix:
 [[1.         0.62613373]
 [0.62613373 1.        ]]
```



4.2 Weight vs. Price

[12]:
```
print("Correlation matrix:\n", np.corrcoef(data['Weight'], data['Price']))
b = sns.jointplot(x="Weight",y="Price", data=data, kind='reg')
regline = b.ax_joint.get_lines()[0]
regline.set_color('red')
```

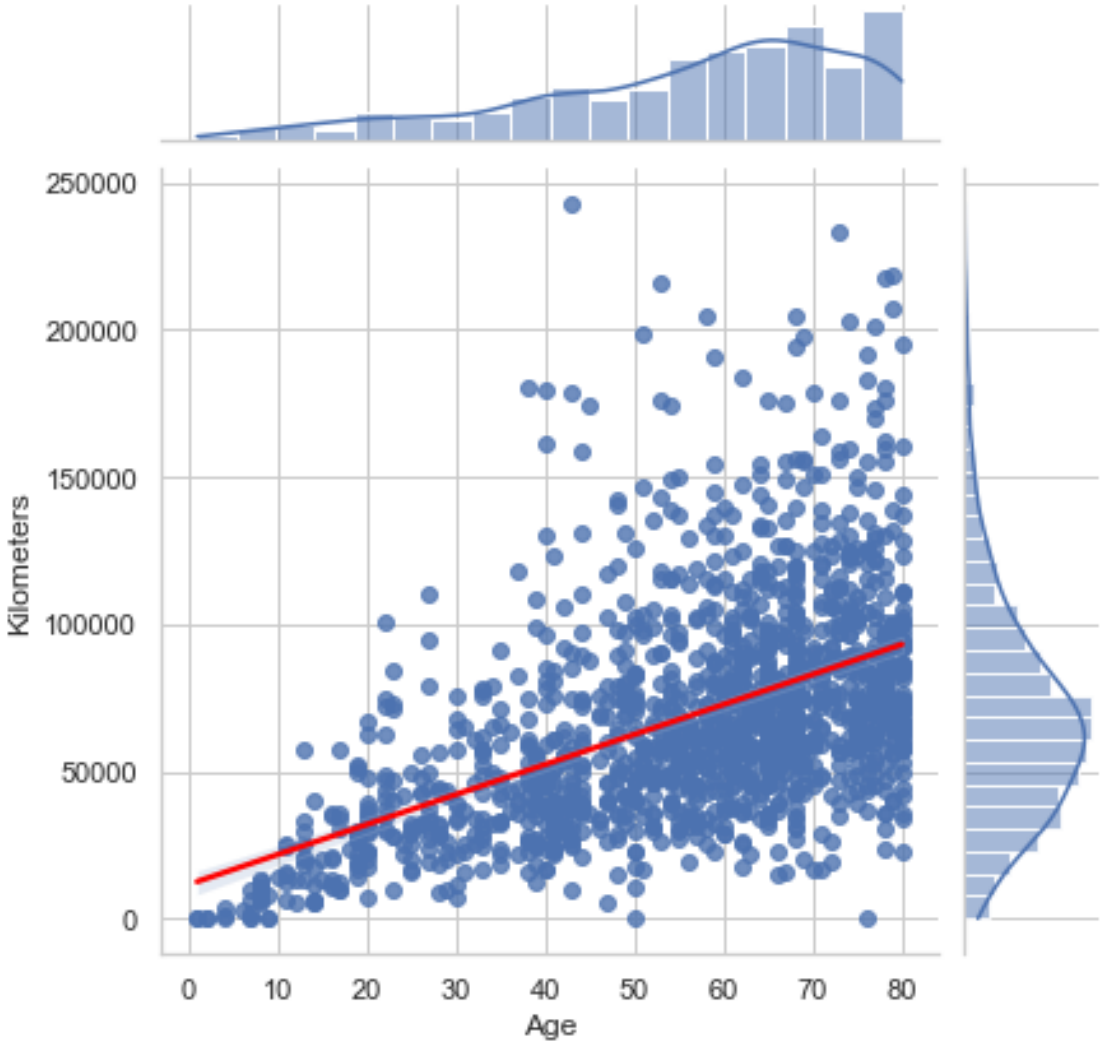
```
Correlation matrix:
 [[1.         0.58119759]
 [0.58119759 1.        ]]
```



4.3 Age vs. Kilometers

[13]:
```
print("Correlation matrix:\n", np.corrcoef(data['Age'], data['Kilometers']))
c = sns.jointplot(x="Age",y="Kilometers", data=data, kind='reg')
regline = c.ax_joint.get_lines()[0]
regline.set_color('red')
```

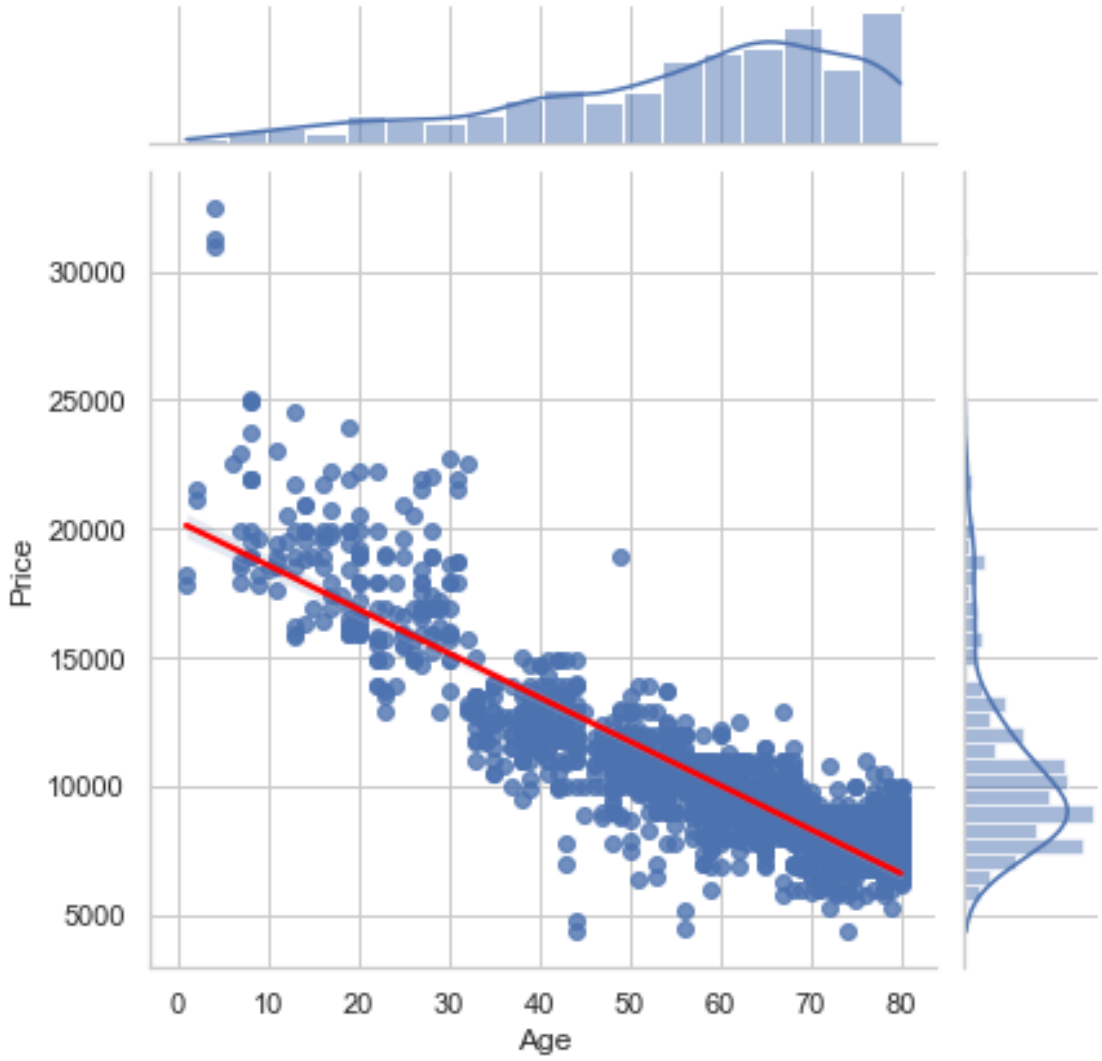
```
Correlation matrix:
 [[1.         0.50567218]
 [0.50567218 1.        ]]
```



4.4 Age vs. Price

[14]:
```
print("Correlation matrix:\n", np.corrcoef(data['Age'], data['Price']))
c = sns.jointplot(x="Age",y="Price", data=data, kind='reg')
regline = c.ax_joint.get_lines()[0]
regline.set_color('red')
```

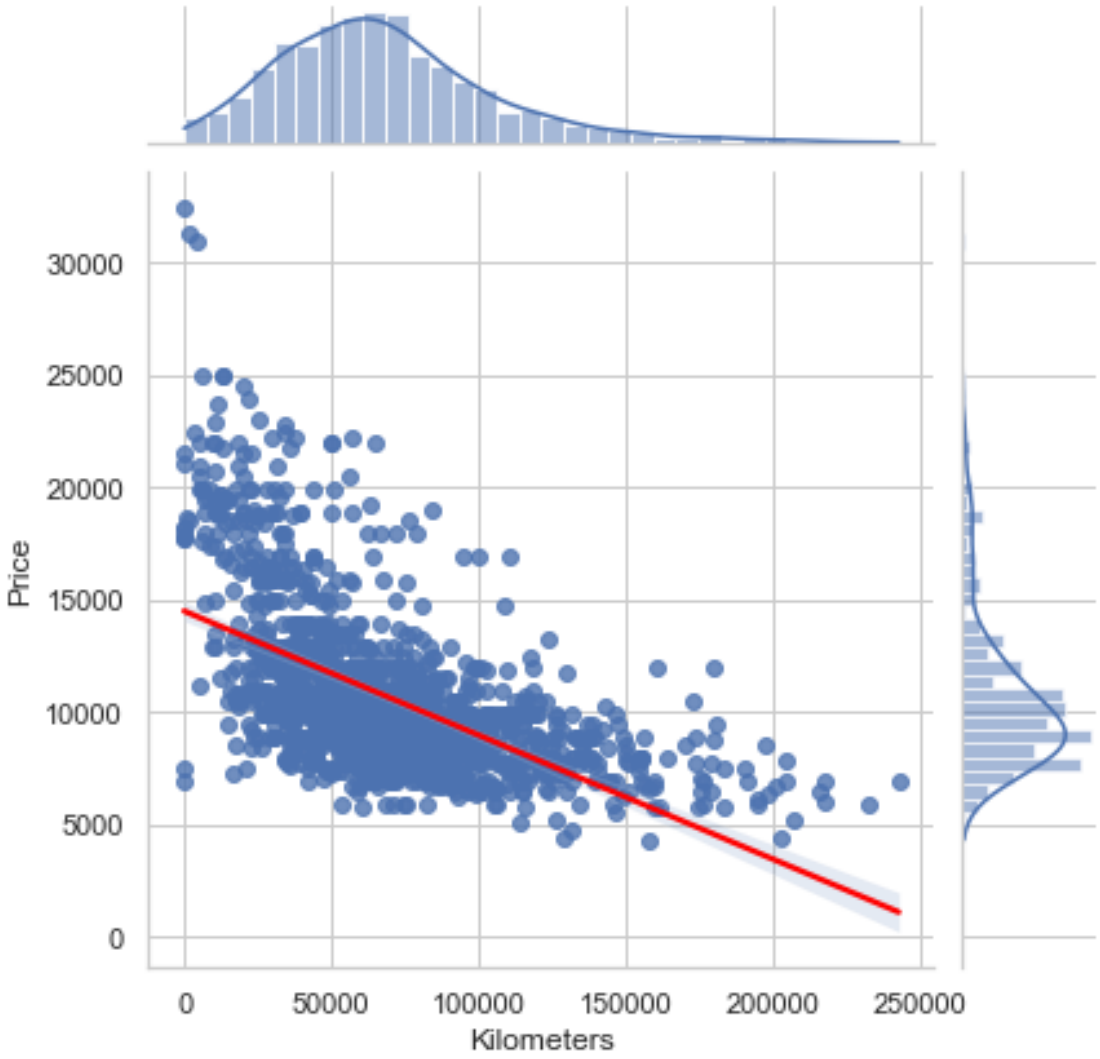
```
Correlation matrix:
 [[ 1.        -0.8765905]
 [-0.8765905  1.       ]]
```



4.5 Kilometers vs. Price

[15]:
```
print("Correlation matrix:\n", np.corrcoef(data['Kilometers'], data['Price']))
c = sns.jointplot(x="Kilometers",y="Price", data=data, kind='reg')
regline = c.ax_joint.get_lines()[0]
regline.set_color('red')
```

```
Correlation matrix:
 [[ 1.         -0.56996016]
 [-0.56996016  1.        ]]
```

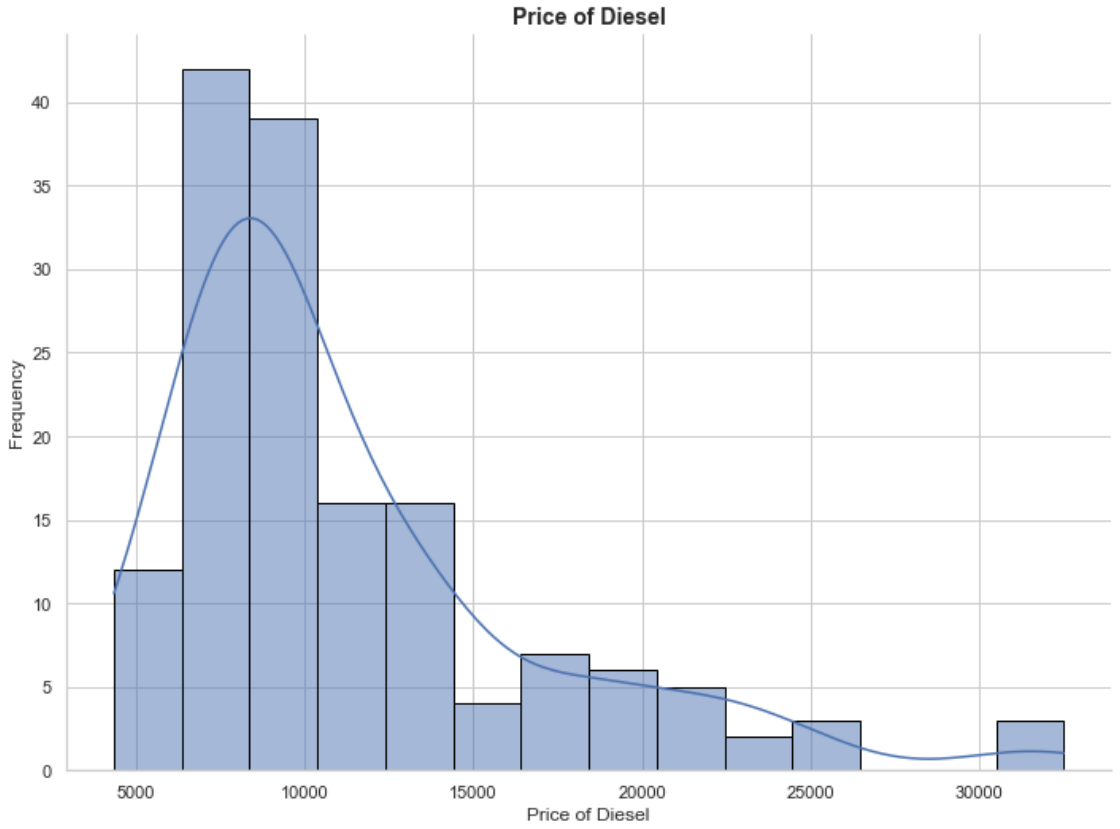


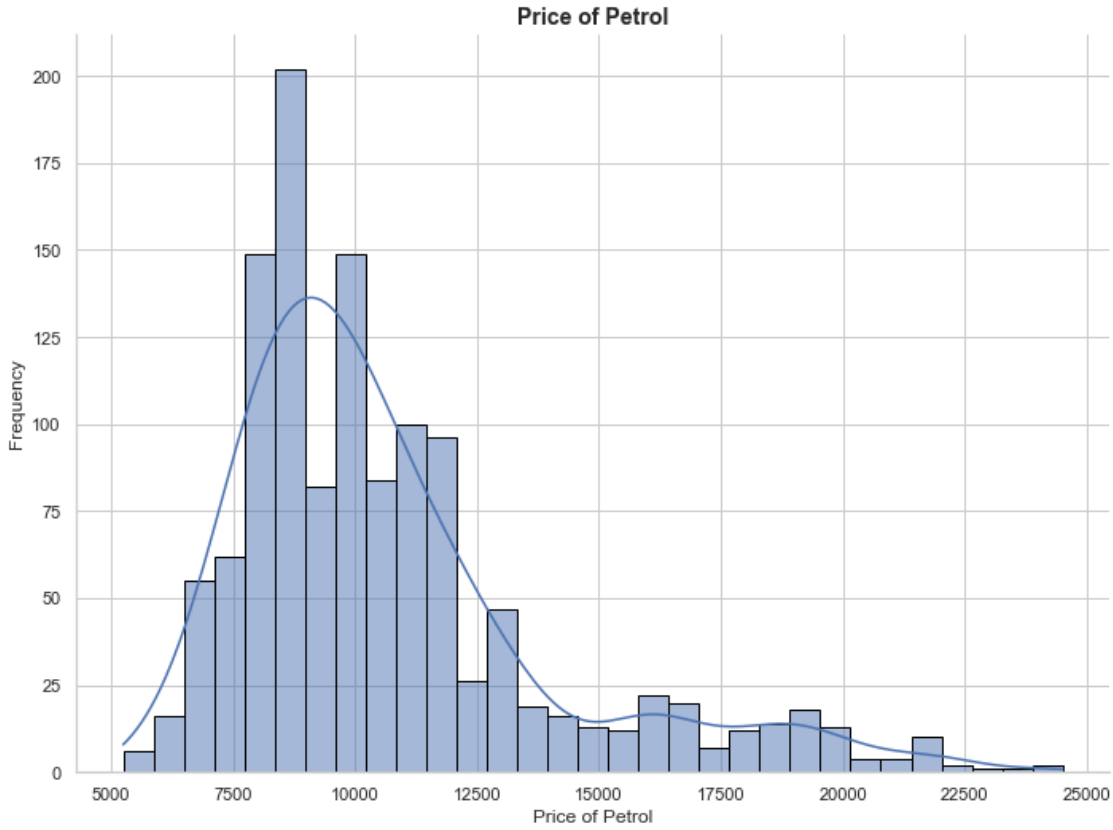
5 Hãy trực quan hóa biểu đồ histogram cho Price theo từng biến biến theo Fuel_type và Color

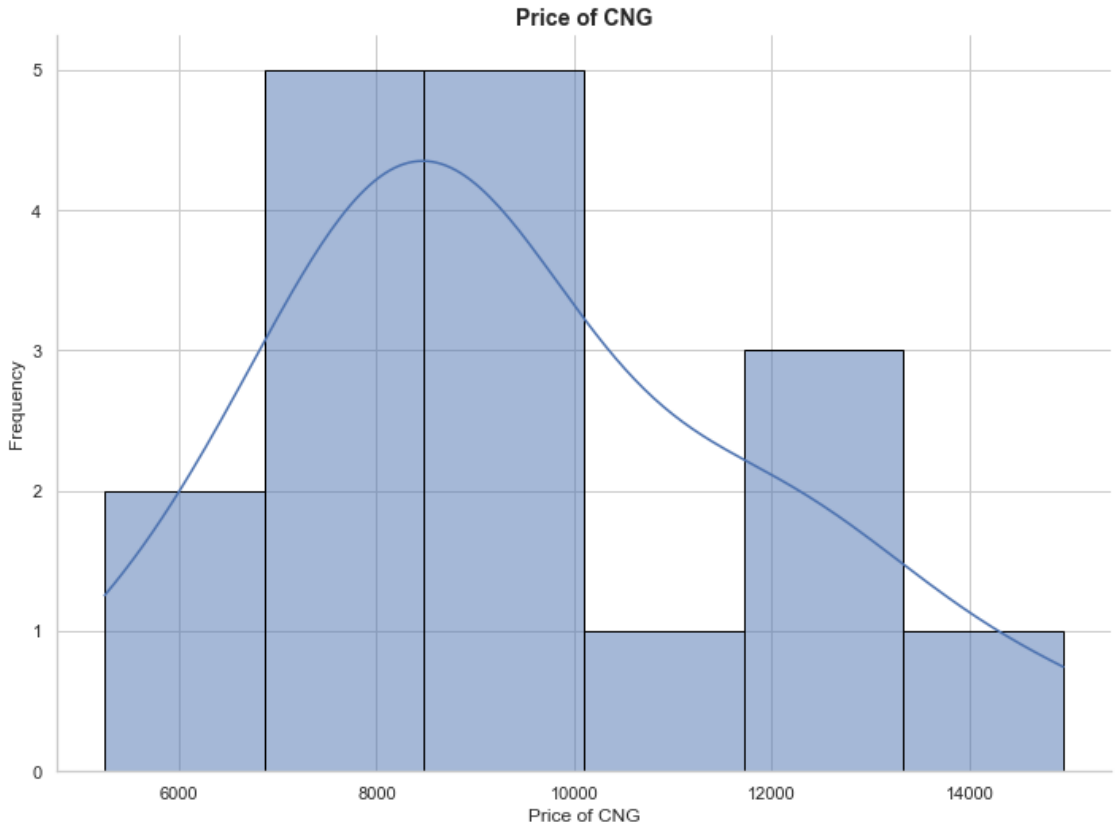
5.1 Price và Fuel_type

[16]:
```
list_fuel_type = data.Fuel_Type.unique()
for x in list_fuel_type:
    temp = data[data["Fuel_Type"]==x]
    fig_obj = plt.figure(figsize=(10, 7.5))
    ax = plt.subplot(111)
    ax.spines["bottom"].set_visible(True)  # Set the spines, or box bounds␣
 ↪visibility
    ax.spines["left"].set_visible(True)
```

```
    ax.spines['right'].set_visible(False)
    ax.spines['top'].set_visible(False)
    sns.histplot(data=temp.Price, kde=True, edgecolor='black')
    plt.title("Price of "+ str(x), fontsize=14, fontweight='bold')
    plt.xlabel("Price of "+ str(x))
    plt.ylabel("Frequency")
    plt.tight_layout()
    plt.show()
```

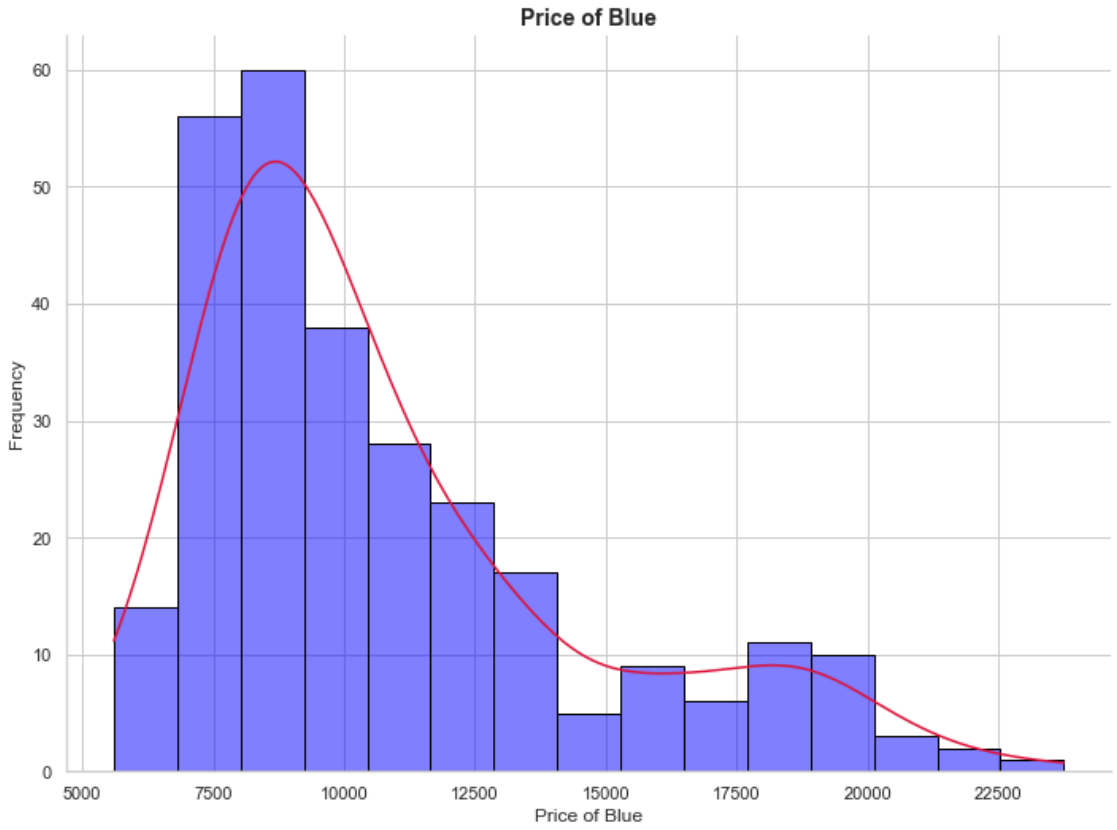



Price of Petrol
Frequency
200
175
150
125
100
75
50
25
0
5000
7500
10000
12500
15000
17500
20000
22500
25000
Price of Petrol

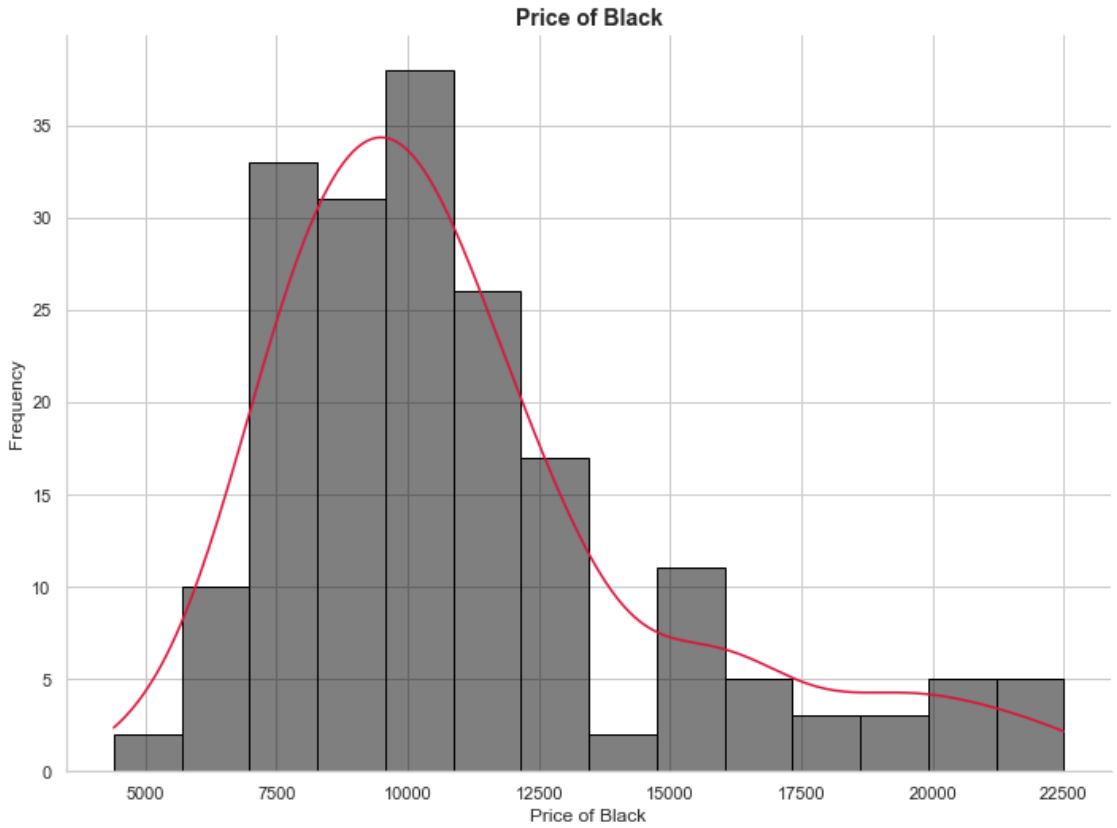


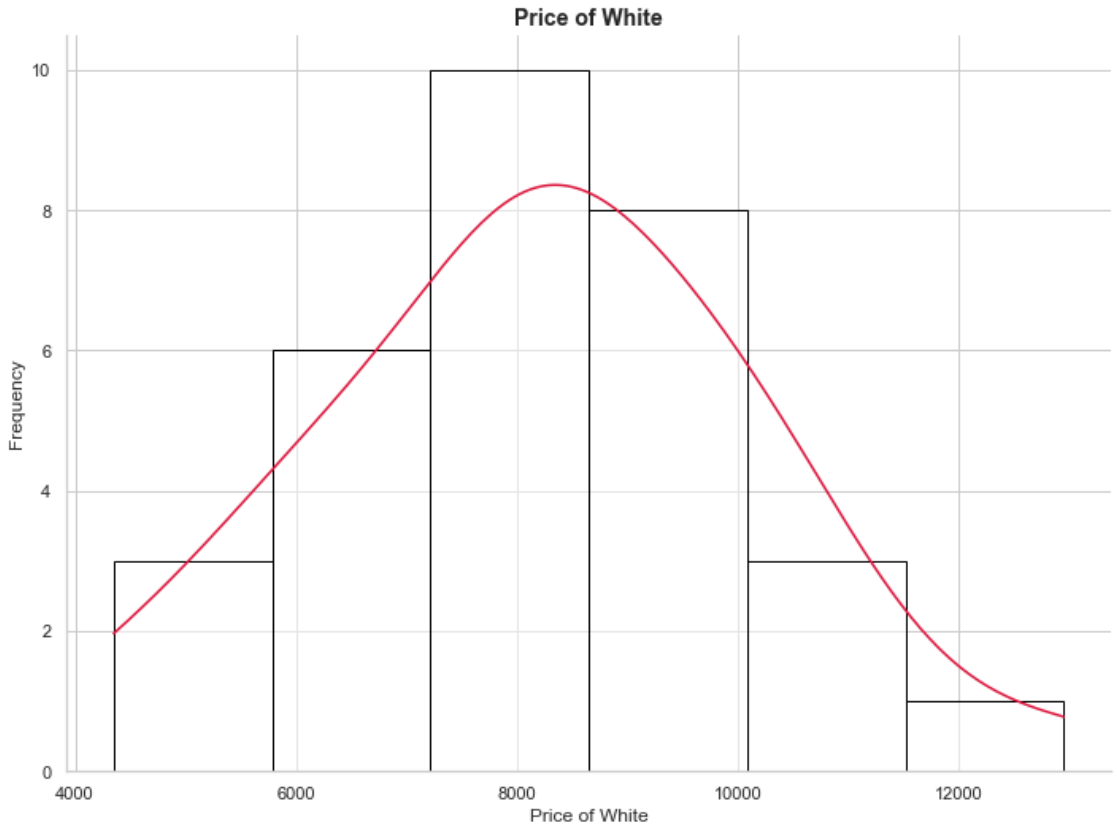
5.2 Price và Colors

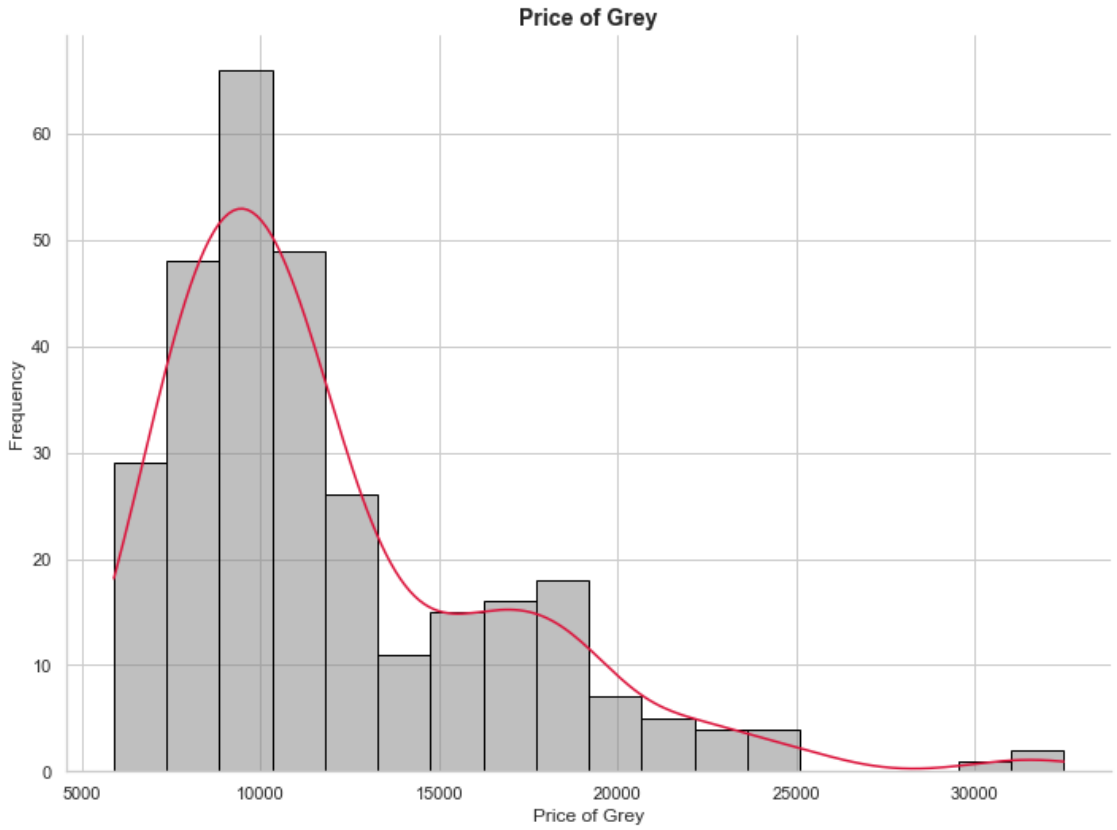
[17]:
```
list_color = data.Color.unique()
for x in list_color:
    temp = data[data["Color"]==x]
    fig_obj = plt.figure(figsize=(10, 7.5))
    ax = plt.subplot(111)
    ax.spines["bottom"].set_visible(True)  # Set the spines, or box bounds␣
 ↪visibility
    ax.spines["left"].set_visible(True)
    ax.spines['right'].set_visible(False)
    ax.spines['top'].set_visible(False)
    ax = sns.histplot(data=temp.Price, kde=True, color=x, edgecolor='black')
    ax.lines[0].set_color('crimson')
    plt.title("Price of "+ str(x), fontsize=14, fontweight='bold')
    plt.xlabel("Price of "+ str(x))
    plt.ylabel("Frequency")
    plt.tight_layout()
    plt.show()
```


Price of Blue
Frequency
60
50
40
30
20
10
0
5000
7500
10000
12500
15000
17500
20000
22500
Price of Blue

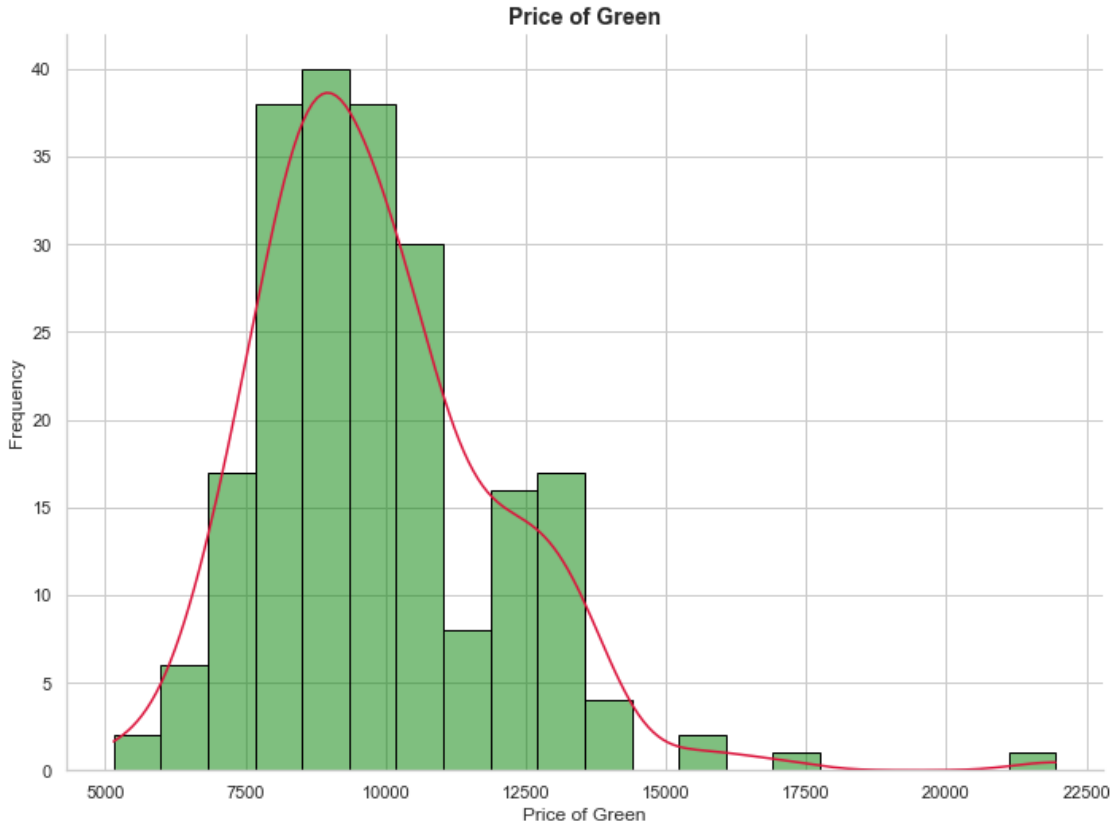

Price of Silver
Frequency
0
5
10
15
20
25
5000
7500
10000
12500
15000
17500
20000
22500
Price of Silver

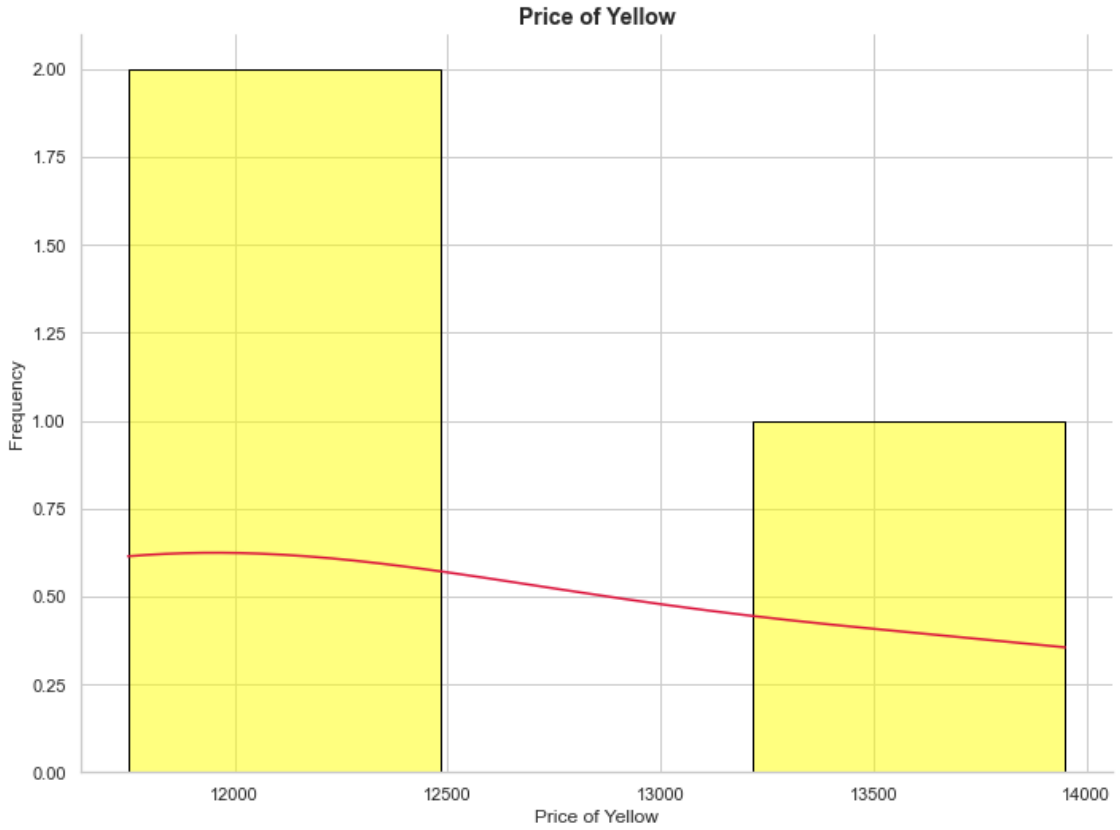

Price of Black
Frequency
0
5
10
15
20
25
30
35
5000
7500
10000
12500
15000
17500
20000
22500
Price of Black

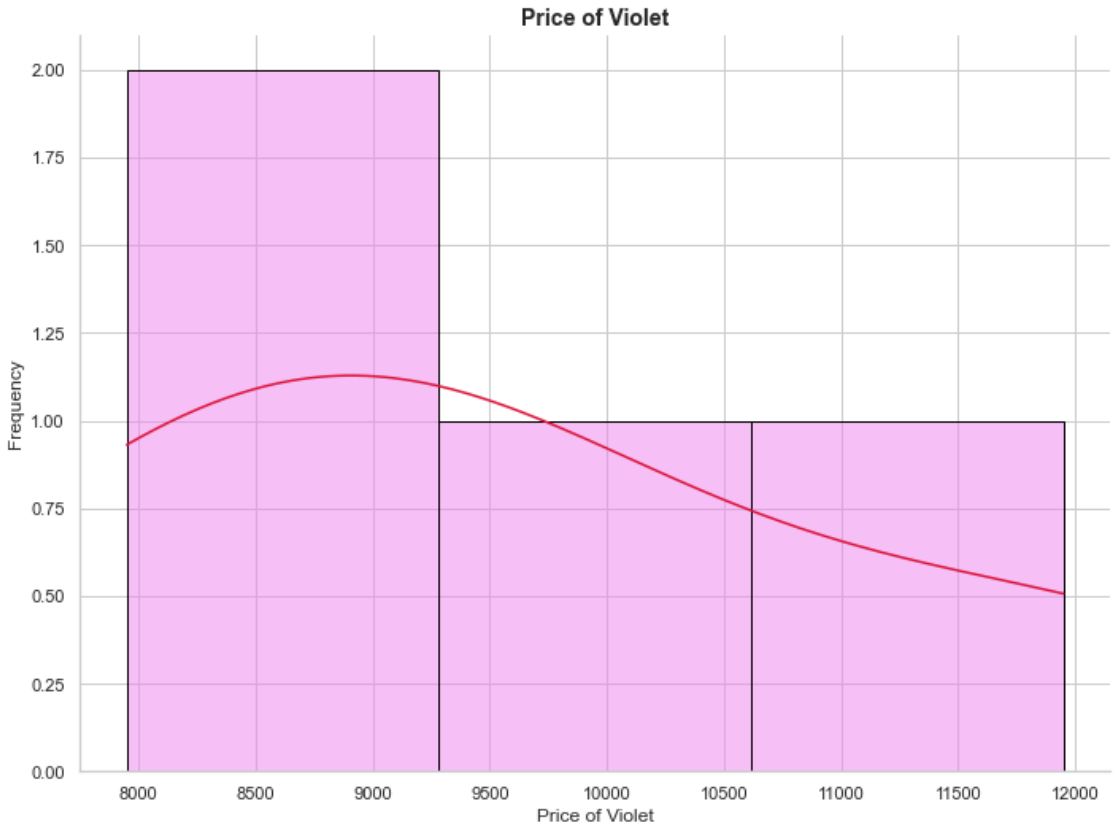

Price of White
Frequency
10
8
6
4
2
0
4000
6000
8000
10000
12000
Price of White

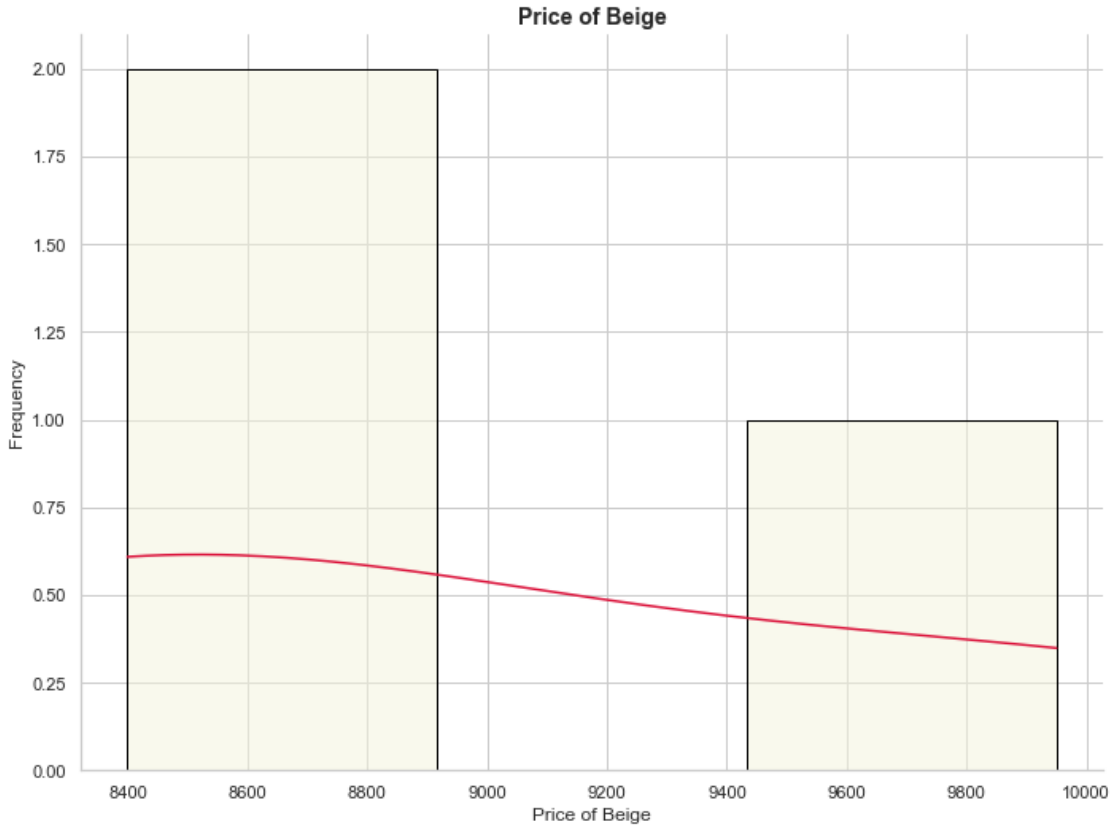

Price of Grey
Frequency
60
50
40
30
20
10
0
5000
10000
15000
20000
25000
30000
Price of Grey


Price of Red
Frequency
0
10
20
30
40
50
60
6000
8000
10000
12000
14000
16000
18000
20000
22000
Price of Red


Price of Green
Frequency
0
5
10
15
20
25
30
35
40
5000
7500
10000
12500
15000
17500
20000
22500
Price of Green


Price of Yellow
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
Frequency
12000
12500
13000
13500
14000
Price of Yellow


Price of Violet
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
Frequency
8000
8500
9000
9500
10000
10500
11000
11500
12000
Price of Violet



6 Hãy đưa ra mô hình dự báo về giá xe `Price` (có thể sử dụng mô hình hồi quy logistic hoặc mô hình học máy bất kỳ)

[18]:
```
from sklearn.linear_model import LogisticRegression
from sklearn.model_selection import train_test_split
from sklearn.metrics import confusion_matrix
from sklearn.preprocessing import OrdinalEncoder
from sklearn.metrics import accuracy_score

enc = OrdinalEncoder()
data["Fuel_Type_fixed"] = enc.fit_transform(data[["Fuel_Type"]])
data["Color_fixed"] = enc.fit_transform(data[["Color"]])
price_mean = data["Price"].sum()/data.shape[0]
def convert_price(cell):
    return 1 if cell >= price_mean else 0
data = data.assign(Price_fixed = data.Price.apply(convert_price))
```

[19]:
```
data.head()
```

[19]:
```
   Price  Age  Kilometers Fuel_Type  HP  Metallic   Color  Automatic    CC  \
0  13500   23       46986    Diesel  90         1    Blue          0  2000
1  13750   23       72937    Diesel  90         1  Silver          0  2000
2  13950   24       41711    Diesel  90         1    Blue          0  2000
3  14950   26       48000    Diesel  90         0   Black          0  2000
4  13750   30       38500    Diesel  90         0   Black          0  2000

   Doors  Quarterly_Tax  Weight  Fuel_Type_fixed  Color_fixed  Price_fixed
0      3            210    1165              1.0          2.0            1
1      3            210    1165              1.0          6.0            1
2      3            210    1165              1.0          2.0            1
3      3            210    1165              1.0          1.0            1
4      3            210    1170              1.0          1.0            1
```

[20]:
```
feature_cols = ['Age', 'Kilometers', 'Fuel_Type_fixed', 'HP', 'Metallic',␣
↪'Color_fixed', 'Automatic', 'CC', 'Doors', 'Quarterly_Tax', 'Weight']
X = data[feature_cols]
y = data.Price_fixed
```

[21]:
```
X_train,X_test,y_train,y_test=train_test_split(X,y,test_size=0.
↪25,random_state=0)
```

[22]:
```
logreg = LogisticRegression()
logreg.fit(X_train,y_train)
```

[22]:
```
LogisticRegression()
```

[23]:
```
y_pred=logreg.predict(X_test)
```

[24]:
```
print(y_pred)
```

```
[0 0 1 0 0 0 0 1 0 0 0 1 1 0 0 1 0 0 1 0 0 0 1 1 1 0 1 0 0 0 0 0 1 0 0 1 0
 1 0 0 0 0 0 0 1 1 0 0 0 0 0 1 0 0 0 1 1 1 0 1 1 0 0 0 1 0 1 0 0 1 0 0 0 1 0
 1 1 0 0 0 0 0 0 0 0 1 1 0 1 1 0 0 0 0 0 1 1 0 1 1 0 1 0 0 1 1 0 0 1 1 0 1 0 1
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 1 0 0 1 0 0 1 1 0 0 0 0 0 0 0 0 0 1 1 1 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 1 1 0 0 0 1 0 0 1 0 0 0 0 1 0 0 1 0 0 0 0 1 0]
```

[25]:
```
cmx = confusion_matrix(y_test, y_pred)
cmx
```

[25]:
```
array([[204,  16],
       [ 29, 110]], dtype=int64)
```

[26]:
```
print("Accuracy =", accuracy_score(y_test,y_pred))
```

```
Accuracy = 0.8746518105849582
```