Imports

In [1]:

```
import pandas as pd
import seaborn as sns
from matplotlib import pyplot as plt
```

Loading and exploring the dataset

1. Load the dataset named carsales.csv and store it in a dataframe called `raw_df` .

In [2]:

```
# Insert your code below
# ======================

raw_df = pd.read_csv('carsales.csv')
```

2. Print the `five` first rows of the dataframe

In [3]:

```
# Insert your code below
# ======================

raw_df.head()
```

Out[3]:

	Unnamed: 0	Brand	Model	Year	Fuel	Horse Power	Engine Cylinders	Number of Doors	Market Categories
0	0	BMW	1 Series M	2011	premium unleaded (required)	335.0	6.0	2.0	Factory Tuner,Luxury,High-Performance
1	1	BMW	1 Series	2011	premium unleaded (required)	300.0	6.0	2.0	Luxury,Performance
2	2	BMW	1 Series	2011	premium unleaded (required)	300.0	6.0	2.0	Luxury,High-Performance
3	3	BMW	1 Series	2011	premium unleaded (required)	230.0	6.0	2.0	Luxury,Performance
4	4	BMW	1 Series	2011	premium unleaded (required)	230.0	6.0	2.0	Luxury

1. **Which columns in `raw_df` contains missing values?**

In [73]:

```
# Insert your code below
# ======================

missing_values_columns = raw_df.columns[raw_df.isnull().any()]

print(f'The columns with missing values are : {missing_values_columns.values}
The columns with missing values are : ['Fuel' 'Horse Power' 'Engine Cylinders'
'Number of Doors'
 'Market Categories']
```

4. Create a copy of `raw_df` named `df`. Remove any rows containing NaN values in the new dataframe. What is the shape of `df` before and after removing the NaN values? How many rows got removed?

Use `df` in all following tasks unless otherwise is stated

In [74]:

```
# Insert your code below
# ======================
df = raw_df.copy() # A new DF that must be copyed otherwise it creates a valu
df = df.dropna() # removes raws with NAN values
df.isna().sum() # a simple way of checking if all the NAN values are removes
```

Out[74]:

```
Unnamed: 0                 0
Brand                      0
Model                      0
Year                       0
Fuel                       0
Horse Power                0
Engine Cylinders           0
Number of Doors            0
Market Categories          0
Vehicle Size               0
Vehicle Style              0
Miles Per Gallon (MPG)     0
Retail Price               0
dtype: int64
```

5. How many unique values exist in each of the columns `Brand` and `Fuel`

In [75]:

```
# Insert your code below
# ======================

Brand_unique = len(df['Brand'].unique())
Fuel_unique = len(df['Fuel'].unique())
print(f'There are { Brand_unique} unique Brands and {Fuel_unique} unique fuel
```

```
There are 47 unique Brands and 8 unique fuel types
```

6. Which car brand has the most cars in the dataset?

In [76]:

```
# Insert your code below
# ======================
# first way of doing this
most_brand = df['Brand'].value_counts().idxmax()
#Second way of doing this
most_brand2 = df['Brand'].mode()

print(f' The brand with the most cars is {most_brand}')
```

```
 The brand with the most cars is Chevrolet
```

7. Find the average Retail Price per vehicle style.

The output should be in the following format:

```
Vehicle Style: [style], Average Price: [msrp]
Vehicle Style: [style], Average Price: [msrp]
Vehicle Style: [style], Average Price: [msrp]
...
```

In [77]:

```python
# Insert your code below
# ======================
vs_rp = df.groupby('Vehicle Style')['Retail Price'].mean()
vs = vs_rp.index
rp = (vs_rp.values).round()

for i,j in zip(vs,rp):
    print(f'Vehicle Style: {i}, Avrege Price: {j}')
```

```
Vehicle Style: 2dr Hatchback, Avrege Price: 22905.0
Vehicle Style: 2dr SUV, Avrege Price: 42031.0
Vehicle Style: 4dr Hatchback, Avrege Price: 23685.0
Vehicle Style: 4dr SUV, Avrege Price: 42589.0
Vehicle Style: Cargo Minivan, Avrege Price: 22964.0
Vehicle Style: Cargo Van, Avrege Price: 30725.0
Vehicle Style: Convertible, Avrege Price: 102362.0
Vehicle Style: Convertible SUV, Avrege Price: 47975.0
Vehicle Style: Coupe, Avrege Price: 106314.0
Vehicle Style: Crew Cab Pickup, Avrege Price: 39033.0
Vehicle Style: Extended Cab Pickup, Avrege Price: 32239.0
Vehicle Style: Passenger Minivan, Avrege Price: 29838.0
Vehicle Style: Passenger Van, Avrege Price: 35963.0
Vehicle Style: Regular Cab Pickup, Avrege Price: 28137.0
Vehicle Style: Sedan, Avrege Price: 56723.0
Vehicle Style: Wagon, Avrege Price: 36177.0
```

8. Filter out non-gasoline cars.

Remove rows where `Fuel == electric` or `Fuel == diesel` and print out the shape of the new dataframe. Save the results to `df_gasoline`

In [78]:

```python
# Insert your code below
# ======================
df_gasoline = df.loc[(df['Fuel'] != 'electric') & (df['Fuel'] != 'diesel')].c

df_gass_shape = df_gasoline.shape

print(f'The shape is {df_gass_shape}')
```

```
The shape is (7284, 13)
```

9. Convert miles per galon to liters per 10 km.

Add a new column to `gasoline_df` with the fuel consumption measured in liters fuel used per 10km driven. Save the results in a new column named `liters_per_10km` .

Below is a function for converting miles per gallon to litres per 10km. Use this function to convert the values.

In [79]:

```python
def mpg_to_liters_per_10km(mpg):
    """Returns miles per gallon converted to liters per 10km

    Args:
        mpg (int): Fuel efficiency measured in miles per gallon

    Returns:
        float: Fuel efficency measured in liters fuel used per 10 km driven
    """
    return 23.5 / mpg
```

In [86]:

```
# Insert your code below
# ======================
df_gasoline['liters_per_10km'] = mpg_to_liters_per_10km(df_gasoline['Miles Pe
if 'liters_per_10km' in df_gasoline:
    print('The column exists')
```

```
The column exists
```

10. Find the cars with the highest and lowest fuel consumption in `df_gasoline` . Print out the brand, model and consumption on the following format:

```
Lowest fuel consumption: [brand] [model], liters per 10km:
[liters_per_10km]
Highest fuel consumption: [brand] [model], liters per 10km:
[liters_per_10km]
```

In [87]:

```
# Insert your code below
# ======================

lowest_fuel_consumption = df_gasoline['liters_per_10km'].min()
highest_fuel_consumption = df_gasoline['liters_per_10km'].max()

Brand_lowest, Model_lowest = df_gasoline.loc[df_gasoline['liters_per_10km'] =

Brand_highest, Model_highest = df_gasoline.loc[df_gasoline['liters_per_10km']


print(f'Lowest fuel consumption: {Brand_lowest} {Model_lowest}, liters per 10

print(f'Highest fuel consumption: {Brand_highest} {Model_highest}, liters per
```

```
Lowest fuel consumption: Toyota Prius, liters per 10km: 0.4051724137931034
Highest fuel consumption: Ferrari Enzo, liters per 10km: 3.357142857142857
```

11. Find all cars in the luxury category and print out the number of cars.

The different cateogories that the cars belong to is stored in the `Market Categories` column. Use this to find all cars in the `Luxury` category. Save the results to `luxury_df` . Use `df` in this task

In [93]:

```
# Insert your code below
# ======================
luxury_df = df.loc[df['Market Categories'] == 'Luxury'].copy()
luxury_unique = luxury_df['Market Categories'].unique()[0]
print(f'The only category in the Market Catergory column for the luxury data
```

```
The only category in the Market Catergory column for the luxury data frame is
the Luxury category
```

Visualizing

12. Create a plot with 2 vertical axes and one horizontal axis. The top plot should display a barchard containing the `count` of the `10 most frequent` car brands. The

second plot should show the `count` of the most frequent fuel types. Both plots should show data in descending order. Use `df` in this task.

Hint: It is recommended to use the `Barplot` function built into Seaborn for barcharts.

The output should look something like this:

Barchart example

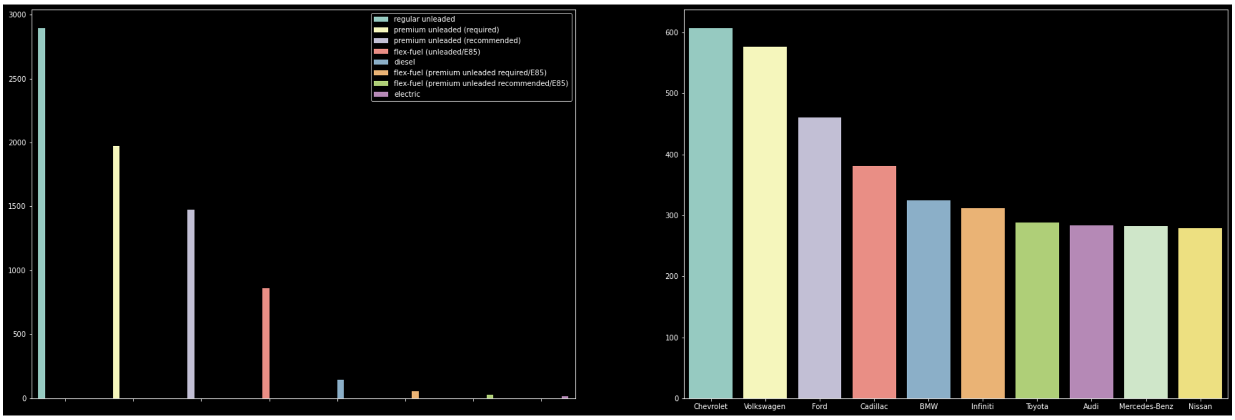
PS: Disregard the color scheme of the example image.

In [83]:

```
# Insert your code below
# ======================
y1 = df['Brand'].value_counts()[:10]
y2 = df['Fuel'].value_counts()

fig, axes = plt.subplots(1,2, figsize=(30,10))
g1 = sns.barplot(ax = axes [0], x = y2.index, y = y2.values, hue = y2.index)
g1.set(xticklabels = [])

g2 = sns.barplot(ax = axes [1], x = y1.index, y = y1.values)
```



13. Create a heatmap showing the correlation between the following columns in `df` :

- Horse Power
- Engine Cylinders
- Miles Per Gallon (MPG)
- Retail Price
- Number of Doors
- Year

The output should look something like this:

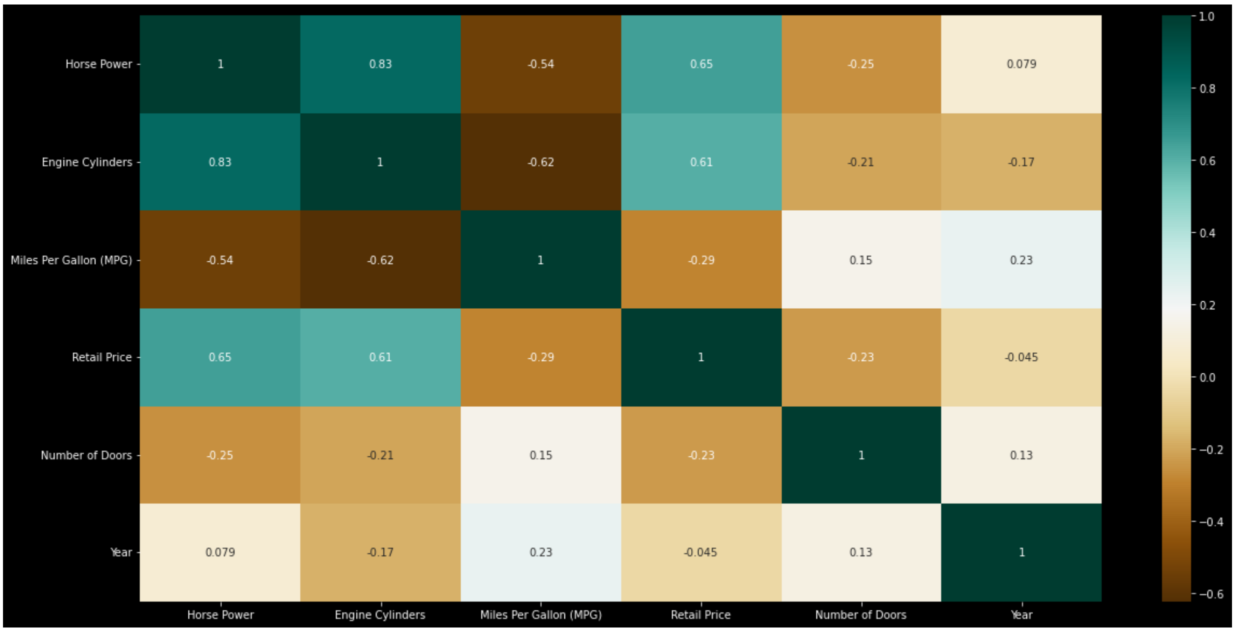
Heatmap example

In [84]:

```
# Insert your code below
# ======================

k = ['Horse Power','Engine Cylinders', 'Miles Per Gallon (MPG)','Retail Price
cols = df[k].corr()

plt.figure(figsize= (20,10))
sns.heatmap(cols,annot = True, cmap = 'BrBG')
plt.show()
```



14. Create a scatterplot with `Horse Power` on the x-axis and `liters_per_10km` on the y-axis. The color of the dots should correspond to the vehcle style. Use `df_gasoline` in this task.

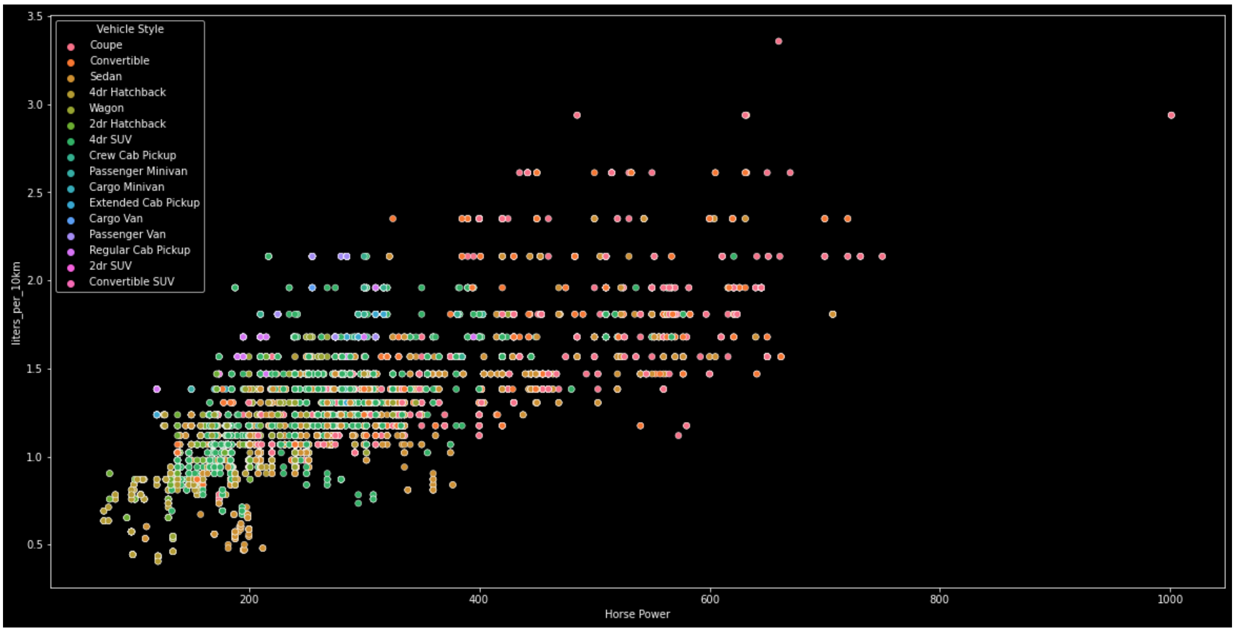
The output should look something like this:

Heatmap example

In [85]:

```
# Insert your code below
# ======================
plt.figure(figsize= (20,10))
sns.scatterplot(df_gasoline['Horse Power'],df_gasoline['liters_per_10km'], hu
plt.show()
```

```
/Users/mohamedatteyeh/opt/anaconda3/lib/python3.8/site-packages/seaborn/_decor
ators.py:36: FutureWarning: Pass the following variables as keyword args: x,
y. From version 0.12, the only valid positional argument will be `data`, and p
assing other arguments without an explicit keyword will result in an error or
misinterpretation.
  warnings.warn(
```


Vehicle Style
Coupe
Convertible
Sedan
4dr Hatchback
Wagon
2dr Hatchback
4dr SUV
Crew Cab Pickup
Passenger Minivan
Cargo Minivan
Extended Cab Pickup
Cargo Van
Passenger Van
Regular Cab Pickup
2dr SUV
Convertible SUV
liters_per_10km
Horse Power