Assignment 3

MAS DSE200

Instructions

- Please submit **both** the pdf and ipynb files.
- You don't need to explain your approach (unless specified) so please be concise in your submission.
- To obtain full marks for a question, both the answer and the code should be correct.
- Completely wrong (or missing) code with correct answer will result in zero marks.
- Please code the solution in the space provided.

Imports

In [1]:
```
import pandas as pd
import numpy as np
import random
import matplotlib.pyplot as plt
```

Preliminaries

Load the Formula1 cars data into a Pandas DataFrame called racecars_df.

In [2]:
```
racecars_df = pd.read_csv('./formula_one.csv', sep=',')
```

1. Inspect data

Print the shape of the racecars_df DataFrame. Then, **display the first 10 entries** in the racecars_df DataFrame to get an idea of what the columns are and what some values might look like.

In [3]:
```
print(racecars_df.shape)
racecars_df.head(10)
```

Out[3]:
```
(1095, 6)
```

	number	max_car_speed	driver_weight	engine_power	fuel_efficiency	fuel_tank_capacity
0	0	232.863283	76.822000	918.060000	90.363605	36.160000
1	1	205.533324	74.403843	917.356829	90.065810	19.426597
2	2	258.100967	63.638000	923.058282	92.189710	14.460000
3	3	249.190045	74.138895	920.530173	95.494480	12.742547
4	4	236.863283	47.294000	921.196563	94.535457	76.740000
5	5	233.983375	79.404000	915.345704	88.678473	33.930000
6	6	239.589632	74.043304	915.653712	91.585075	21.385657
7	7	218.646212	54.710000	918.133985	90.441205	74.920000
8	8	246.883152	83.582000	920.153126	93.551053	24.030000
9	9	227.576604	51.498000	915.092267	89.763146	68.050000

2. Exploratory Analysis: Missing Data

a) Please **report how many values are missing (null) in each column**.

In [4]:
```
racecars_df.isnull().sum()
```

Out[4]:
```
number                0
max_car_speed         4
driver_weight         5
engine_power          3
fuel_efficiency       3
fuel_tank_capacity    0
dtype: int64
```

b) **Update racecars_df DataFrame by removing all rows that have any missing values**
Print the shape of the racecars_df DataFrame after the removal to confirm that the change took place.

In [5]:
```
print("Dimensions before removing null values: ", racecars_df.shape)

racecars_df.dropna(inplace=True)   # NOTE: Original racecars_df is overwritten
print("Dimensions after removing null values:  ", racecars_df.shape)
```

```
Dimensions before removing null values:  (1095, 6)
Dimensions after removing null values:   (1083, 6)
```

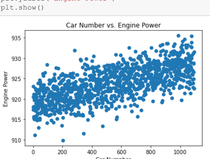
3. Engine powers of different cars

Let's see what how the engine powers have evolved for the cars that have raced on this track.

3a) **Plot all the engine powers corresponding to the different cars**

- The x-axis is the car number(number column)
- The y-axis is the engine power
- Use either a scatter or line plot
- Label **both** axes appropriately
- Add an appropriate title

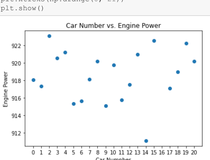
In [6]:
```
plt.scatter(x=racecars_df['number'], y=racecars_df['engine_power'])
plt.title('Car Number vs. Engine Power')
plt.xlabel('Car Nunmber')
plt.ylabel('Engine Power')
plt.show()
```



3b) **Repeat part a**, but do it only for the **first 20 cars** in the dataset.
Make sure that the values appearing on the x-axis are integers.(Check out the documentation of plt.xticks.)

In [7]:
```
new_racecars_df = racecars_df.head(20)

plt.scatter(x=new_racecars_df['number'], y=new_racecars_df['engine_power'])
plt.title('Car Number vs. Engine Power')
plt.xlabel('Car Nunmber')
plt.ylabel('Engine Power')
plt.xticks(np.arange(0, 21))
plt.show()
```



4. Max Speed

How many cars achieved maximum speed over 220 during their races? **What percentage** (up to 2 decimal places) of the total samples does this make up?

In [8]:
```
cars = len(racecars_df[racecars_df.max_car_speed>220])
print(cars, 'cars achieved maximum speed over 220 during their races.')

percentage = cars/len(racecars_df)*100
round_percentage = "%.2f" % round(percentage,2)
print ("This makes up {}% of the total sample.".format(round_percentage))
```

```
783 cars achieved maximum speed over 220 during their races.
This makes up 72.30% of the total sample.
```

5. Driver weight distribution

Build a histogram using all the driver weights from the dataset.

The x-axis should have 10 bins (ranges that the driver weights fall into, also called buckets). To be explicit, if you give pyplot your list of driver weights and 10 bins to put them in, your x-axis should look like this: [40,50,60,70,80,90,100].

- The x-axis is the driver weight
- The y-axis is the frequency
- Label **both** axes appropriately
- Add an appropriate title

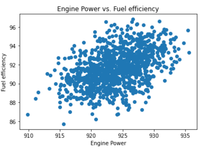
In [9]:
```
plt.hist(racecars_df['driver_weight'], bins=10)
plt.title("Histogram of Driver Weight over Frenquency")
plt.xlabel("Driver Weight")
plt.ylabel("Frequency")
plt.show()
```

6. Engine Power vs Fuel efficiency

6a) Plot the engine power vs fuel efficiency.

- The x-axis is the engine power
- The y-axis is the fuel efficiency
- Use a scatter plot
- Label **both** axes appropriately
- Add an appropriate title

In [10]:
```
plt.scatter(x=racecars_df['engine_power'], y=racecars_df['fuel_efficiency'])
plt.title('Engine Power vs. Fuel efficiency')
plt.xlabel('Engine Power')
plt.ylabel('Fuel efficiency')
plt.show()
```



6b) Calculate the correlation coefficients of the same columns you plotted in part a.

In [11]:
```
np.corrcoef(racecars_df['engine_power'],racecars_df['fuel_efficiency'])
```

Out[11]:
```
array([[1.        , 0.44694707],
       [0.44694707, 1.        ]])
```

6c) In the markdown cell below, **write a couple sentences** that describe the relationship between engine power and fuel efficiency in this dataset. Talk about things like:

- Are they correlated?
- Positively or negatively?
- Is this correlation strong or weak?

Respond here

In [12]:
```
print('Yes, they are correlated.')
print('Positively.')
print('This correlation is weak.')
```

```
Yes, they are correlated.
Positively.
This correlation is weak.
```

In [ ]:
```

```