In [85]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
```

Columns details

In [2]:
```
df = pd.read_csv('car_average.csv')
df.head()
```

Out[2]:

	mpg	cylinders	displacement	horsepower	weight	acceleration	model year	origin	car name
0	18.0	8	307.0	130	3504	12.0	70	1	chevrolet chevelle malibu
1	15.0	8	350.0	165	3693	11.5	70	1	buick skylark 320
2	18.0	8	318.0	150	3436	11.0	70	1	plymouth satellite
3	16.0	8	304.0	150	3433	12.0	70	1	amc rebel sst
4	17.0	8	302.0	140	3449	10.5	70	1	ford torino

Field	Description
mpg	The fuel economy of the car in terms of miles travelled per gallon of gasoline
cylinders	The number of cylinders in the car's engine
displacement	The volume of air displaced by all the pistons of a piston engine
horsepower	Horsepower is a measure of power the engine produces
weight	The total weight of the car
acceleration	The time in seconds it takes for the car to reach 60 miles per hour
model year	The year (in the 20th century) the car model was released. For example 80 means the ...
origin	The region where the car was manufactured. 1 - USA. 2 - Europe. 3 - Japan
car name	The name of the car model.

In [260…
```
# making a copy of df
df1 = df.copy()
```

In [3]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 398 entries, 0 to 397
Data columns (total 9 columns):
 #   Column        Non-Null Count  Dtype  
---  ------        --------------  -----  
 0   mpg           398 non-null    float64
 1   cylinders     398 non-null    int64  
 2   displacement  398 non-null    float64
 3   horsepower    398 non-null    object 
 4   weight        398 non-null    int64  
 5   acceleration  398 non-null    float64
 6   model year    398 non-null    int64  
 7   origin        398 non-null    int64  
 8   car name      398 non-null    object 
dtypes: float64(3), int64(4), object(2)
memory usage: 28.1+ KB
```

In [5]:
```
df.describe()
```

Out[5]:

	mpg	cylinders	displacement	weight	acceleration	model year	origin
count	398.000000	398.000000	398.000000	398.000000	398.000000	398.000000	398.000000
mean	23.514573	5.454774	193.425879	2970.424623	15.568090	76.010050	1.572864
std	7.815984	1.701004	104.269838	846.841774	2.757689	3.697627	0.802055
min	9.000000	3.000000	68.000000	1613.000000	8.000000	70.000000	1.000000
25%	17.500000	4.000000	104.250000	2223.750000	13.825000	73.000000	1.000000
50%	23.000000	4.000000	148.500000	2803.500000	15.500000	76.000000	1.000000
75%	29.000000	8.000000	262.000000	3608.000000	17.175000	79.000000	2.000000
max	46.600000	8.000000	455.000000	5140.000000	24.800000	82.000000	3.000000

In [9]:
```
# creating a new column of average in KMPL units
df['kmpl'] = round(df['mpg']*1.609,1)
```

In [10]:
```
df.head()
```

Out[10]:

	mpg	cylinders	displacement	horsepower	weight	acceleration	model year	origin	car name	kmpl
0	18.0	8	307.0	130	3504	12.0	70	1	chevrolet chevelle malibu	29.0
1	15.0	8	350.0	165	3693	11.5	70	1	buick skylark 320	24.1
2	18.0	8	318.0	150	3436	11.0	70	1	plymouth satellite	29.0
3	16.0	8	304.0	150	3433	12.0	70	1	amc rebel sst	25.7
4	17.0	8	302.0	140	3449	10.5	70	1	ford torino	27.4

In [12]:
```
df.nunique()
```

Out[12]:
```
mpg             129
cylinders         5
displacement     82
horsepower       94
weight          351
acceleration     95
model year       13
origin            3
car name        305
kmpl            129
dtype: int64
```

In [13]:
```
# changing origin from 1,2,3 to usa , europe and japan
df['origin'].unique()
```

Out[13]:
```
array([1, 3, 2], dtype=int64)
```

In [21]:
```
d= {1:'USA',2:'Europe',3:'Japan'}
df['origin_new'] = df['origin'].map(d)
```

In [25]:
```
df.head()
```

Out[25]:

	mpg	cylinders	displacement	horsepower	weight	acceleration	model year	origin	car name	kmpl
0	18.0	8	307.0	130	3504	12.0	70	1	chevrolet chevelle malibu	29.0
1	15.0	8	350.0	165	3693	11.5	70	1	buick skylark 320	24.1
2	18.0	8	318.0	150	3436	11.0	70	1	plymouth satellite	29.0
3	16.0	8	304.0	150	3433	12.0	70	1	amc rebel sst	25.7
4	17.0	8	302.0	140	3449	10.5	70	1	ford torino	27.4

Q. What is the average fule efficiency of a car ?

In [31]:
```
print('The average of all the cars is ',round(df['kmpl'].mean(),1),' KMPL')
```

```
The average of all the cars is  37.8  KMPL
```

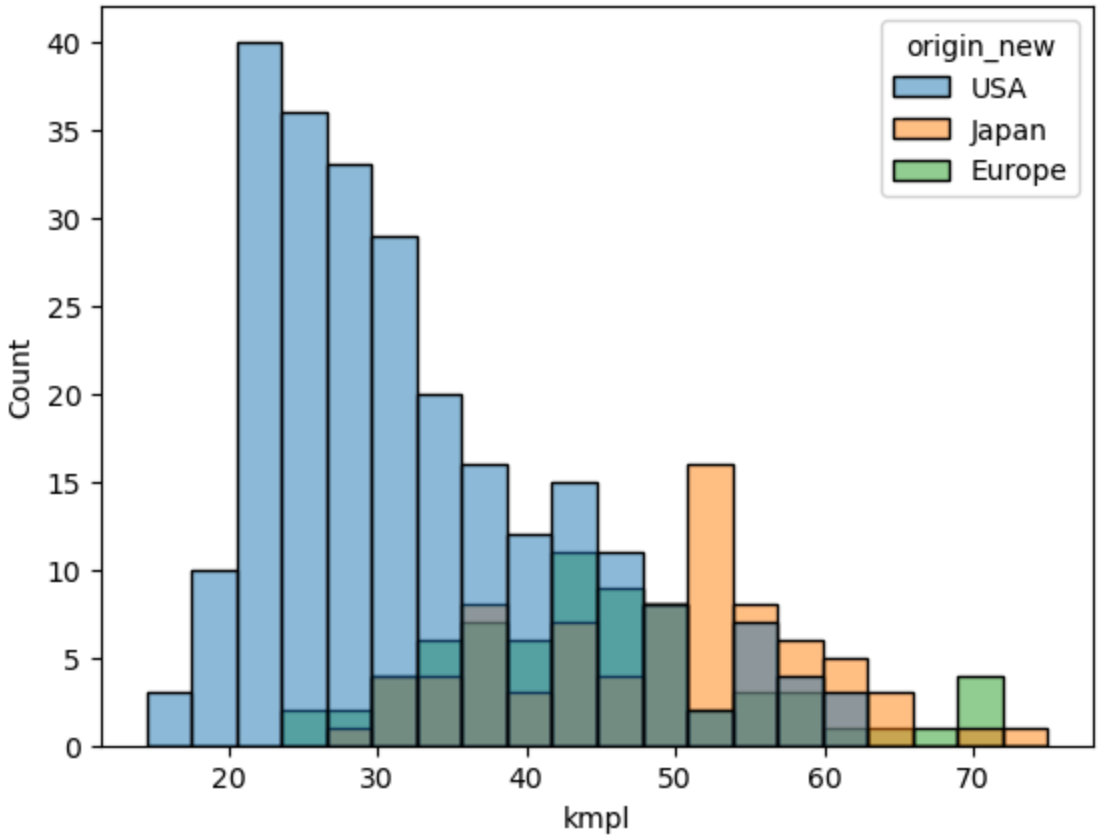
Ans - The average fule efficiency of a car is 37.8 KMPL

Q. what is the milage distribution of cars amoung different car makers ?

In [190…
```
sns.histplot(x='kmpl',data=df,bins=20,
             hue ='origin_new')
round(df.groupby('origin_new')[['kmpl']].mean(),1)
```

Out[190]:

origin_new	kmpl
Europe	44.9
Japan	49.0
USA	32.3

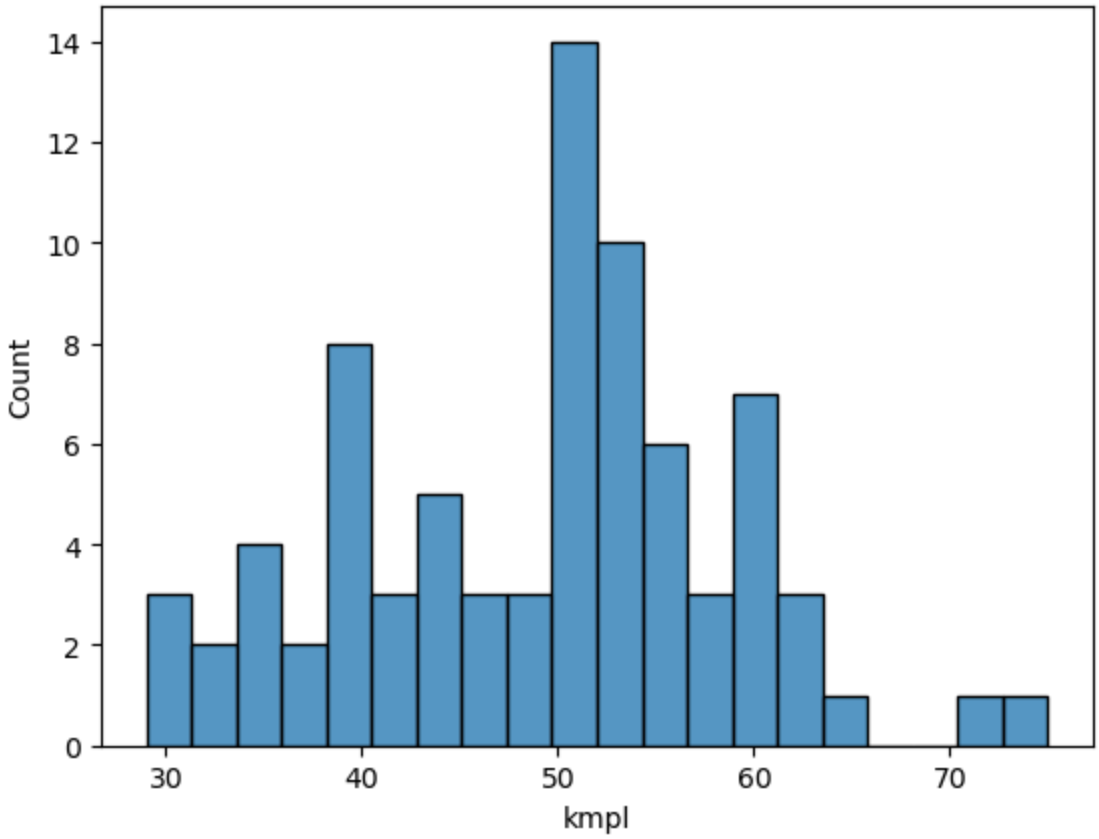


Ans - As we can see the cars made by USA are lowest fule efficient with mean of 32 kmpl where as europe hase much better with 44 kmpl and japan with the highest fule efficient cars with average of 49 kmpl.

Q. As japan make the highest fule efficient cars show the distribution of milage distribution of japan?

In [72]:
```
# histogram of cars from only Japan
sns.histplot(x='kmpl',data=(df.loc[df['origin_new']=='Japan']),bins=20)
```

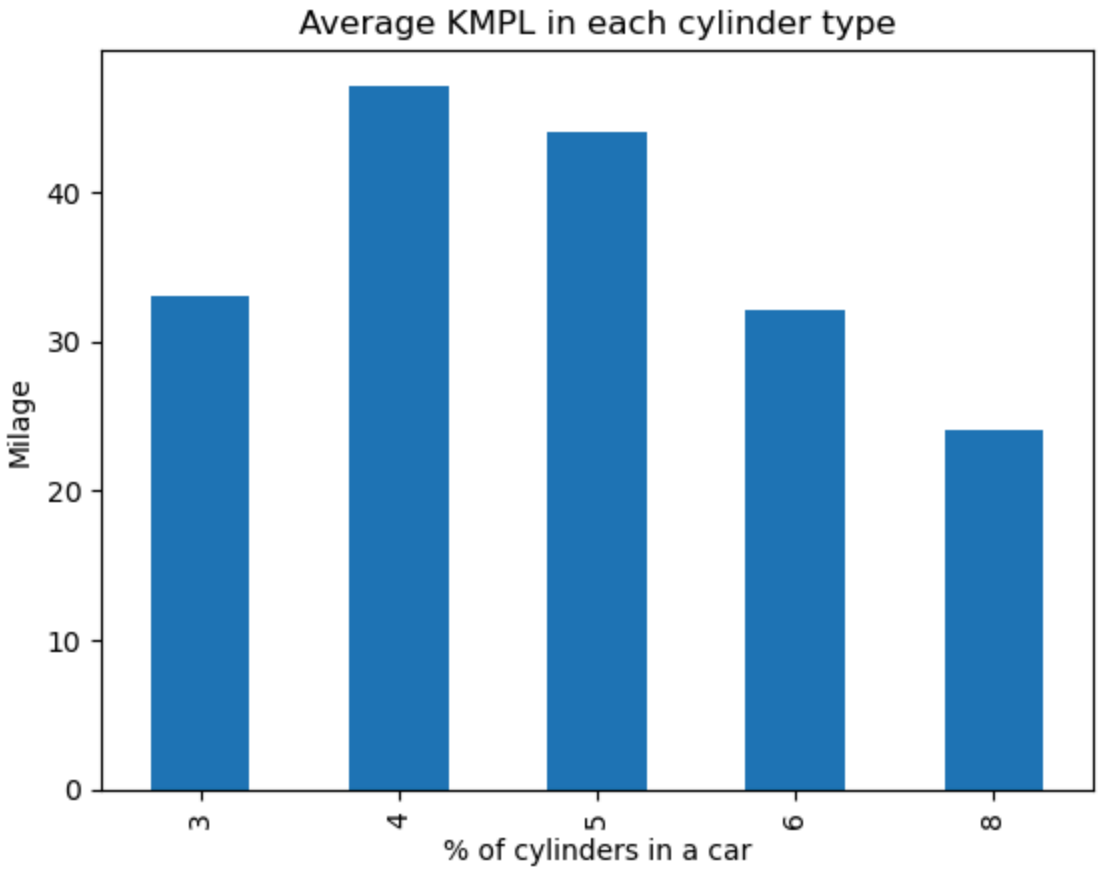
Out[72]:
```
<Axes: xlabel='kmpl', ylabel='Count'>
```



Q. Does cylinder counts affect the average of a car ?

In [192…
```
df.sort_values(by='cylinders').groupby('cylinders')['kmpl'].mean().plot(kind='bar',tit
plt.ylabel('Milage')
plt.xlabel('% of cylinders in a car')
```

Out[192]:
```
Text(0.5, 0, '% of cylinders in a car')
```



Ans - Yes, as we can see the 4 cylinser car gives the highest milage followed by 5 cylinders where as 8 and 3 are the lowest

In [98]:
```
df.head()
```

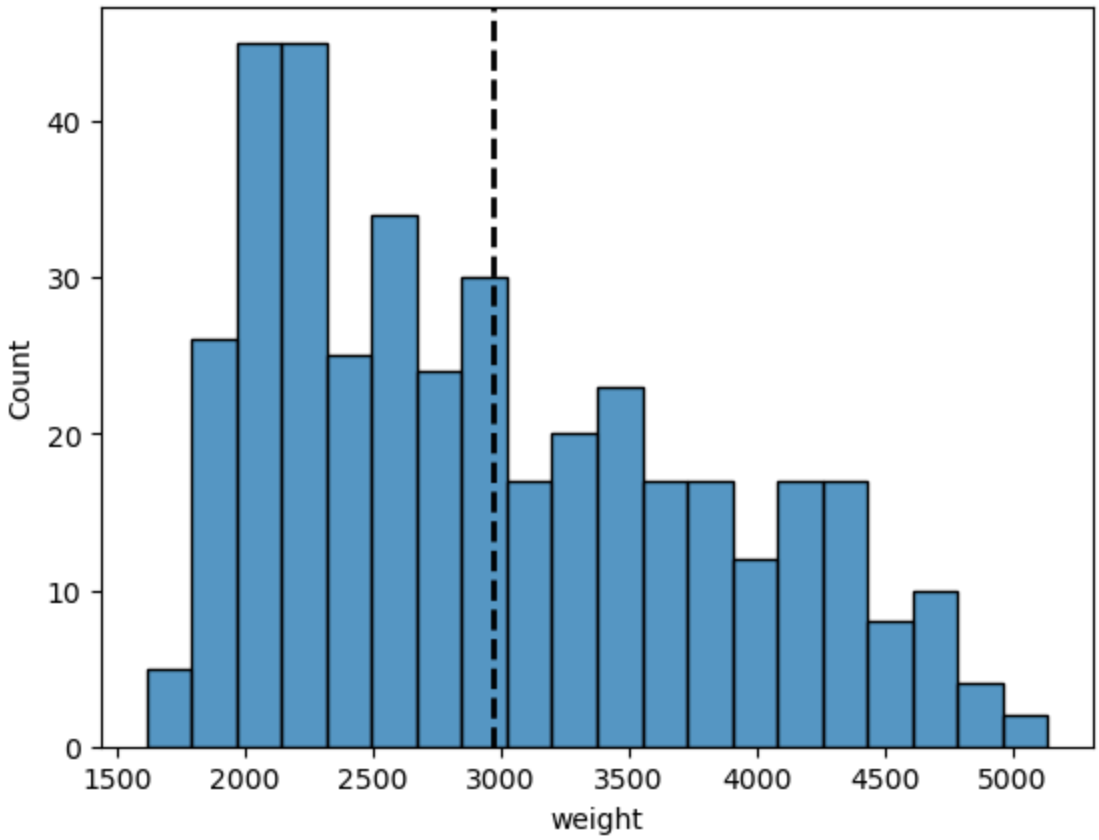
Out[98]:

	mpg	cylinders	displacement	horsepower	weight	acceleration	model year	origin	car name	kmpl
0	18.0	8	307.0	130	3504	12.0	70	1	chevrolet chevelle malibu	29.0
1	15.0	8	350.0	165	3693	11.5	70	1	buick skylark 320	24.1
2	18.0	8	318.0	150	3436	11.0	70	1	plymouth satellite	29.0
3	16.0	8	304.0	150	3433	12.0	70	1	amc rebel sst	25.7
4	17.0	8	302.0	140	3449	10.5	70	1	ford torino	27.4

Q. What is the distribution of weight of a car ?

In [214…
```
sns.histplot(x='weight',data=df,bins=20)
plt.axvline(df['weight'].mean(),color='black',
            linestyle='dashed',linewidth=2)
print('weight of a average car = ',round(df['weight'].mean(),1))
```

```
weight of a average car =  2970.4
```

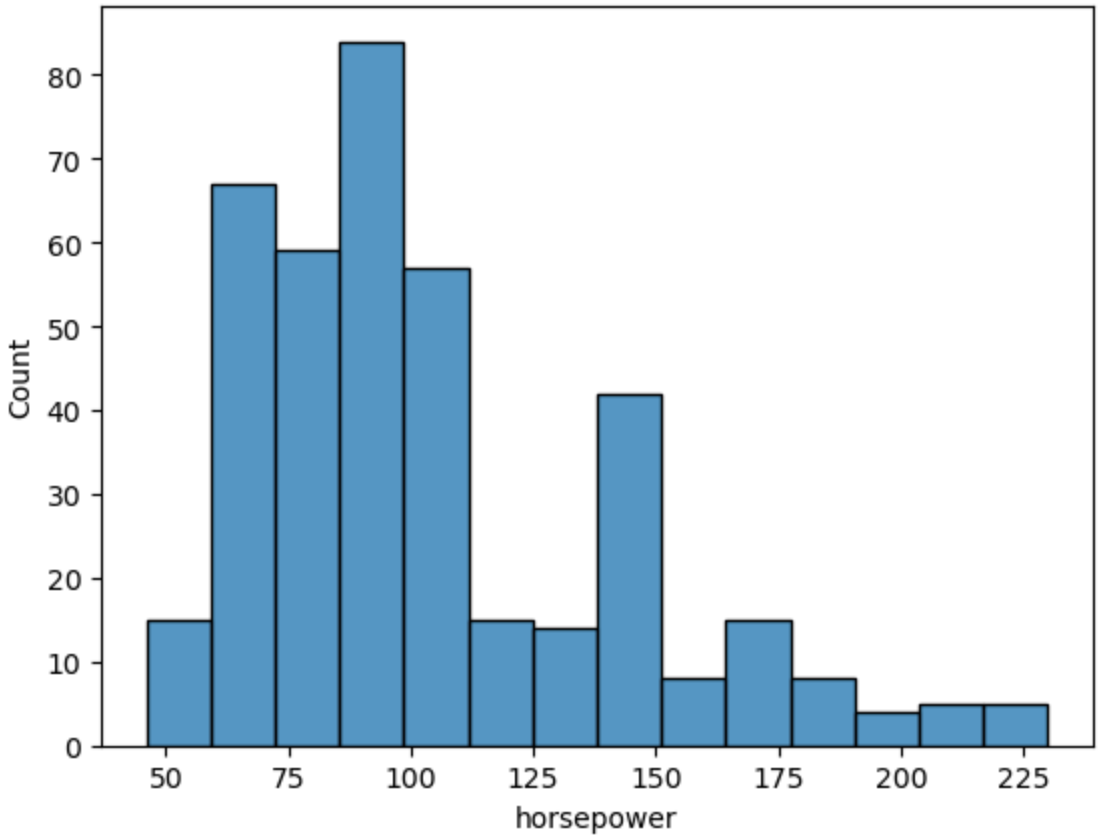


Ans- The average cars weight's around 2970 KG where the mejority of car are around 2200 KG of weight and it goes to nearly 5000 KG of weight.

Q. How much horsepower does a normal car generate ?

In [129…
```
sns.histplot(x='horsepower',data=df)
```

Out[129]:
```
<Axes: xlabel='horsepower', ylabel='Count'>
```



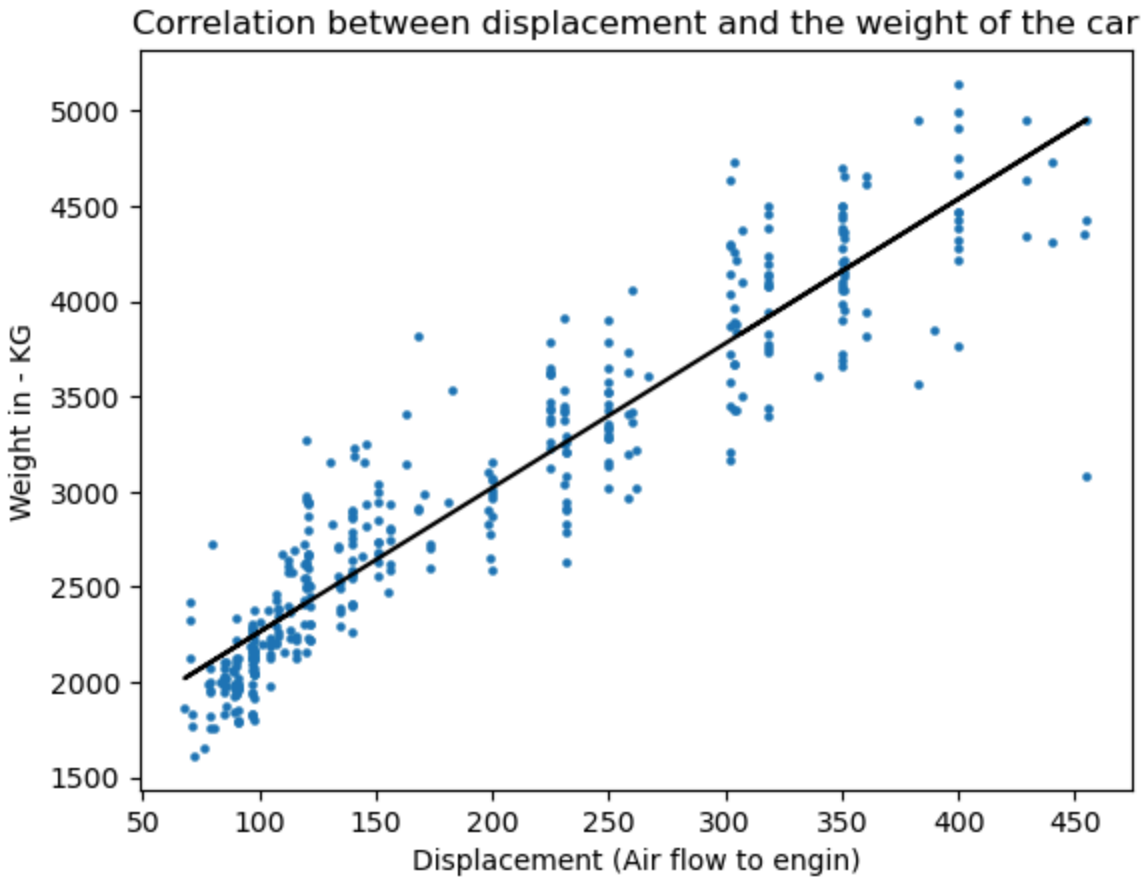
Ans - Normally a car generate horsepower between 60 - 110 but when you go for highend car it can generate horse power of 225.

Q. Is there any relation between displacement and the weight of the car ?

In [166…

```
from sklearn.linear_model import LinearRegression as lr
m = lr()
x= np.array(df['displacement']).reshape(-1,1)
m.fit(x,df['weight'])
y = m.predict(x)
plt.plot(x,y,color='black')

plt.scatter(x=df['displacement'],y=df['weight'],s=5)
plt.title('Correlation between displacement and the weight of the car')
plt.xlabel('Displacement (Air flow to engin)')
plt.ylabel('Weight in - KG')
plt.show()
```



Ans - Yes, there is a high correlation between the weight of the car and its displacement.

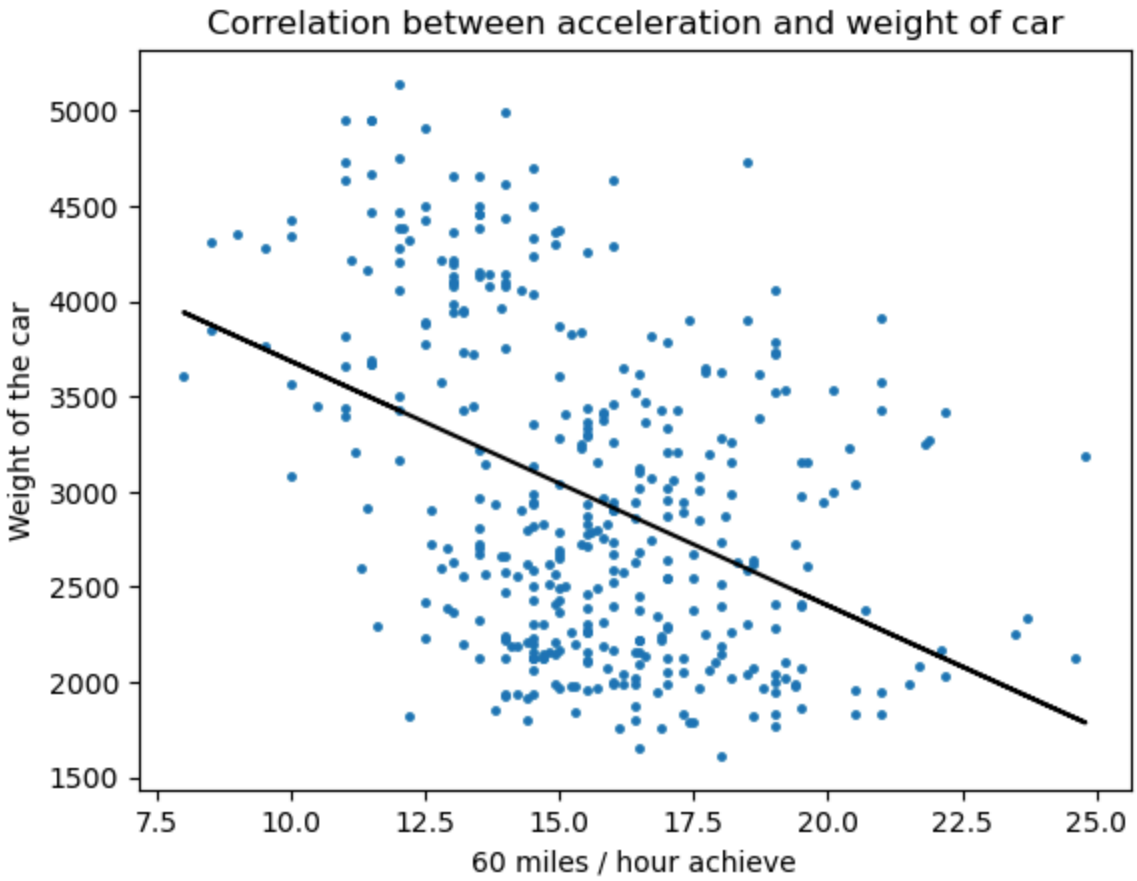
Q. Does a car's weight make it slow ?

In [186…

```
plt.scatter(x=df['acceleration'],y=df['weight'],s=6)
x1 =np.array(df['acceleration']).reshape(-1,1)
model = lr()
model.fit(x1,df['weight'])
y1 = model.predict(x1)
plt.plot(x1,y1,color='black')
plt.title('Correlation between acceleration and weight of car')
plt.xlabel('60 miles / hour achieve')
plt.ylabel('Weight of the car')
```

Out[186]:

```
Text(0, 0.5, 'Weight of the car')
```



Ans - Yes, a car's weight and it's acceleration time has a negative correlation that means if the car weight increase it will become slower .

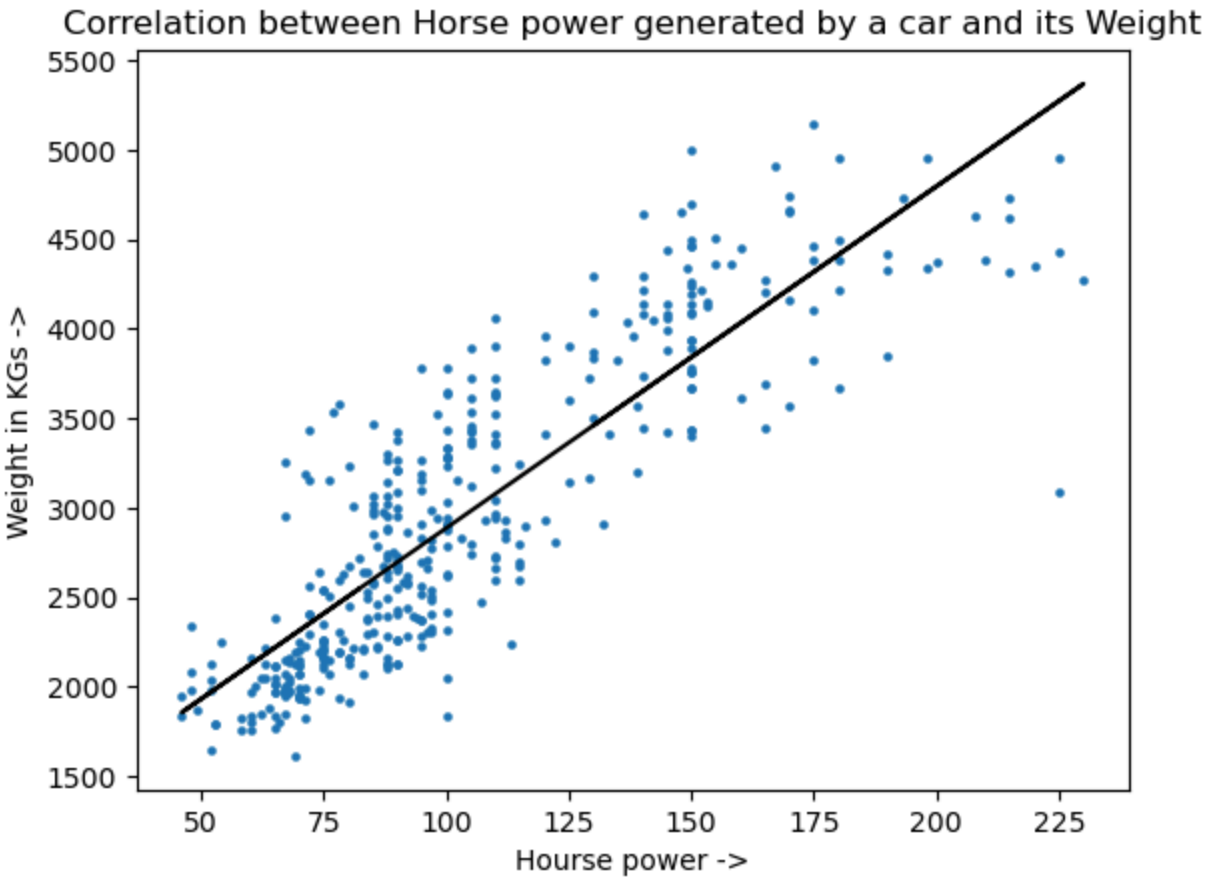
Q. Is there any relation between the weight of a car and how much horsepower it can generate ?

In [245…

```
plt.scatter(y=df['weight'],x=df['horsepower'],s=5)
x =np.array(df['horsepower']).reshape(-1,1)
model = lr()
model.fit(x,df['weight'])
y = model.predict(x)
plt.plot(x,y,color='black')
plt.xlabel('Hourse power ->')
plt.ylabel('Weight in KGs ->')
plt.title('Correlation between Horse power generated by a car and its Weight')
```

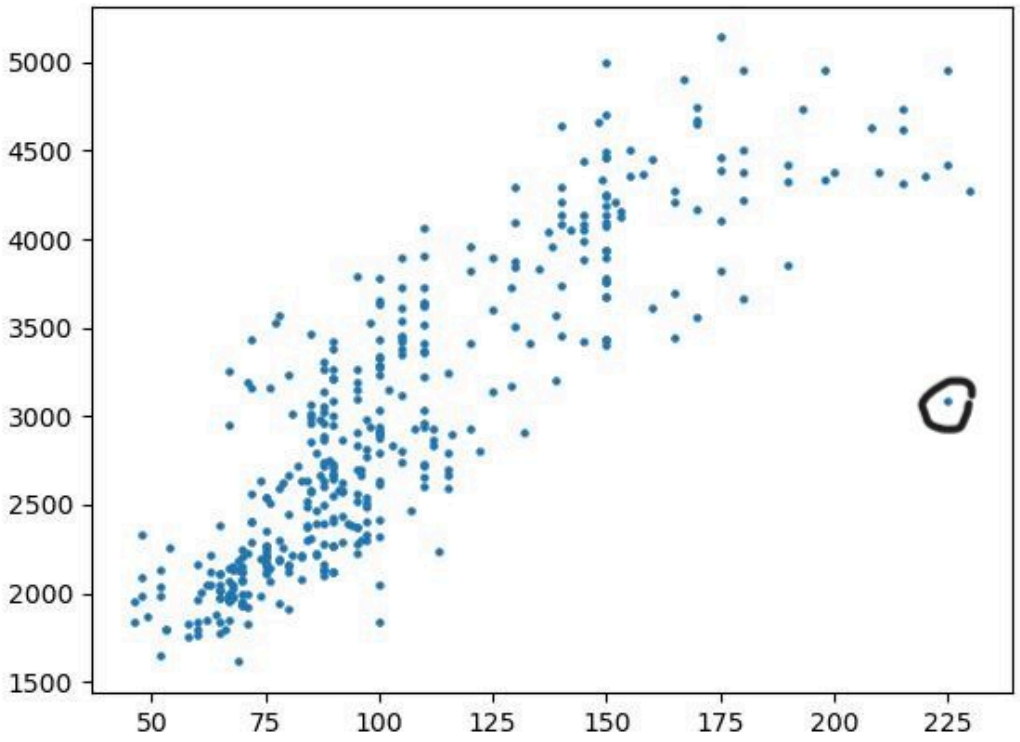
Out[245]:

```
Text(0.5, 1.0, 'Correlation between Horse power generated by a car and its Weight')
```



Ans - Yes, there is a high positive correlation between the weight of a car and how much horsepower it generate

Q. Find out which car is this who has lowest weight and has high horsepower then other normal cars ?



In [234…
```
df.loc[(df['weight']>3000) & (df['horsepower']>200)].sort_values(by='weight').head(1)
```

Out[234]:

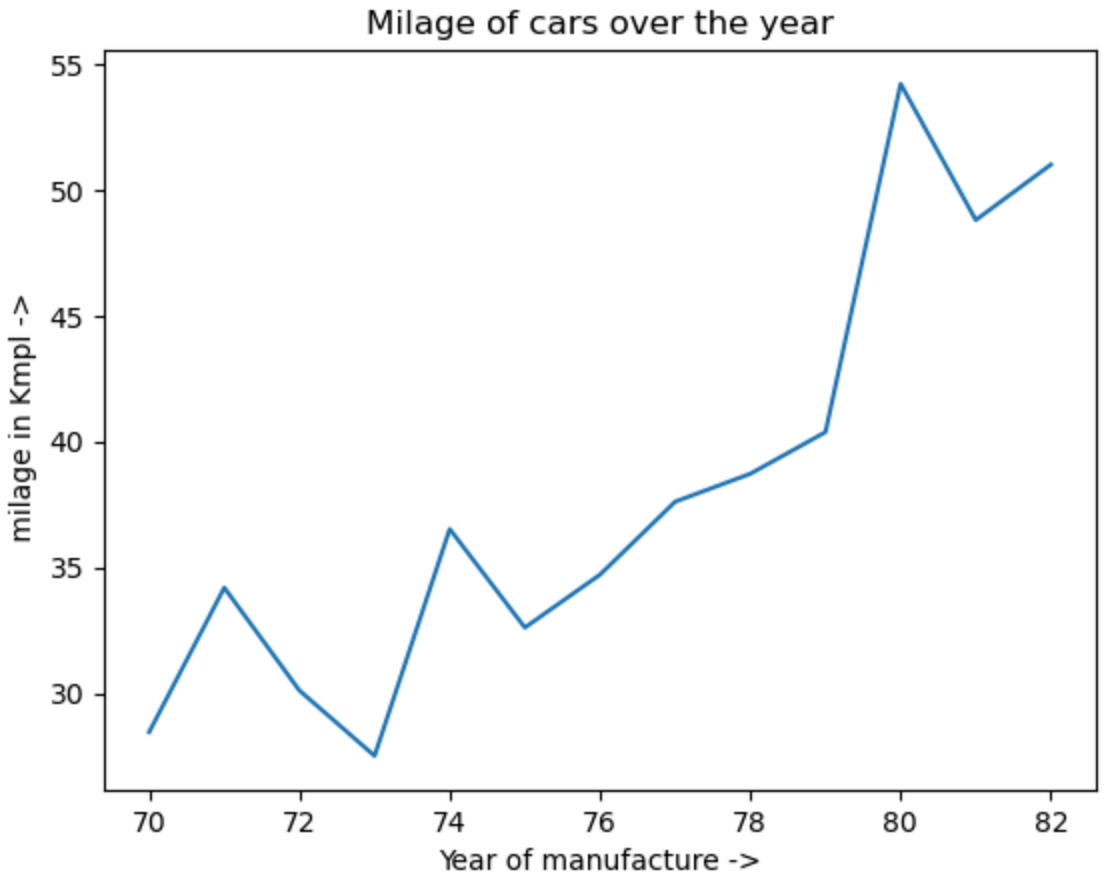
	mpg	cylinders	displacement	horsepower	weight	acceleration	model year	origin	car name	kmpl	o
13	14.0	8	455.0	225	3086	10.0	70	1	buick estate wagon (sw)	22.5	

Ans - The car's name is Buick Estate Wagon made by USA

Q. Does the technology for milage improve over time ?

In [259…
```
df.groupby('model year')['kmpl'].mean().plot(kind='line',
                                             title='Milage of cars over the year',
                                             xlabel='Year of manufacture ->',
                                             ylabel=' milage in Kmpl ->')
```

Out[259]:
```
<Axes: title={'center': 'Milage of cars over the year'}, xlabel='Year of manufacture
->', ylabel=' milage in Kmpl ->'>
```



Ans - Yes, the technology has improved over time as in 70s the car could only give a average of 30 KMPL while the car's of 80s model give a average of 50 KMPL.

In [ ]: