LINEAR REGRESSION

Import Library

1. Lakukan langkah yang sama seperti minggu sebelumnya untuk meng-import library Numpy dan Pandas, pylab, matplotlib.pyplot.

In [1]:
```
import matplotlib.pyplot as plt
import pandas as pd
import pylab as pl
import numpy as np
%matplotlib inline
```

Import Data

2. Gunakan dataset FuelConsumptionCo2.csv dan masukkan ke dalam dataframe menggunakan Pandas. Berikan nama df

3. Tampilkan informasi dataset dan isi data.

Menampilkan Statistik Data

4. Membaca data :

In [2]:
```
df = pd.read_csv(r"D:\SEMESTER 4\IS411 Data Modelling\LAB\IS411_C-H7_0000005484_Christopher Darren_Week-13\FuelConsumptionCo2.csv")

# melihat dataset
df.head()
```

Out[2]:

	MODELYEAR	MAKE	MODEL	VEHICLECLASS	ENGINESIZE	CYLINDERS	TRANSMISSION	FUELTYPE	FUELCONSUMPTION_CITY	FUELCONSUMPTION_HWY	FUELCONSUMPTION_COMB	FUELCONSUMPTION_COMB_MPG	CO
0	2014	ACURA	ILX	COMPACT	2.0	4	AS5	Z	9.9	6.7	8.5	33	
1	2014	ACURA	ILX	COMPACT	2.4	4	M6	Z	11.2	7.7	9.6	29	
2	2014	ACURA	ILX HYBRID	COMPACT	1.5	4	AV7	Z	6.0	5.8	5.9	48	
3	2014	ACURA	MDX 4WD	SUV - SMALL	3.5	6	AS6	Z	12.7	9.1	11.1	25	
4	2014	ACURA	RDX AWD	SUV - SMALL	3.5	6	AS6	Z	12.1	8.7	10.6	27	

5. Eksplorasi deskriptif data yang diunduh.

In [3]:
```
# merangkum data
df.describe()
```

Out[3]:

	MODELYEAR	ENGINESIZE	CYLINDERS	FUELCONSUMPTION_CITY	FUELCONSUMPTION_HWY	FUELCONSUMPTION_COMB	FUELCONSUMPTION_COMB_MPG	CO2EMISSIONS
count	1067.0	1067.000000	1067.000000	1067.000000	1067.000000	1067.000000	1067.000000	1067.000000
mean	2014.0	3.346298	5.794752	13.296532	9.474602	11.580881	26.441425	256.228679
std	0.0	1.415895	1.797447	4.101253	2.794510	3.485595	7.468702	63.372304
min	2014.0	1.000000	3.000000	4.600000	4.900000	4.700000	11.000000	108.000000
25%	2014.0	2.000000	4.000000	10.250000	7.500000	9.000000	21.000000	207.000000
50%	2014.0	3.400000	6.000000	12.600000	8.800000	10.900000	26.000000	251.000000
75%	2014.0	4.300000	8.000000	15.550000	10.850000	13.350000	31.000000	294.000000
max	2014.0	8.400000	12.000000	30.200000	20.500000	25.800000	60.000000	488.000000

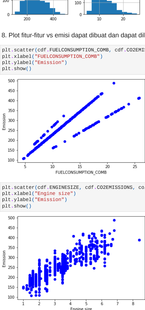
In [4]:
```
cdf = df[['ENGINESIZE','CYLINDERS','FUELCONSUMPTION_COMB','CO2EMISSIONS']]
cdf.head(10)
```

Out[4]:

	ENGINESIZE	CYLINDERS	FUELCONSUMPTION_COMB	CO2EMISSIONS
0	2.0	4	8.5	196
1	2.4	4	9.6	221
2	1.5	4	5.9	136
3	3.5	6	11.1	255
4	3.5	6	10.6	244
5	3.5	6	10.0	230
6	3.5	6	10.1	232
7	3.7	6	11.1	255
8	3.7	6	11.6	267
9	2.4	4	9.2	212

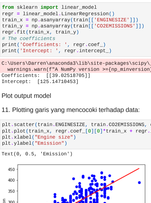
7. Fitur-fitur tersebut dapat diplot sebagai berikut:

In [5]:
```
viz = cdf[['CYLINDERS','ENGINESIZE','CO2EMISSIONS','FUELCONSUMPTION_COMB']]
viz.hist()
plt.show()
```



8. Plot fitur-fitur vs emisi dapat dibuat dan dapat dilihat linearitas hubungannya.

In [6]:
```
plt.scatter(cdf.FUELCONSUMPTION_COMB, cdf.CO2EMISSIONS, color='blue')
plt.xlabel("FUELCONSUMPTION_COMB")
plt.ylabel("Emission")
plt.show()
```

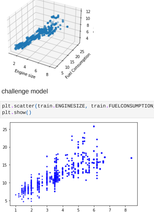


In [7]:
```
plt.scatter(cdf.ENGINESIZE, cdf.CO2EMISSIONS, color='blue')
plt.xlabel("Engine size")
plt.ylabel("Emission")
plt.show()
```

Challenge

1. Plot CYLINDER vs the Emission, untuk melihat hubungan linearnya:

In [8]:
```
plt.scatter(cdf.CYLINDERS, cdf.CO2EMISSIONS, color='blue')
plt.xlabel("CYLINDERS")
plt.ylabel("Emission")
plt.show()
```

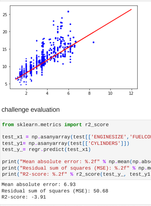


Pembuatan dataset pelatihan dan pengujian

In [9]:
```
msk = np.random.rand(len(df)) < 0.8
train = cdf[msk]
test = cdf[~msk]
```

9. Distribusi Data Pelatihan.

In [10]:
```
plt.scatter(cdf.ENGINESIZE, cdf.CO2EMISSIONS, color='blue')
plt.xlabel("Engine size")
plt.ylabel("Emission")
plt.show()
```



Pemodelan

10. Menggunakan sklearn package untuk memodelkan data.

In [11]:
```
from sklearn import linear_model
regr = linear_model.LinearRegression()
train_x = np.asanyarray(train[['ENGINESIZE']])
train_y = np.asanyarray(train[['CO2EMISSIONS']])
regr.fit(train_x, train_y)
# The coefficients
print('Coefficients: ', regr.coef_)
print('Intercept: ',regr.intercept_)
```

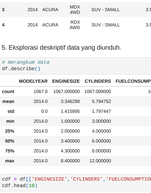
```
C:\Users\Darren\anaconda3\lib\site-packages\scipy\__init__.py:146: UserWarning: A NumPy version >=1.16.5 and <1.23.0 is required for this version of SciPy (detected version 1.24.3
  warnings.warn(f"A NumPy version >={np_minversion} and <{np_maxversion}"
Coefficients:  [[39.02518705]]
Intercept:  [125.14718453]
```

Plot output model

11. Plotting garis yang mencocoki terhadap data:

In [12]:
```
plt.scatter(train.ENGINESIZE, train.CO2EMISSIONS, color='blue')
plt.plot(train_x, regr.coef_[0][0]*train_x + regr.intercept_[0], '-r')
plt.xlabel("Engine size")
plt.ylabel("Emission")
```

Out[12]:
```
Text(0, 0.5, 'Emission')
```



Evaluasi

In [13]:
```
from sklearn.metrics import r2_score

test_x = np.asanyarray(test[['ENGINESIZE']])
test_y = np.asanyarray(test[['CO2EMISSIONS']])
test_y_ = regr.predict(test_x)

print("Mean absolute error: %.2f" % np.mean(np.absolute(test_y_ - test_y)))
print("Residual sum of squares (MSE): %.2f" % np.mean((test_y_ - test_y) ** 2))
print("R2-score: %.2f" % r2_score(test_y_, test_y) )
```

```
Mean absolute error: 24.65
Residual sum of squares (MSE): 1031.72
R2-score: 0.69
```

Model Regresi Variabel Jamak

1. Buatlah seperti langkah no. 9 untuk variabel – variabel: Engine size, Fuel Consumptions, dan Cylinders!

2. Lakukan langkah pemodelan seperti no.10 dengan menggunakan 3 variabel tersebut sebagai data X!

3. Lakukan sampai tahap evaluasinya!

In [14]:
```
import matplotlib.pyplot as plt
from mpl_toolkits.mplot3d import Axes3D

# Create the figure and axes
fig = plt.figure()
ax = fig.add_subplot(111, projection='3d')

# Define the data for the three variables
engine_size = cdf.ENGINESIZE
fuel_consumption = cdf.FUELCONSUMPTION_COMB
cylinders = cdf.CYLINDERS

# Plot the data in 3D
ax.scatter(engine_size, fuel_consumption, cylinders)

# Set the labels for each axis
ax.set_xlabel("Engine Size")
ax.set_ylabel("Fuel Consumption")
ax.set_zlabel("Cylinders")

plt.show()
```


challenge model

In [15]:
```
plt.scatter(train.ENGINESIZE, train.FUELCONSUMPTION_COMB, train.CYLINDERS, color='blue')
plt.show()
```


In [16]:
```
from sklearn import linear_model
regr = linear_model.LinearRegression()
train_x1 = np.asanyarray(train[['ENGINESIZE','CYLINDERS']])
train_y1 = np.asanyarray(train[['FUELCONSUMPTION_COMB']])
regr.fit(train_x1, train_y1)
# The coefficients
print('Coefficients: ', regr.coef_)
print('Intercept: ', regr.intercept_)
```

```
Coefficients:  [[1.02722556 0.18148429]]
Intercept:  [4.44426533]
```

Visualize

In [17]:
```
plt.scatter(train.ENGINESIZE, train.FUELCONSUMPTION_COMB, train.CYLINDERS, color='blue')
plt.plot(train_x1, regr.coef_[0][0]*train_x1 + regr.intercept_[0], '-r')
#plt.xlabel("Engine size")
#plt.ylabel("Emission")
plt.show()
```


challenge evaluation

In [18]:
```
from sklearn.metrics import r2_score

test_x1 = np.asanyarray(test[['ENGINESIZE','FUELCONSUMPTION_COMB']])
test_y1= np.asanyarray(test[['CYLINDERS']])
test_y_= regr.predict(test_x1)

print("Mean absolute error: %.2f" % np.mean(np.absolute(test_y_ - test_y1)))
print("Residual sum of squares (MSE): %.2f" % np.mean((test_y_ - test_y1) ** 2))
print("R2-score: %.2f" % r2_score(test_y_, test_y1) )
```

```
Mean absolute error: 6.93
Residual sum of squares (MSE): 50.68
R2-score: -3.91
```

In [19]:
```
!jupyter nbconvert --to html "./0000005484_Christopher Darren_Week13_ASINKRON.ipynb" --output-dir="./"
```

```
[NbConvertApp] Converting notebook ./0000005484_Christopher Darren_Week13_ASINKRON.ipynb to html
[NbConvertApp] Writing 801481 bytes to 0000005484_Christopher Darren_Week13_ASINKRON.html
```

In [ ]:
```
```