Problem Statement

Linear Regression

Import Libraries

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

In [2]:
```
a=pd.read_csv("bharat.csv")
a
```

Out[2]:

	Sr. No.	Train Name	Train Number	Originating City	Originating Station	Terminal City	Ter
0	1	New Delhi - Varanasi Vande Bharat Express	22435/22436	Delhi	New Delhi	Varanasi	Var
1	2	New Delhi - Shri Mata Vaishno Devi Katra Vande...	22439/22440	Delhi	New Delhi	Katra	Shri
2	3	Mumbai Central - Gandhinagar Capital Vande Bha...	20901/20902	Mumbai	Mumbai Central	Gandhinagar	Gandh
3	4	New Delhi - Amb Andaura Vande Bharat Express	22447/22448	Delhi	New Delhi	Andaura	
4	5	MGR Chennai Central - Mysuru Vande Bharat Express	20607/20608	Chennai	Chennai Central	Mysuru	My
5	6	Bilaspur - Nagpur Vande Bharat Express	20825/20826	Bilaspur, Chhattisgarh	Bilaspur Junction	Nagpur	Na
6	7	Howrah - New Jalpaiguri Vande Bharat Express	22301/22302	Kolkata	Howrah Junction	Siliguri	N
7	8	Visakhapatnam - Secunderabad Vande Bharat Express	20833/20834	Visakhapatnam	Visakhapatnam Junction	Hyderabad	S
8	9	Mumbai CSMT - Solapur Vande Bharat Express	22225/22226	Mumbai	Chhatrapati Shivaji Terminus	Solapur	
9	10	Mumbai CSMT - Sainagar Shirdi	22223/22224	Mumbai	Chhatrapati Shivaji	Shirdi	S

	Sr. No.	Train Name	Train Number	Originating City	Originating Station	Terminal City	Ter
10	11	Vande Bharat Exp... Rani Kamalapati (Habibganj) - Hazrat Nizamuddi...	20171/20172	Bhopal	Terminus Habibganj (Rani Kamalapati)	Delhi	Hazra
11	12	Secunderabad - Tirupati Vande Bharat Express	20701/20702	Hyderabad	Secunderabad Junction	Tirupati	
12	13	MGR Chennai Central - Coimbatore Vande Bharat ...	20643/20644	Chennai	Chennai Central	Coimbatore	Coimb
13	14	Delhi Cantonment - Ajmer Vande Bharat Express	20977/20978	Delhi	Delhi Cantonment	Ajmer	A
14	15	Kasaragod - Thiruvananthapuram Vande Bharat Ex...	20633/20634	Kasaragod	Kasaragod	Thiruvananthapuram	Thiruv
15	16	Howrah - Puri Vande Bharat Express	22895/22896	Kolkata	Howrah Junction	Puri	
16	17	Anand Vihar Terminal - Dehradun Vande Bharat E...	22457/22458	Delhi	Anand Vihar Terminal	Dehradun	Dehr
17	18	New Jalpaiguri - Guwahati Vande Bharat Express	22227/22228	Siliguri	New Jalpaiguri Junction	Guwahati	
18	19	Mumbai CSMT - Madgaon Vande Bharat Express	22229/22230	Mumbai	Chhatrapati Shivaji Terminus	Madgaon	Mad
19	19	Mumbai CSMT - Madgaon Vande Bharat Express	22229/22230	Mumbai	Chhatrapati Shivaji Terminus	Madgaon	Mad
20	20	Patna - Ranchi Vande Bharat Express	22349/22350	Patna	Patna Junction	Ranchi	Ra
21	21	KSR Bengaluru - Dharwad Vande Bharat Express	20661/20662	Bangalore	Bangalore City	Hubbali - Dharwad	
22	22	Rani Kamalapati (Habibganj) - Jabalpur Vande B...	20173/20174	Bhopal	Habibganj (Rani Kamalapati)	Jabalpur	Jab
23	23	Indore - Bhopal Vande Bharat Express	20911/20912	Indore	Indore Junction	Bhopal	Bh
24	24	Jodhpur - Sabarmati (Ahmedabad) Vande Bharat E...	12461/12462	Jodhpur	Jodhpur Junction	Ahmedabad	Saba
25	25	Gorakhpur - Lucknow Charbagh Vande Bharat Express	22549/22550	Gorakhpur	Gorakhpur Junction	Charbagh	Luckn

To display top 10 rows

In [3]:
```
c=a.head(15)
c
```

Out[3]:

	Sr. No.	Train Name	Train Number	Originating City	Originating Station	Terminal City	Ter
0	1	New Delhi - Varanasi Vande Bharat Express	22435/22436	Delhi	New Delhi	Varanasi	Var
1	2	New Delhi - Shri Mata Vaishno Devi Katra Vande...	22439/22440	Delhi	New Delhi	Katra	Shri
2	3	Mumbai Central - Gandhinagar Capital Vande Bha...	20901/20902	Mumbai	Mumbai Central	Gandhinagar	Gandh
3	4	New Delhi - Amb Andaura Vande Bharat Express	22447/22448	Delhi	New Delhi	Andaura	
4	5	MGR Chennai Central - Mysuru Vande Bharat Express	20607/20608	Chennai	Chennai Central	Mysuru	My
5	6	Bilaspur - Nagpur Vande Bharat Express	20825/20826	Bilaspur, Chhattisgarh	Bilaspur Junction	Nagpur	Na
6	7	Howrah - New Jalpaiguri Vande Bharat Express	22301/22302	Kolkata	Howrah Junction	Siliguri	N
7	8	Visakhapatnam - Secunderabad Vande Bharat Express	20833/20834	Visakhapatnam	Visakhapatnam Junction	Hyderabad	S
8	9	Mumbai CSMT - Solapur Vande Bharat Express	22225/22226	Mumbai	Chhatrapati Shivaji Terminus	Solapur	
9	10	Mumbai CSMT - Sainagar Shirdi Vande Bharat Exp...	22223/22224	Mumbai	Chhatrapati Shivaji Terminus	Shirdi	S
10	11	Rani Kamalapati (Habibganj) - Hazrat Nizamuddi...	20171/20172	Bhopal	Habibganj (Rani Kamalapati)	Delhi	Hazra
11	12	Secunderabad - Tirupati Vande Bharat Express	20701/20702	Hyderabad	Secunderabad Junction	Tirupati	

	Sr. No.	Train Name	Train Number	Originating City	Originating Station	Terminal City	Ter
12	13	MGR Chennai Central - Coimbatore Vande Bharat ...	20643/20644	Chennai	Chennai Central	Coimbatore	Coimb
13	14	Delhi Cantonment - Ajmer Vande Bharat Express	20977/20978	Delhi	Delhi Cantonment	Ajmer	A
14	15	Kasaragod - Thiruvananthapuram Vande Bharat Ex...	20633/20634	Kasaragod	Kasaragod	Thiruvananthapuram	Thiruva

To find Missing values

In [4]:
```
c.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 15 entries, 0 to 14
Data columns (total 16 columns):
 #   Column              Non-Null Count  Dtype 
---  ------              --------------  ----- 
 0   Sr. No.             15 non-null     int64 
 1   Train Name          15 non-null     object
 2   Train Number        15 non-null     object
 3   Originating City    15 non-null     object
 4   Originating Station 15 non-null     object
 5   Terminal City       15 non-null     object
 6   Terminal Station    15 non-null     object
 7   Operator            15 non-null     object
 8   No. of Cars         15 non-null     int64 
 9   Frequency           15 non-null     object
 10  Distance            15 non-null     object
 11  Travel Time         15 non-null     object
 12  Speed               15 non-null     object
 13  Average Speed       15 non-null     object
 14  Inauguration        15 non-null     object
 15  Average occupancy   15 non-null     object
dtypes: int64(2), object(14)
memory usage: 2.0+ KB
```

To display summary of statistics

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

Out[5]:

	Sr. No.	No. of Cars
count	26.000000	26.000000
mean	13.230769	12.923077
std	7.306478	3.969112
min	1.000000	8.000000
25%	7.250000	8.000000

	Sr. No.	No. of Cars
50%	13.500000	16.000000
75%	19.000000	16.000000
max	25.000000	16.000000

To display column heading

In [6]:
```
a.columns
```

Out[6]:
```
Index(['Sr. No.', 'Train Name', 'Train Number', 'Originating City',
       'Originating Station', 'Terminal City', 'Terminal Station', 'Operator',
       'No. of Cars', 'Frequency', 'Distance', 'Travel Time', 'Speed',
       'Average Speed', 'Inauguration', 'Average occupancy'],
      dtype='object')
```

Pairplot

In [7]:
```
s=a.dropna(axis=1)
s
```

Out[7]:

	Sr. No.	Train Name	Train Number	Originating City	Originating Station	Terminal City	Ter
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24	24	Jodhpur - Sabarmati (Ahmedabad) Vande Bharat E...	12461/12462	Jodhpur	Jodhpur Junction	Ahmedabad	Saba
25	25	Gorakhpur - Lucknow Charbagh Vande Bharat Express	22549/22550	Gorakhpur	Gorakhpur Junction	Charbagh	Luckr

In [8]:
```
s.columns
```

Out[8]:
```
Index(['Sr. No.', 'Train Name', 'Train Number', 'Originating City',
       'Originating Station', 'Terminal City', 'Terminal Station', 'Operator',
       'No. of Cars', 'Frequency', 'Distance', 'Travel Time', 'Speed',
       'Average Speed', 'Inauguration', 'Average occupancy'],
      dtype='object')
```

To train the Model

In [9]:
```
g=c[['Sr. No.']]
h=c['No. of Cars']
```

To split dataset into training end test

In [10]:
```
from sklearn.model_selection import train_test_split
g_train,g_test,h_train,h_test=train_test_split(g,h,test_size=0.6)
```

To run the model

In [11]:
```
from sklearn.linear_model import LinearRegression
```

In [12]:
```
lr=LinearRegression()
lr.fit(g_train,h_train)
```

Out[12]:
```
LinearRegression()
```

In [13]:
```
print(lr.intercept_)
```

```
18.0
```

Coeffecient

In [14]:
```
coeff=pd.DataFrame(lr.coef_,g.columns,columns=['Co-effecient'])
coeff
```

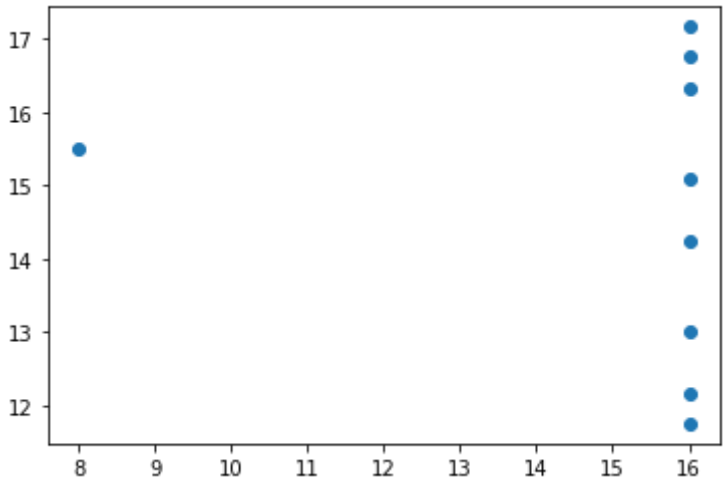
Out[14]:

	Co-effecient
Sr. No.	-0.416667

Best Fit line

In [15]:
```
prediction=lr.predict(g_test)
plt.scatter(h_test,prediction)
```

Out[15]:
```
<matplotlib.collections.PathCollection at 0x271dc1228e0>
```



To find score

In [16]:
```
print(lr.score(g_test,h_test))
```

```
-0.8271484375
```

Import Lasso and ridge

In [17]:
```
from sklearn.linear_model import Ridge,Lasso
```

Ridge

In [18]:
```
ri=Ridge(alpha=5)
ri.fit(g_train,h_train)
```

Out[18]:
```
Ridge(alpha=5)
```

In [19]:
```
ri.score(g_test,h_test)
```

Out[19]:
```
-0.7613254827958043
```

In [20]:
```
ri.score(g_train,h_train)
```

Out[20]:
```
0.31173414371140107
```

Lasso

In [21]:
```
l=Lasso(alpha=6)
l.fit(g_train,h_train)
```

Out[21]:
```
Lasso(alpha=6)
```

In [22]:
```
l.score(g_test,h_test)
```

Out[22]:
```
-0.060302734375
```

In [23]:
```
ri.score(g_train,h_train)
```

Out[23]:
```
0.31173414371140107
```

ElasticNet

In [24]:
```
from sklearn.linear_model import ElasticNet
e=ElasticNet()
e.fit(g_train,h_train)
```

Out[24]:
```
ElasticNet()
```

Coeffecient,intercept

In [25]:
```
print(e.coef_)
```

```
[-0.37373737]
```

In [26]:
```
print(e.intercept_)
```

```
17.656565656565657
```

Prediction

In [27]:
```
d=e.predict(g_test)
d
```

Out[27]:
```
array([14.29292929, 16.16161616, 16.90909091, 15.41414141, 16.53535354,
       13.17171717, 12.05050505, 12.42424242, 15.04040404])
```

In [28]:
```
print(e.score(g_test,h_test))
```

```
-0.6932535583103763
```

Evaluation

In [29]:
```
from sklearn import metrics
print("Mean Absolute error:",metrics.mean_absolute_error(h_test,d))
```

```
Mean Absolute error: 2.4489337822671153
```

In [30]:
```
print("Mean Squared error:",metrics.mean_squared_error(h_test,d))
```

```
Mean Squared error: 10.703034837714972
```

In [31]:
```
print("Mean Squared error:",np.sqrt(metrics.mean_squared_error(h_test,d)))
```

```
Mean Squared error: 3.271549302351253
```

Model Saving

In [32]:
```
import pickle
filename="pre"
pickle.dump(lr,open(filename,"wb"))
```

In [33]:
```
filename='pre'
model = pickle.load(open(filename,'rb'))
```

In [35]:
```
eral=[[15],[30]]
result=model.predict(eral)
result
```

Out[35]:
```
array([11.75,  5.5 ])
```

In [ ]:

In [ ]: