PRACTICE-4:

Design a model to predict the housing price from Boston Dataset using Linear Regression

```
import numpy as np
import matplotlib.pyplot as plt
import pandas as pd
import seaborn as sns
%matplotlib  inline
```

```
 from google.colab import drive
 drive.mount('/content/drive')
```

```
Mounted at /content/drive
```

```
import io
import pandas as pd
df=pd.read_csv('/content/drive/MyDrive/Data Sets/BostonHousing.csv')
df.head()
```

	crim	zn	indus	chas	nox	rm	age	dis	rad	tax	ptratio	b	lstat	medv
0	0.00632	18.0	2.31	0	0.538	6.575	65.2	4.0900	1	296	15.3	396.90	4.98	24.0
1	0.02731	0.0	7.07	0	0.469	6.421	78.9	4.9671	2	242	17.8	396.90	9.14	21.6
2	0.02729	0.0	7.07	0	0.469	7.185	61.1	4.9671	2	242	17.8	392.83	4.03	34.7
3	0.03237	0.0	2.18	0	0.458	6.998	45.8	6.0622	3	222	18.7	394.63	2.94	33.4
4	0.06905	0.0	2.18	0	0.458	7.147	54.2	6.0622	3	222	18.7	396.90	5.33	36.2

```
df.info()
```

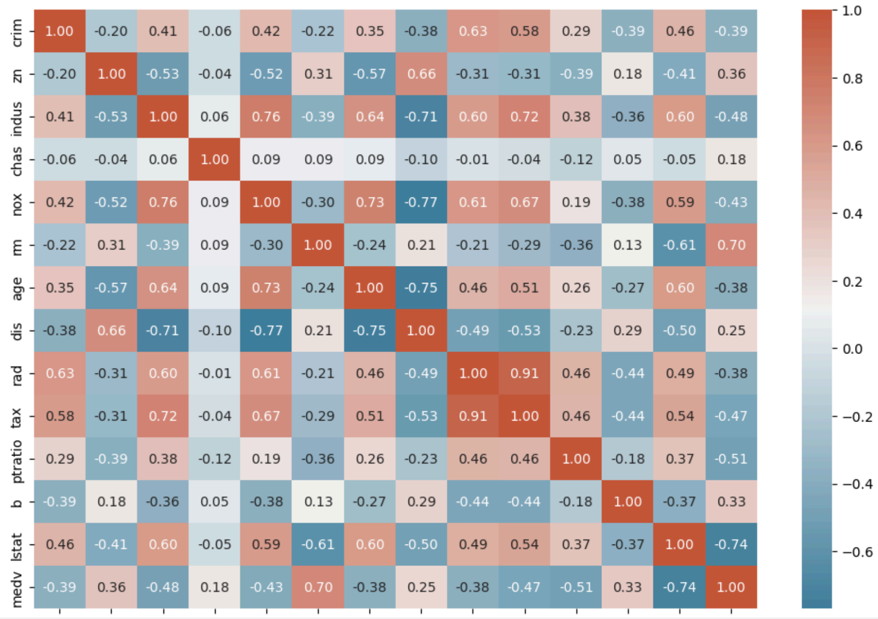
```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 506 entries, 0 to 505
Data columns (total 14 columns):
 #   Column   Non-Null Count  Dtype
---  ------   --------------  -----
 0   crim     506 non-null    float64
 1   zn       506 non-null    float64
 2   indus    506 non-null    float64
 3   chas     506 non-null    int64
 4   nox      506 non-null    float64
 5   rm       506 non-null    float64
 6   age      506 non-null    float64
 7   dis      506 non-null    float64
 8   rad      506 non-null    int64
 9   tax      506 non-null    int64
 10  ptratio  506 non-null    float64
 11  b        506 non-null    float64
 12  lstat    506 non-null    float64
 13  medv     506 non-null    float64
dtypes: float64(11), int64(3)
memory usage: 55.5 KB
```

```
df.describe()
```

	crim	zn	indus	chas	nox	rm	age	dis	rad	tax	ptratio	b	lstat	medv
count	506.000000	506.000000	506.000000	506.000000	506.000000	506.000000	506.000000	506.000000	506.000000	506.000000	506.000000	506.000000	506.000000	506.000000
mean	3.613524	11.363636	11.136779	0.069170	0.554695	6.284634	68.574901	3.795043	9.549407	408.237154	18.455534	356.674032	12.653063	22.532806
std	8.601545	23.322453	6.860353	0.253994	0.115878	0.702617	28.148861	2.105710	8.707259	168.537116	2.164946	91.294864	7.141062	9.197104
min	0.006320	0.000000	0.460000	0.000000	0.385000	3.561000	2.900000	1.129600	1.000000	187.000000	12.600000	0.320000	1.730000	5.000000
25%	0.082045	0.000000	5.190000	0.000000	0.449000	5.885500	45.025000	2.100175	4.000000	279.000000	17.400000	375.377500	6.950000	17.025000
50%	0.256510	0.000000	9.690000	0.000000	0.538000	6.208500	77.500000	3.207450	5.000000	330.000000	19.050000	391.440000	11.360000	21.200000
75%	3.677083	12.500000	18.100000	0.000000	0.624000	6.623500	94.075000	5.188425	24.000000	666.000000	20.200000	396.225000	16.955000	25.000000

```
#let's plot all the columns to look at their distributions
for i in df.columns:
  plt.figure(figsize=(7,4))
  sns.histplot(data=df,x=i,kde=True)
  plt.show()
```

```
plt.figure(figsize=(12,8))
cmap=sns.diverging_palette(230,20,as_cmap=True)
sns.heatmap(df.corr(),annot=True,fmt='.2f',cmap=cmap)
plt.show()
```




```
Y=df['medv']
X=df.drop(columns={'medv'})
```

```
#splitting the data in 70:30 ratio of train to test data
from sklearn.model_selection import train_test_split
X_train,X_test,y_train,y_test=train_test_split(X,Y,test_size=0.30,random_state=1)
```

```
print(X_train.shape)
print(X_test.shape)
print(y_train.shape)
print(y_test.shape)
```

```
(354, 13)
(152, 13)
(354,)
(152,)
```

```
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error
lin_model=LinearRegression()
lin_model.fit(X_train,y_train)
```

```
▾ LinearRegression
```

```
b=lin_model.coef_
m=lin_model.intercept_
```

```
b
```

```
array([-9.85424717e-02,  6.07841138e-02,  5.91715401e-02,  2.43955988e+00,
       -2.14699650e+01,  2.79581385e+00,  3.57459778e-03, -1.51627218e+00,
        3.07541745e-01, -1.12800166e-02, -1.00546640e+00,  6.45018446e-03,
       -5.68834539e-01])
```

```
m
```

```
46.396493871823864
```

```
from sklearn.metrics import r2_score
#model evaluation for training set '
y_train_predict=lin_model.predict(X_train)
rmse=(np.sqrt(mean_squared_error(y_train,y_train_predict)))
r2=r2_score(y_train,y_train_predict)

print("The model performance for training set")
print("--------------------------------------")
print('RMSE is {}'.format(rmse))
print('R2 score is {}'.format(r2))
print("\n")
```

```
The model performance for training set
--------------------------------------
RMSE is 4.849055005805464
R2 score is 0.7103879080674731
```

```
from sklearn.metrics import r2_score
#model evaluation for training set '
y_test_predict=lin_model.predict(X_test)
rmse=(np.sqrt(mean_squared_error(y_test,y_test_predict)))
r2=r2_score(y_test,y_test_predict)

print("The model performance for training set")
print("--------------------------------------")
print('RMSE is {}'.format(rmse))
print('R2 score is {}'.format(r2))
print("\n")


```

```
The model performance for training set
--------------------------------------
RMSE is 4.453237437198149
R2 score is 0.7836295385076292
```

HW:

1.Write the regression equation ypred=m+b0x1+b1x2+-------------------b12x13

2.Select one datasample from the dataset

3.find ypred value

4.find the absolute error for ypred and yactual

```
l=[]
l=list(df.iloc[3])
b=list(b)
print(l)
print(b)


```

```
[0.03237, 0.0, 2.18, 0.0, 0.458, 6.998, 45.8, 6.0622, 3.0, 222.0, 18.7, 394.63, 2.94, 33.4]
[-0.09854247168320542, 0.060784113842432486, 0.05917154006562941, 2.4395598751549907, -21.469964963213876, 2.7958138545358477, 0.0035745977759409353, -1.516272184239845, 0.307541745464
```

```
ypred=m
for i in range(len(b)):
  ypred=ypred+(b[i]*l[i])
print(ypred)

```